METHODOLOGICAL GUIDE FOR THE IMPLEMENTATION OF NATURAL CAPITAL ACCOUNTING MODELS IN MARINE PROTECTED AREAS


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Index of acronyms

CAIB: Autonomous Community of the Balearic Islands

CCN: Natural Capital Accounting (spanish acronym)

CICES: Common International Classification of Ecosystem Services

CNCA: Corporate Natural Capital Accounts

CSIC: Spanish Higher Scientific Research Council

EEA: European Environment Agency

ES: Ecosystem Service(s)

GIS: Geographic Information Systems

IEO: Spanish Institute of Oceanography

KIP-INCA: Knowledge Innovation Project on Integrated Systems for Natural Capital and Ecosystem Services Accounting in the EU

MITECO: Ministry for Ecological Transition and Demographic Challenge

MPA: Marine Protected Area

NCA: Natural Capital Accounting

NCAVES: Natural Capital Accounting and Valuation of Ecosystem Services

RMLL: Joint Levante de Mallorca-Cala Rajada Marine Reserve and Marine Reserve *Llevant* de Mallorca.

SCN: System of National Accounts

SE: Ecosystem Service (s) (Spanish acronym)

SEEA: System of Environmental Economic Accounting

SEEA-CF: System of Environmental Economic Accounting-Central Framework

SEEA-EEA:System of Environmental Economic Accounting-Experimental Ecosystem Accounting

SEO: Spanish Ornithological Society

SGPM: General Secretariat for Maritime Fisheries (Spain)

UNSD: United Nations Statistics Division

WAVES: Wealth Accounting and the Valuation of Ecosystem Services

1. Introduction to the methodological guide

This document is a ***methodological guide for the application of natural capital accounting models in Marine Protected Areas***.

The document has been prepared within the framework of the MPA Networks Project, financed by the European Regional Development Fund through the European Interreg instrument. The project is coordinated by MedPAN, the Mediterranean Network of Marine Protected Areas, which includes 63 member organizations and 51 associations from 20 countries, with the aim of strengthening marine protected areas in the Mediterranean. In turn, the purpose of the MPA Networks Project is to contribute to the effective management of marine protected areas in the Mediterranean, proposing solutions for sustainable financing, sustainable management of small-scale fisheries and the conservation of mobile species.

The **purpose** of this methodological guide is to provide detailed guidance to any type of entity or organization, public or private, interested in applying Natural Capital Accounting (NCA) in a marine protected area, regardless of the location. For this reason, this guide is aimed both at public entities and actors like administrations, universities, research centers, associations or NGOs, among others, and is also for private entities like companies, corporations, and other private actors.

Natural capital accounting **provides** a better and greater understanding of the natural resources existing in a marine area. This knowledge can be used as a tool to improve political and management decision-making, such as changes in management measures, regulatory alternatives or regulatory variations, among many others. Natural capital accounts provide a particular approach by monitoring the changes recorded over time by natural assets and ecosystem services (ES) of marine ecosystems, which aims to ensure sustainable use of natural resources.

The preparation of this methodological guide has allowed us to **learn lessons by overcoming barriers** of all kinds, a process described throughout the document. One of the main recommendations contained in this document is compliance and monitoring of each one of the steps of natural capital accounting, involving actors, local agents and experts from different disciplines throughout the process, whenever possible. This method contributes to the accounting process not only thanks to the multidisciplinary approach necessary whenever working in the area of natural capital, but also thanks to the validation made by agents who know the area of study or have the necessary knowledge that allows the work to be carried out successfully.

Another recommendation for the best construction of an accounting of natural capital is to have access to information about the study area: a cartography *ad hoc* of the area under analysis, studies that determine the status of marine habitats, monitoring and follow-up programs of marine assets that provide data, economic valuation methods and economic data with the least possible uncertainty. Similarly, it is important to periodically update the data entered into the accounting model and to record changes in the value of natural assets, in order to monitor changes that occur over time and thus allow decision making based on these dynamic results.

A natural capital accounting model is a very useful tool to improve political and managerial decision making; not only in the environmental field, but in any area of pursuit of sustainability. Having a detailed report on the value of natural assets and their maintenance costs provides the necessary information to assess and decide on the measures that need to be taken in a given area, in order to increase the value and improve the state of nature in the short, medium or long term.

2. Background: Focus of natural capital in the marine environment

Marine Protected Areas (MPAs) are areas of sea and coastal protected and managed because they are ecologically important. They protect marine life while ensuring the livelihood of fishers, stimulating the local economy and offering tourists the opportunity to rekindle their links with nature.

In marine waters, ecosystems and marine resources are under significant pressure. Human activities, as well as the effects of climate change and natural disasters, have a huge impact on marine ecosystems and the so-called blue economy. As a consequence, **natural capital**, formed by the reserves of natural assets (soil, water, habitats, biodiversity, air), which produce flows of goods and services for society (food, regulation of the water cycle, CO2 capture$_{2,}$ places for recreation), is being affected.

> "**MPAs provide benefits for the conservation of biodiversity** - they are a refuge for species and prevent the deterioration of habitats, they allow the development of natural biological communities and help to revitalize fish populations or degraded environments, and **- for the development of local economies** - they ensure the future of artisanal fishing and promote the development of economic activities for the benefit of local populations.»

The first step for sustainable management of marine natural capital is to recognize the value provided by the blue economy. The blue economy is an economic approach that integrates the importance of seas and oceans as engines of innovation and growth for the sustainable development of different sectors of economic activity related to the marine environment. Specifically, it contemplates activities such as fishing, aquaculture and the use of marine environments to generate renewable energy or tourism, among others.

A healthy marine environment is essential to the blue economy and the well-being of its citizens. As a whole, the coastal strip, with its beaches, clean waters and seabed, is the mainstay of many economic activities. It is essential to make visible this interdependence between marine waters, social welfare and the local economy, so as to guarantee a sustainable future.

This interdependence can be identified, quantified and valued through the so-called **natural capital approach**. This approach represents a new conception for evaluating the relationship of our society with nature, the advantages of which are shown in Figure 1. Among them, stands out the possibility of integrating different elements associated with environmental management together with economic aspects, allowing economic development to be related to the conservation of marine natural heritage through a sustainable model framework.

NATURAL CAPITAL FOCUS

Figure 1. *Benefits of the natural capital approach.* Source: Own elaboration

This methodology guide serves as a roadmap for the application of natural capital accounting models in the marine environment. **Natural Capital Accounting** is a tool that can help public and private stakeholders to better understand the interactions between economy and nature. Specifically, it allows the creation of accounts of the natural assets and ecosystem services of a given area, with the aim of accounting for their condition, extension, physical value and economic cost of maintenance. The concept of value is fundamental within accounting, since it implies the best integration of environmental and economic information.

"**Natural capital accounting** is of particular relevance to the marine environment. Studies attempting to compare the total value of the world's ecosystems demonstrate the relative high value of marine, coastal and transitional environments, compared to their terrestrial and freshwater counterparts »

The application of natural capital accounting models in the marine environment is essential, as it provides information to those responsible for making decisions that affect these ecosystems, so that they easily understand how investment in environmental assets contributes to broader social objectives, as well as the management, mitigation or restoration actions that are necessary to avoid the deterioration of these assets.

3. Methodology

3.1 Natural Capital Accounting Framework

To understand the meaning of Natural Capital Accounting (NCA) it is necessary to understand the definition of financial accounting. Financial accounting traditionally refers to the systematic and comprehensive recording of events - for example, financial transactions - relating to a business and also to the process of summarizing, analyzing, and reporting those events to supervisory bodies - for example, tax authorities.

Accounting is used for two main purposes: management accounting, oriented to help in internal decision-making, the fundamental principles of which are fitness for purpose and flexibility; and financial accounting, oriented to divulgation or financial reporting to third parties, whose fundamental principles are data quality and comparability to reduce information asymmetry.

This financial accounting context influences the development of natural capital accounting, which is primarily an approach to assist in the measurement of natural assets and ecosystem services. Natural capital accounting is aimed at facilitating forward-looking decisions, as ***the goal is to help safeguard the health and condition of natural capital***. This requires reporting the long-term value of natural capital assets and liabilities.

Natural capital accounting has been defined as '*a tool to measure changes in the stock and condition of natural capital at a variety of scales, and to integrate the value of ecosystem services into accounting and reporting systems.*' (European Commission and European Environment Agency, 2016)

Natural capital accounts make it possible to monitor changes in the state of natural capital over time, within a framework comparable to that of economic accounts. In general terms, and as shown in Figure 2, the natural capital accounting framework includes evaluation of both *inventories* (*stocks*) and *flows*, in monetary and physical terms.

Basically, the central requirement in order to establish a natural capital accounting system is to measure the extent, condition (or status), quantity and value of natural capital assets, including the services and benefits derived from them. Specifically, the accounting process aims to answer the following five questions:

I. What assets exist in the study area, what is their extension and in what state are they?
II. What benefits (services) do they provide and in what amount?
III. What is the economic value of these benefits?
IV. How much does it cost to maintain these assets?
V. What is the net present value, taking into account both the costs of maintaining these assets and the benefits they and their services provide?

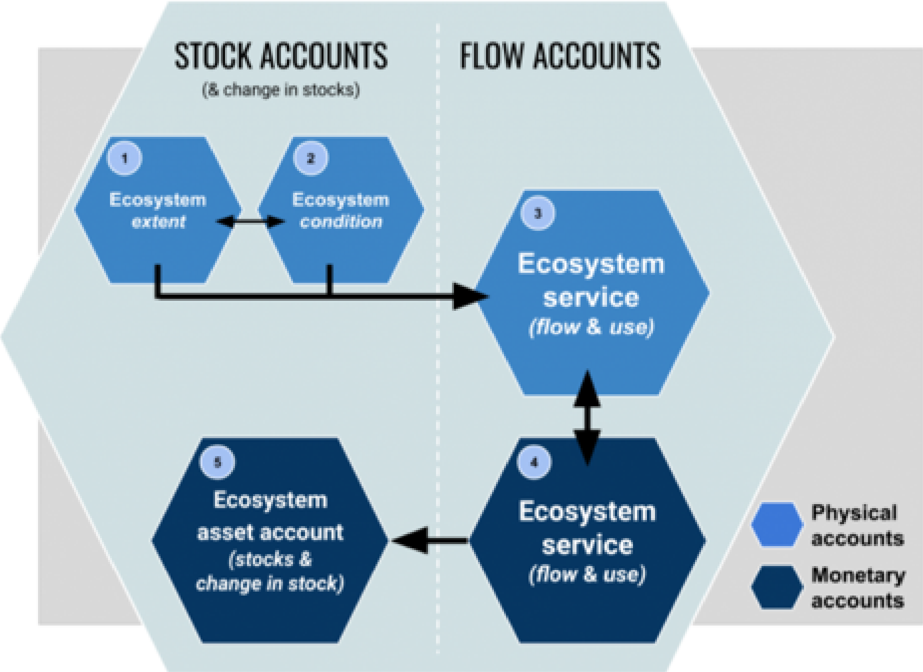


Figure 2. *Conceptual diagram of the different accounts that make up the natural capital accounting framework.* Source: United Nations (SEEA EA).

The demand for natural capital accounting frameworks and their application at the organizational, regional and state levels has been increasing in recent years. For example, the European Green Deal, through the Biodiversity Strategy of the European Union (EU) for 2030, calls for the creation of an international natural capital accounting initiative.

At international level and from the perspective of the public sector, there is the recognized **SEEA - EEA, System of Environmental Economics Accounting-Experimental Ecosystem Accounting**[1], a framework defined and recently approved[2] by the United Nations, which represents the most relevant natural capital accounting scheme on a global scale. Specifically, it has two different parts: on the one hand, the SEEA Central Framework or SEEA CF, which analyzes "individual environmental assets", such as water resources; on the other hand, the Experimental Ecosystem Accounting (SEEA EEA), which takes the ecosystem perspective and considers how individual environmental assets interact as part of natural processes within a given spatial area.

An example of the SEEA EEA application has been developed by the KIP INCA project —Knowledge Innovation Project on Integrated Natural Capital Accounting—, promoted by various entities[3] and focused on supporting the development of the SEEA EA by testing its application in the EU. Specifically, KIP INCA uses the SEEA EEA manual as a guide to develop pilot accounts of the extent and condition of ecosystems and ecosystem service accounts at the EU level.

[1] 2021 Draft.Available at: https://unstats.un.org/unsd/statcom/52nd-session/documents/BG-3f-SEEA-EA_Final_draft-E.pdf

[2] https://seea.un.org/ecosystem-accounting

[3] Eurostat, European Environment Agency (https://www.eea.europa.eu,
DG ENV (https://ec.europa.eu/info/departments/environment_en),
DG Research and Innovation (https://ec.europa.eu/info/departments/research-and-innovation_en)
And European Commission's Joint Research Centre (https://ec.europa.eu/info/departments/joint-research-centre_en)

In addition to the SEEA EEA, another natural capital accounting framework is the **Corporate Natural Capital Accounting (CNCA)**. The CNCA, developed for the United Kingdom Natural Capital Committee in 2015 (eftec, RSPB and PwC, 2015[4]), arose with the purpose of supporting companies and organizations in understanding the risks and opportunities associated with the deterioration of natural capital.

The CNCA framework aims to facilitate the collection of information on natural capital in a consistent and comparable format to support informed decision-making about the management of natural capital. The framework reflects the interdependencies between natural assets and organizations and focuses on the impact that an organization can have on the long-term health of natural capital. Some examples of organizations that have carried out pilot studies applying real data under the CNCA are Lafarge Tamarc, National Trust, The Crown State or United Utilities.

The CNCA incorporates a high degree of flexibility that has allowed such organizations to obtain useful information for their own purposes. Its uses include complementing and improving the management systems of organizations, making operational decisions, reporting on natural capital and improving environmental management.

Comparing the SEEA EEA and CNCA frameworks, both share a very similar conceptual and methodological approach. Therefore, there are more similarities than differences between the two. One of the main differences is the target *group of* each one: while the SEEA EEA focuses on the public sector and national accounts, the CNCA focuses on the corporate point of view. Another main difference is that the CNCA integrates and considers so-called maintenance costs, that is, the expenses necessary for the maintenance of natural assets and ecosystem services.

This methodological guide is based on both the SEEA EEA and the CNCA framework. The steps to take when applying any of them are identical. In some specific aspects, such as the consideration of maintenance costs, the CNCA has been followed, since these are not considered by the SEEA EEA. The different phases to consider for the development of natural capital accounting in an MPA are explained below.

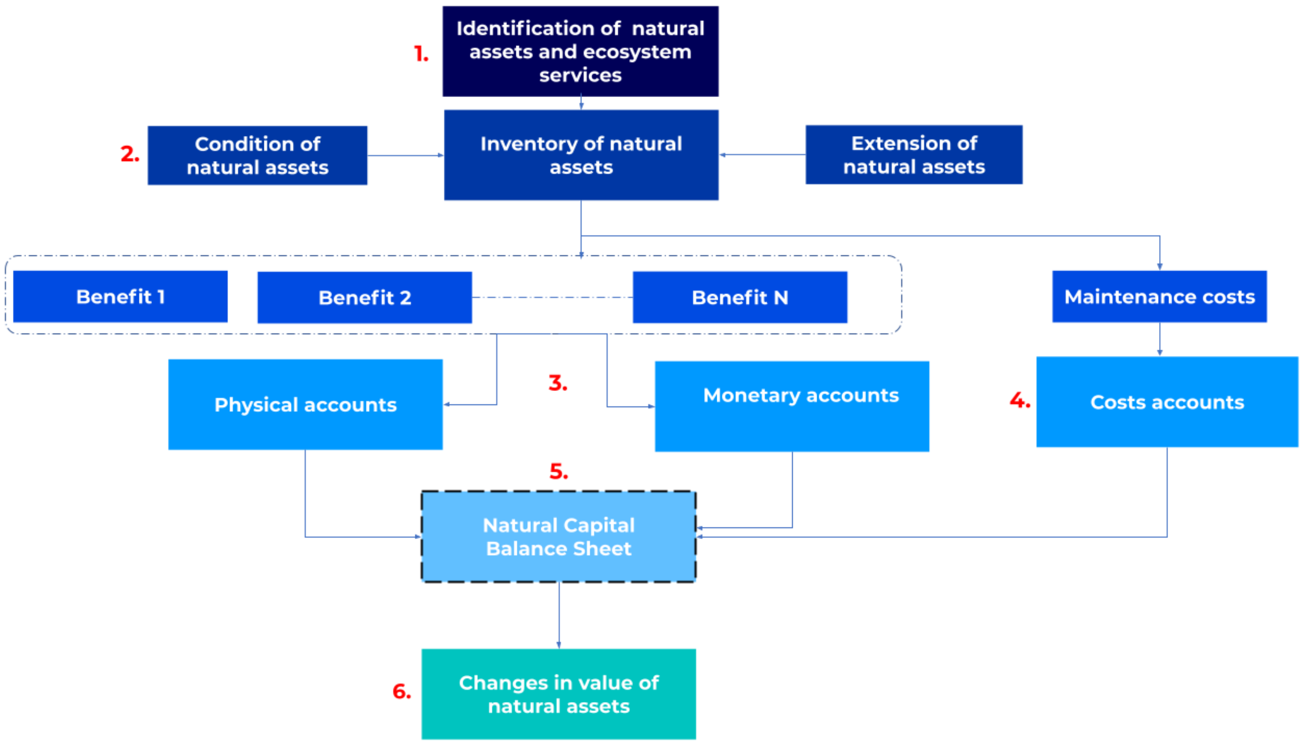
3.2 Guide to the natural capital accounting model step by step

To apply natural capital accounting in an MPA, the following methodology has been developed (Figure 3), elaborated from eftec Natural Capital Account Template[4].

[4] eftec, RSPB and PwC. (2015). *Developing Corporate Natural Capital Accounts*. Report for the Natural Capital Committee. Available at:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/516968/ncc-research-cnca-final-report.pdf

The map in Figure 3 summarizes the different steps to follow in order to perform a natural capital accounting exercise, in this case, for an MPA.

Figure 3. *Illustrative map of the steps to be taken to apply natural capital accounting in marine protected areas.*
Source: Own elaboration from the Eftec Natural Capital Account Template.



- The **first step** is to precisely delineate the study area and the baseline, and then identify the natural assets and ESs present in the MPA. Defining the study area and the baseline allows the study to be focused spatially and temporally, providing a reference to report on the value of natural assets and report changes on the established baseline. Thus, the existing natural assets in the study area should be identified, as well as the ecosystem services that they supply through their ecological and biological functions. Section 4.1 *Guidance for the identification of ecosystem assets and services* details the identification process in more depth, indicating, among other things, the potential ESs that can be found in marine protected areas.
- The **second step** that must be taken is to record the extent and condition of the natural assets, that is, to carry out an inventory of the natural capital assets (habitats and species). The reserves of natural assets and ecosystem services that make up natural capital can be measured in physical and monetary terms. The physical metric can include, for example, the richness and abundance of species and the area and condition of habitats. In this second step, details about the stocks of natural capital assets that are relevant to the accounts should be recorded, including the extent and condition of habitats and species. This phase is of great importance, because both the quantity (extension) and the quality (condition) of the natural assets will influence the flow of services and, therefore, the benefits that will be used by society. Details on this stage can be found in section 4.2 *Guide to determine the extent and condition of natural assets*.
- The **third step** is to generate the physical and monetary accounts of all the identified ESs. These services produce benefits to human beings that can be valued in terms of the compensations that individuals make. In this step, it is sought to quantitatively value each ecosystem service (benefit) through an annual physical indicator, and also economically using the most robust valuation method available, and with the least degree of uncertainty. Both processes are detailed in sections

4.3 *Guide for physical accounts* and 4.4 *Guide for monetary accounts*, which contain tables of physical indicators and valuation methods for all possible ecosystem services present in an MPA.

- In the **fourth step,** the maintenance costs are calculated, together with legal and other annual costs related to the maintenance of the MPA in good condition (see section 4.5 *Guide to the calculation of maintenance costs* for more details). Such costs are framed in the CNCA and refer to the fact that natural assets not only provide streams of benefits, but that there are also yearly costs involved in the management of the MPA for proper operation and maintenance that guarantees the protection of the species and habitats present.

- The **fifth step** involves constructing the Natural Capital Balance Sheet for the study area, which shows the value of the MPA's natural capital assets, as well as their associated costs. This step can be considered as a summary of what has been done so far, and the final report, where steps 1-4 previously described make up the calculations in order to arrive at this balance sheet. The net value of natural capital assets for a given instant is calculated as the sum of the total present value of the 60-year flows of all ecosystem services minus the present value of the 60-year flows of maintenance costs. For this calculation, both the benefits (monetary flows) and the annual costs are projected over 60 years. and to this future projection a certain discount rate is applied to show the present projected future values. The result is a monetary value of the assets and costs, and by subtracting these values, a single monetary value is obtained which is the net monetary value of the natural assets of the MPA. This value is the reference value against which future changes in the natural capital of the MPA can be compared. All of this is described in depth in section 4.6 *Guide to the Natural Capital Balance Sheet.*

- In the **sixth step,** future changes that may occur with respect to benefits (SE) and natural assets in the analyzed MPA are updated and recorded in the *Natural Capital Balance Sheet.* These changes are likely to happen, so ESs will be affected in quantity, quality and value. The objective of such a record-update should be to report the variation in the values of assets and liabilities during a given accounting period. Therefore, this step seeks to monitor the state of the natural capital of an MPA in relation to a baseline, as a result of eventual changes in the quality and quantity of said natural capital. This topic is detailed in section 4.7 *Guidance for future movements in the Natural Capital Balance Sheet*.

4. Accounting process

4.1 Guidance for the identification of ecosystem assets and services

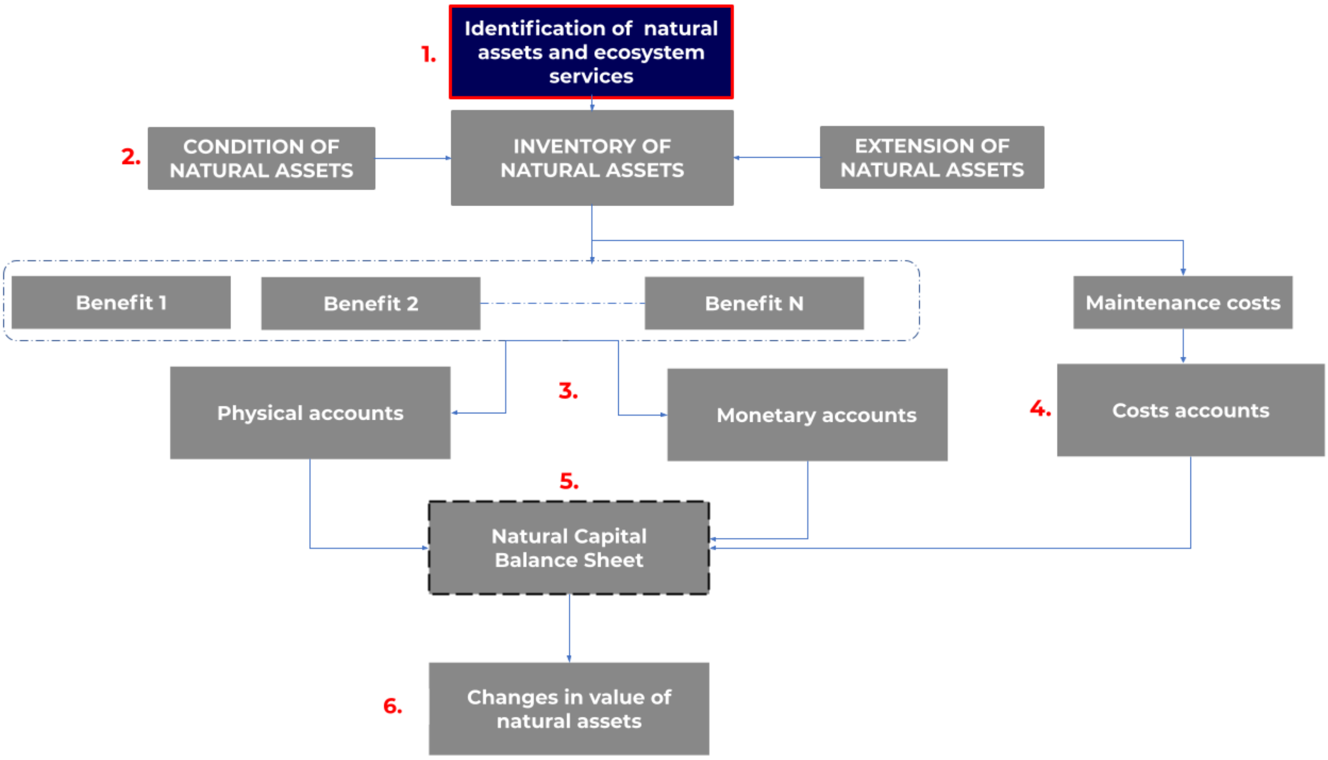


Figure 4. *First step of the accounting process: Identification of natural assets and ecosystem services.*
Source: Own elaboration

The first step is to establish the study area and a baseline that provides a baseline scenario on the state of the natural capital of the MPA. Subsequent changes in the state of natural capital can be measured by comparing it to this baseline.

To be able to identify the natural assets present in the MPA and the flows of benefits (through ecosystem services) that they provide to society, it is necessary to know the relationship between society and the natural environment. To do this, the natural capital approach allows the **identification and categorization of existing natural assets or resources**. During this stage, the situation of the different natural assets that make up the natural capital must be identified and described. A framework to follow is provided by the following figure:

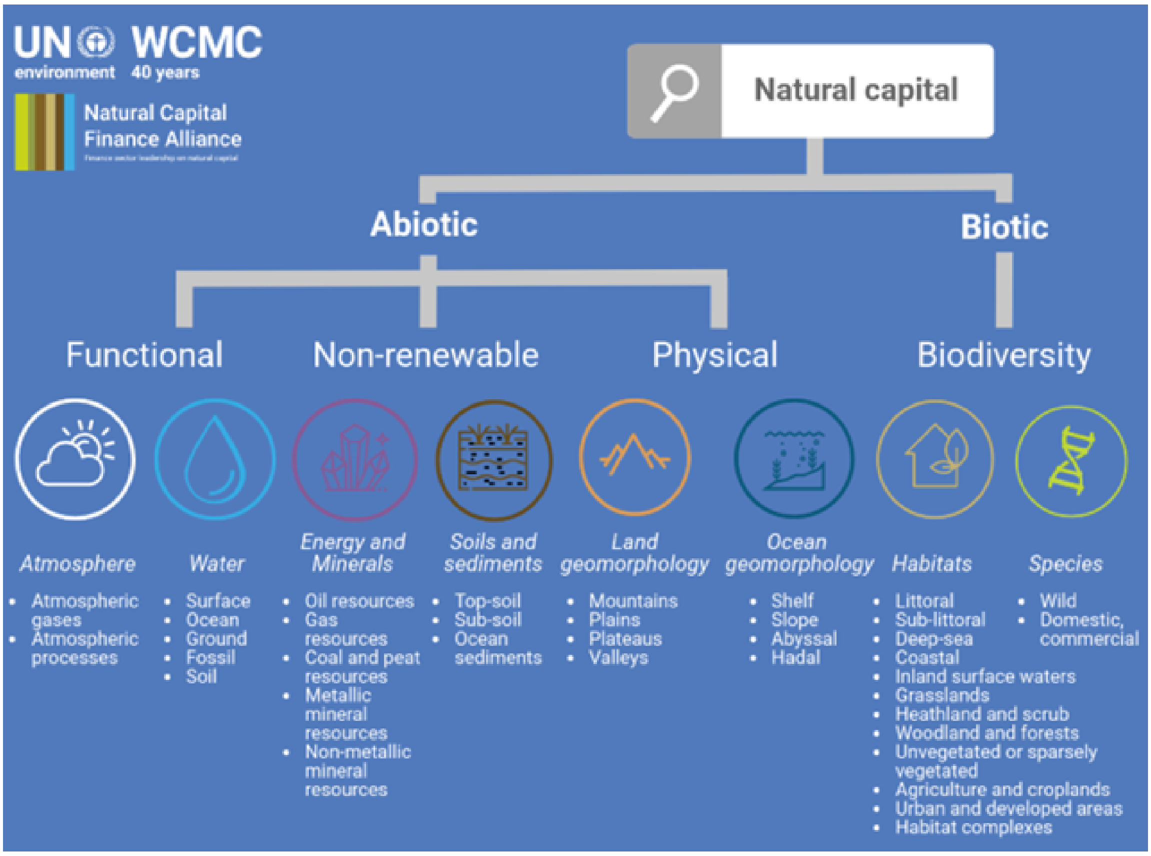


Figure 5. *Classification of natural assets that build up natural capital.* Source: Leach *et al*, 2019[5].

Figure 5 shows a classification of natural assets from which the ESs that are present in the study area can be identified. Next, we proceed to **identify the benefits, represented by the services that ecosystems provide to society**. Ecosystems generate flows or services due to the ecological and biological functions of the assets or natural resources that compose them, which are used, transformed and enjoyed by human beings. In other words, the consumption or experience of ecosystem services produces direct or indirect benefits that society receives through its relationship with the natural environment.

To identify and select the ESs in the study area, we propose the use of the Common International Classification of Ecosystem Services - CICES - as a scientifically and internationally accepted source of information that classifies and categorizes the different ecosystem services offered by natural assets. CICES was developed from work on environmental accounting carried out by the European Environment Agency (EEA) and contributes to the review of the System of Environmental Economic Accounting (SEEA), which is currently led by the United Nations Statistical Division (UNSD). Therefore, CICES is a standardized and regulated framework that identifies 90 different ecosystem services that all ecosystems on the planet can offer, regardless of the site considered.

[5] Leach et al. (2019) A common framework of natural capital assets for use in public and private sector decision-making. *Ecosystem Services* 36.

Figure 6. *Classification of ecosystem services that ecosystems provide to humans.* Source: PBL, WUR, CICES 2014.pre-

After identifying and selecting the natural assets of the MPA, we proceed to identify **the ecosystem services** that these assets provide. This pre-identification can be carried out by various methods, such as visits to the study area, bibliographic review or consultation with experts.

Once a preliminary list of services is obtained, we proceed to the **final identification of the ecosystem services** offered by the natural assets of the study area. The identification can be considered as a validation of the pre-identification carried out previously, for which workshops or interviews with local actors and other external agents can be held. In these participatory processes, the preliminary results are presented for their review and validation by the actors and agents. It is possible then to build the final list of services present in the MPA.

More detailed information about what natural assets and ecosystem services are and how they are classified is provided below:

4.1.1. Natural assets

The main assets that can be found in an MPA are the following:

- **Marine habitats.**
- **Species (for commercial, social and cultural use).**
- **Underwater landscapes.**
- **Sea floor and geological resources.**
- **Marine waters**.

These habitats are distributed through the vertical structure of marine ecosystems:

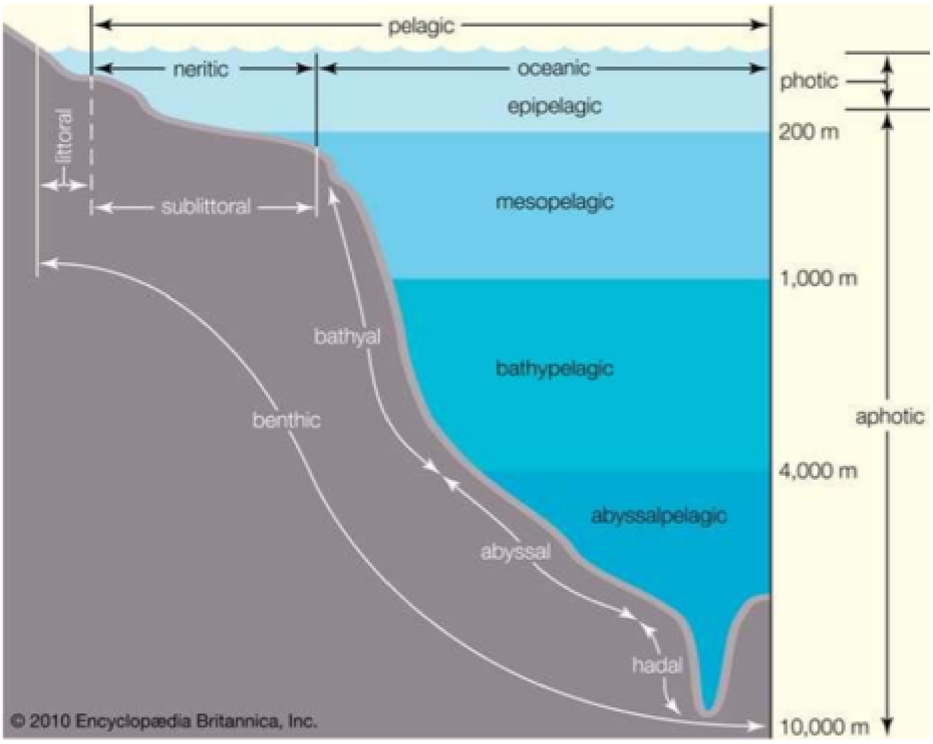


Figure 7*. Vertical structure of marine ecosystems.* Source: Kingsford (2018)[6].

Habitats are responsible for the vital life-sustaining processes of the sea (they maintain essential ecological processes and life support systems), including photosynthesis, maintenance of food chains, nutrient circulation, degradation of pollutants and the conservation of biological diversity and productivity. Furthermore, marine habitats are the main components of underwater landscapes and, when they are in a favorable natural state, provide an essential base for sustainable nature-based tourism.

Some species have an important commercial interest, either because they are the object of fishing or collection by professional or amateur fishers, or because they are species whose observation or contemplation promotes recreational activities that, in addition, can be the object of business. Other species are of interest for conservation because their populations have been reduced or have disappeared, or because they play a structuring role in habitats, which makes them key to maintaining diversity and ecosystem services. Finally, there are species that can be considered emblematic and that have become part of the culture, custom and collective imagination of local populations and their visitors.

[6] Kingsford, MJ (2018) Marine ecosystem. Britannica. Available at: https://www.britannica.com/science/marine-ecosystem/Physical-and-chemical-properties-of-seawater

The dynamics that characterize the water mass of a given MPA favor processes such as larval dispersal or spreading of nutrients and oxygen, and can offer the opportunity to generate energy from clean sources. Another interesting asset that concerns the body of water are the dissolved substances that it contains and that can be used. Likewise, the physical-chemical processes that take place within the body of water constitute an element of capital importance in neutralizing pollutants of various kinds.

It may seem that the use of the seabed and its geological resources in an MPA is not very consistent with the conservation objectives, but in a study like this it is important not to forget them. Sand and gravel, fossil fuels and minerals are possible assets that can be considered.

4.1.2 Ecosystem services

The three types of ecosystem services to be considered in the accounting studies of an MPA are described below. In turn, Table 1 **shows the most common ecosystem services that can be found in an MPA.**

- **Provisioning services**

Among the ESs, those related to fishing and the collection of seafood products stand out, mainly for human consumption, but also for the industry (food, pharmaceutical, biotechnological, cosmetic, chemical) and even for manufacturing of ornamental goods (jewelry, decoration), everyday goods (clothing) or agricultural and construction use (*Posidonia oceanica* remains). Likewise, aquaculture activities at sea represent an important provisioning service, not only in large marine farms (*off-shore*), but also in small artisanal farms.

Seawater capture can be an important provisioning ecosystem service (for cooling, to obtain drinking water in desalination plants, to obtain sea salt in salt pans), as can be the extraction of mineral resources (for construction, mineral extraction, extraction of gas and oil) and sediments (for construction, or for beach and coastal amenagements).

Finally, there are also provisioning ESs related to energy production (tidal, wind, photovoltaic).

- **Regulation services**

In an MPA, regulation services are based on the ecological inertia and resilience of natural systems. The self-purification capacity of marine waters makes it possible to neutralize bacteria and viruses of terrestrial origin that reach the sea through water courses and discharges. It also facilitates the assimilation of nutrients, the recycling of organic matter and the sequestration of polluting substances.

Some marine habitats and ecosystems are powerful carbon sinks or oxygen producers, while some communities, such as plankton, act by regulating the climate as they intervene in the albedo effect. In turn, certain habitats are essential in protecting the coast (sedimentary or rocky).

- **Cultural services**

MPAs are a source of inspiration for educational, research, cultural and intellectual activities, due to the diversity of ecosystems, species and abiotic elements that they host, and also as ideal places to carry out active and passive recreational activities such as diving, boat trips, navigation, recreational fishing, visitation, observation, etc.

MPAs often have living systems or abiotic elements that give them a symbolic, religious or spiritual significance, and can also have an important option, legacy and existence value, since people value the fact that they are conserved for present and future generations.

Table 1. Ecosystem services present in marine protected areas (own elaboration from CICES)

CICES code	Name of the service	CICES Definition	CICES Code	Name of the service	CICES Definition
PROVISIONING SERVICES					
1.1.2.1	Aquaculture plants for nutrition	Aquaculture plant cultures (including mushrooms and algae) for nutritional purposes	1.1.2.2	Materials from aquaculture plants	Fibers and other materials from aquaculture plants, fungi, algae and bacteria for direct use or processing
1.1.2.3	Aquaculture plants as an energy source	Aquaculture-grown plants (including fungi and algae) used as an energy source	1.1.4.1	Aquaculture animals for nutrition	Animals grown by aquaculture for nutritional purposes
1.1.4.2	Materials from aquaculture animals	Fibers and other materials from animals raised by aquaculture for direct use or processing.	1.1.5.1	Aquatic plants for nutrition	Wild plants (terrestrial and aquatic, including fungi and algae) used for nutrition
1.1.5.2	Aquatic plant materials	Fibers and other wild plant materials for direct use or for processing (excluding genetic material)	1.1.5.3	Aquatic plants as energy source	Wild plants (terrestrial and aquatic, including fungi and algae) used as energy source
1.1.6.1	Aquatic animals for nutrition	Wild animals (terrestrial and aquatic) used for nutritional purposes	1.1.6.2	Materials from wild animals	Fibers and other materials from wild animals for direct use or processing (excluding genetic material)
1.1.6.3	Aquatic animals as a source of energy	Wild animals (terrestrial or aquatic) that can be used as a source of energy	1.2.1.1	Seeds to maintain population	Seeds, spores and other plant materials collected to maintain or establish a population
1.2.1.2	Plants for new strains	Higher and lower plants (whole organisms) used to generate new strains or varieties	1.2.1.3	Plant genes for new entities	Individual genes extracted from higher and lower plants for the design and construction of new biological entities
1.2.2.1	Animals to maintain population	Animal material collected for the purpose of maintaining or establishing a population	1.2.2.2	Animals for new strains	Wild animals (whole organisms) used to feed new strains or varieties
1.2.2.3	Genes for new entities	Individual genes extracted from organisms for the design and construction of new biological entities	4.2.1.2	Water used as a material	Surface water used as a material (not for human consumption)
4.2.1.4	Water or tidal energy	Coastal and marine waters used as energy sources	4.3.1.1	Minerals for nutrition	Mineral substances for nutritional purposes (eg. salt)
4.3.1.2	Minerals for materials	Mineral substances for material purposes	4.3.1.3	Minerals for energy	Mineral substances used as a source of energy
4.3.2.3	Wind energy	Wind energy	4.3.2.4	Solar energy	Solar energy
REGULATION SERVICES					

2.1.1.2	Filtration of waste by living organisms	Filtration / sequestration / storage / accumulation by microorganisms, algae, plants and animals	2.2.4.2	Fixation of organic matter in soils	Decomposition and fixation processes and their effect on soil quality
2.2.5.2	Control of the chemical quality of salt water	Regulation of chemical conditions of salt water by living processes	2.2.1.1	Protection of Coastal Erosion	Control of erosion ratios
2.2.1.3	Regulation of water flows	Regulation of the hydrological cycle and water flows (including flood control and coastal protection)	2.2.2.3	Maintenance of Biodiversity	Maintaining populations in their first stages of life and habitats (including their genetic protection)
2.2.6.1	CO_2 capture	Regulation of the chemical composition of the atmosphere and oceans	2.2.6.2	Climate regulation	Temperature and humidity regulation, including ventilation and perspiration
5.1.1.1	Filtration of waste by non-living processes	Dilution by freshwater and marine ecosystems			
CULTURAL SERVICES					
3.1.1.1	Living systems that enable active recreation activities	Characteristics of living systems that allow activities that promote health, recovery or enjoyment through active or immersive interactions	3.1.1.2	Living systems that enable passive Recreation Activities	Characteristics of the living systems that allow activities that promote health, recovery, or enjoyment through passive or observational interactions
3.1.2.1	Living systems that enable research activities	Characteristics of living systems that allow scientific research or the creation of traditional ecological knowledge	3.1.2.2	Living systems that enable Education Activities	Characteristics of living systems that allow education and training
3.1.2.3	Living systems that enable cultural activities	Characteristics of living systems that are highlighted in cultural or historical terms	3.1.2.4	Living systems that enable aesthetic experiences	Characteristics of living ecosystems that enable aesthetic experiences
3.2.1.1	Living systems with symbolic significance	Elements of living systems with symbolic significance	3.2.1.2	Living systems with religious significance	Elements of living systems that have sacred or religious meanings
3.2.1.3	Living systems for entertainment	Elements of living systems used for entertainment	3.2.2.1	Living systems that grant Existence Value	Characteristics of living systems that have an existence value
3.2.2.2	Living systems that grant option or legacy value	Characteristics of living systems that have option or legacy value	6.1.1.1	Natural and abiotic characteristics that allow Active or Passive Recreation Activities	Natural and abiotic characteristics of nature that allow active or passive physical and experiential interactions
6.1.2.1	Natural and abiotic features that enable intellectual activities	Natural and abiotic features of nature that allow intellectual interactions	6.2.1.1	Natural and abiotic features that enable spiritual activities	Natural, abiotic features of nature that allow spiritual, symbolic and other interactions
6.2.2.1	Natural and abiotic characteristics that grant the existence, option or legacy value	Natural or abiotic characteristics or characteristics of nature that have an existence, option or legacy value			

Although it is not mandatory as part of this first phase of the accounting process of natural capital, it is recommended that, once the natural assets and ecosystem services have been identified, a relational matrix of assets and services be developed. This matrix relates all natural assets to all identified ecosystem services, showing those services provided by each one of the MPA assets. Its objective is to establish a hierarchy - that is, to prioritize the evaluation of services through the granting of an order of importance according to the degree of interaction, demand or benefit of the users who enjoy the assets.

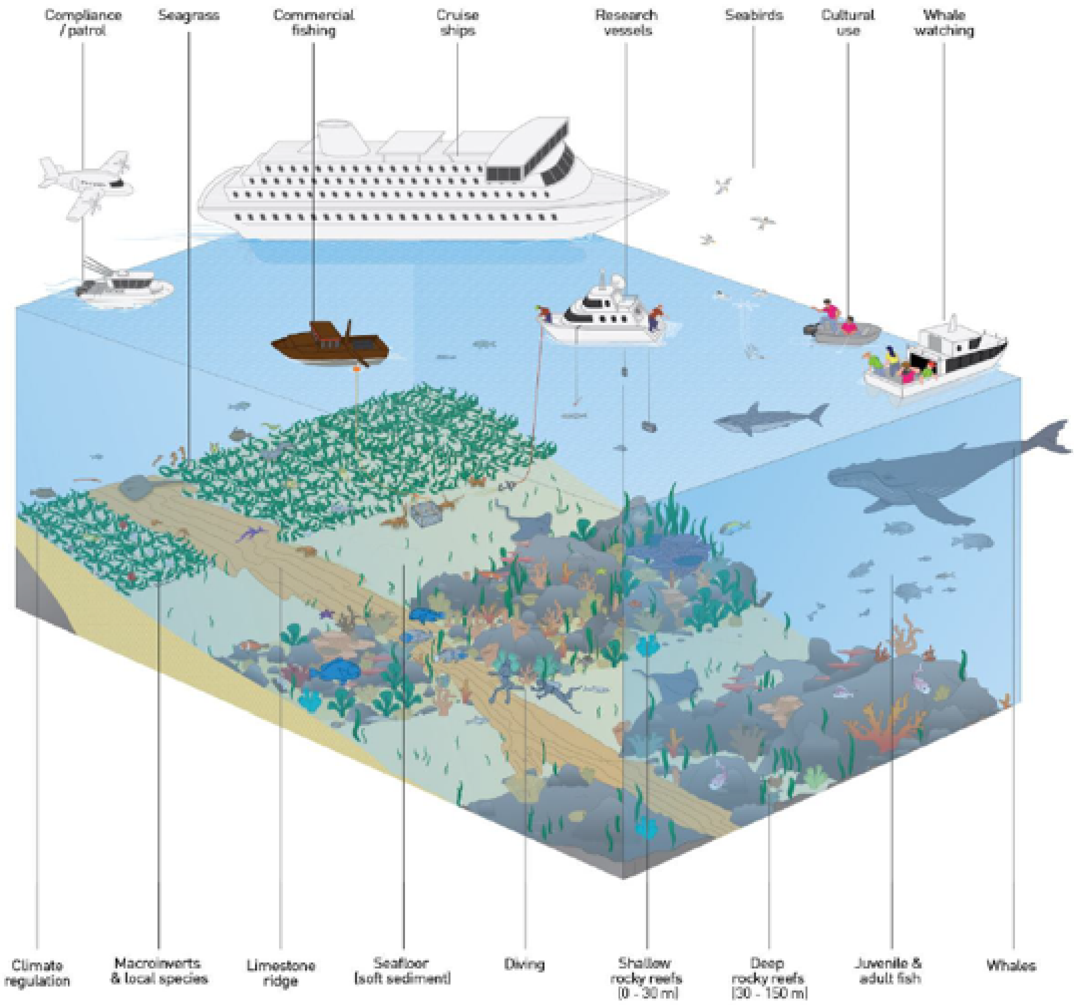


Figure 8. *Illustration showing the relationship between natural assets and ecosystem services in a marine environment.* Source: IDEEA Group (2020)[7].

[7] IDEEA Group (2020) Data assessment report, Ocean accounting pilot for Geographe Marine Park, Institute for the Development of Environmental-Economic Accounting, Victoria, Australia.

4.2 Guide to determine the extent and condition of natural assets

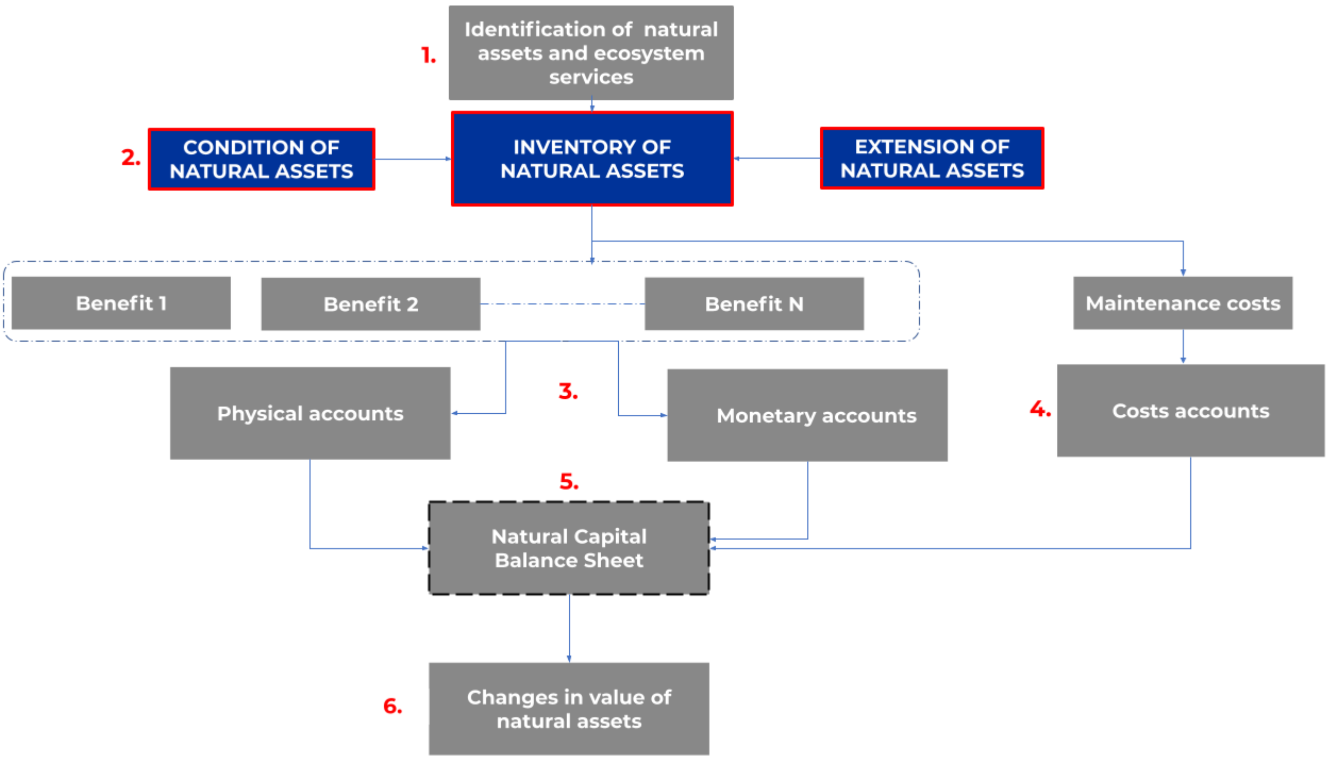


Figure 9. *Second step of the accounting process: Calculation of the extension and condition of natural assets.* Source: Own elaboration

Once the natural assets and ecosystem services have been identified, the next step in the natural capital accounting process is to **calculate the extent and condition of the natural assets**. Next, the methods that can be used to carry out the inventory of natural assets in an MPA are detailed, that is, the measurement of the extension and condition of natural assets.

4.2.1 Extension

The extension of natural assets refers to the quantity or abundance of these, measured in area (hectares) and in abundance or other quantitative indicators for species.

Cartography is considered one of the best tools for data analysis and decision-making related to MPAs. In the same way, cartography is the best ally when calculating the extension of each one of the identified natural assets. Thematic mapping allows the identification, classification and description of natural resources (such as fish populations and benthic habitats), human activities (such as different forms of fishing or other extractive activities, leisure and tourism activities, sites used for research and scientific study) and comparing with any historical records to find out about the temporal evolution of these aspects.

Any initiative to declare an MPA should be accompanied by a cartographic set, consisting of a bathymetry, resources and activities maps. The techniques that can be used to develop them range from simple hand drawing to computer design, the use of remote sensors such as flying devices (aircraft, satellites, drones and the subsequent interpretation of the information), underwater photographs and videos through diving. or with a remotely operated vehicle (ROV), sonars, etc. An appropriate tool corresponds to each cartographic purpose. The use of geographic information systems (GIS) is highly recommended.

If a cartography that collects robust information is available, the determination of the extent of the assets will have low uncertainty. Otherwise, it is advisable to undertake the preparation of the most extensive, precise and detailed cartography that available resources allow.

As for species, a necessary first approximation that seems to contradict the concept of extension is the fact of their presence. There are sources of information on species (bioatlas, catalogs of taxa by geographical space and platforms that support observer programs based on citizen science) that provide data on the known presence of species in the places where they have been observed. This information, valuable in itself, should be supplemented with quantitative data where required. It is essential for those assets that are exploited or those that, being in an unfavorable state, are targets of management measures aimed at their recovery. In general, it is always better to be able to answer these two questions: 'what species are there' and 'how many individuals are there', especially if the next question to answer is 'how much are the species worth'.

In the design of an MPA, a prior assessment of natural resources, such as populations of exploited species, habitats, geological resources or other non-biotic resources, is usually made. The techniques for estimating resources are as varied as the resources themselves. In some cases, it is possible to use the catch data of the fishing fleet operating in the area or sightings done by collaborating volunteers, although it is always preferable to employ *ad hoc* monitoring programs, designed by specialists.

4.2.2 Condition

The condition of natural assets refers to the state, in terms of quality, of these assets.

Usually, once the MPA is declared, natural resources are monitored over time to verify their recovery under the management measures implemented. The result of this monitoring is also the basis for the adaptive management that is applied in many MPAs.

The ideal situation to undertake the analysis of the condition of natural assets is to have monitoring programs for the different assets present in the MPA in order to evaluate their condition from the outset. There are a multitude of methods, each of them appropriate to assess the status of a certain type of asset. However, it is common for this type of information to not be available for a given MPA. In this case, monitoring programs developed for another purpose can provide valuable information on the state of the resources and thus can be used. Examples of this are programs to monitor the quality of marine waters, beaches and their bathing waters, fishery products and the state of habitats. The level of uncertainty that is introduced when using this type of data can be high, since it is usual that in the area of an MPA there are few or no control points of these programs and extrapolations must be necessary.

Ultimately, the use of scientific or other publications to obtain qualitative or quantitative information to determine the condition of assets is a valid option. This method is also applied for calculating the extension of natural assets.

4.3 Guide for physical and monetary accounts

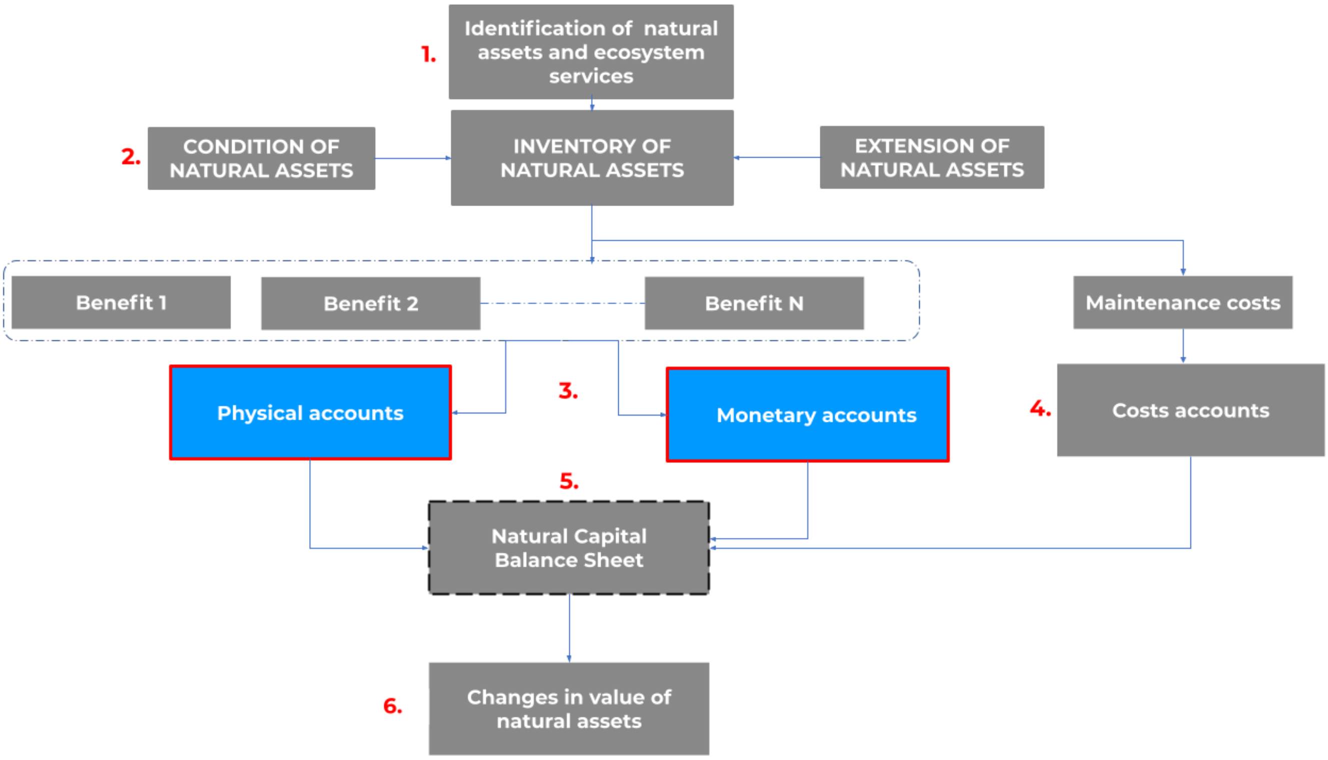


Figure 10*. Third step of the accounting process: Calculation of the physical accounts.* Source: Own elaboration.

4.3.1. Guide for physical accounts

Once the natural assets and ecosystem services in the study area have been identified, they are valued with specific quantitative, qualitative and monetary data, to then establish an accounting balance.

This section details how to measure the annual flow of ecosystem services provided to society by the MPA, that is, the physical amount of ecosystem services provided by the natural assets of the study area and from which society obtains benefits. The idea is to generate a calculation process that evaluates the amount of ecosystem services that is supplied to society. To do that, different sources of cartographic information, field data and open information sources must be used in order to generate the information needed to proceed with the physical assessment.

The quantitative variables are dependent on the evaluated service. These can be production data, as in the case of provisioning ecosystem services; number of visitors, as in the case of cultural ecosystem services; or units of surface or volume, as in the case of regulating ecosystem services. The physical indicators used are closely related to the valuation methods used, which are described in the following section.

Table 2 shows **the recommended physical indicators for the 48 ecosystem services that can be identified in an MPA.**

Interreg Mediterranean MPA NETWORKS
Project co-financed by the European Regional Development Fund
Marilles Foundation CBBA Centre Balear de Biologia Aplicada ECOCSA Reserva de Biodiversidad eftec

Table 2. Physical units to physically value ecosystem services in Marine Protected Areas (own elaboration)

CICES code	Name of the service	Physical units	CICES code	Name of the service	Physical units
PROVISIONING SERVICES					
1.1.2.1	Aquaculture plants for nutrition	Kilograms	1.1.2.2	Aquaculture plant materials	Kilograms
1.1.2.3	Aquaculture plants as a source of energy	Kilograms	1.1.4.1	Aquaculture animals for nutrition	Kilograms
1.1.4.2	Materials from aquaculture animals	Kilograms	1.1.5.1	Aquatic plants for nutrition	Kilograms
1.1.5.2	Materials of aquatic plants	Kilograms	1.1.5.3	Aquatic plants as a source of energy	Kilograms
1.1.6.1	Aquatic animals for nutrition	Kilograms	1.1.6.2	Wild animal materials	Kilograms
1.1.6.3	Aquatic animals as a source of energy	Kilograms	1.2.1.1	Seeds to maintain population	Number of seeds
1.2.1.2	Plants for new strains	Kilograms, number of individuals	1.2.1.3	Plant genes for new entities	Number of genes
1.2.2.1	Animals to maintain population	Kilograms, number of individuals	1.2.2.2	Animals for new strains	Kilograms, number of individuals
1.2.2.3	Genes for new entities	Number of genes	4.2.1.2	Water used as material	Liters
4.2.1.4	Water or tidal energy	kW	4.3.1.1	Minerals for nutrition	Kilograms
4.3.1.2	Minerals for materials	Kilograms	4.3.1.3	Minerals for energy	Barrels or m^3
4.3.2.3	Wind energy	kW	4.3.2.4	Solar energy	kW

REGULATION SERVICES					
2.1.1.2	Filtration of waste by living organisms	Ha of ecosystems that they filter; m^3 of filtered water	2.2.4.2	Fixation of organic matter in soils	Ha of ecosystems, carbon stored in soil (tons / ha)
2.2.5.2	Chemical quality control of salt water	Ha of ecosystems that they control; m^3 of controlled water	2.2.1.1	Coastal erosion protection	Ha of ecosystems that they protect; tons eroded / ha; reduction in wave energy (J / m^2)
2.2.1.3	Regulation of Water Flows	Ha of ecosystems that they regulate; m^3 of water (flood)	2.2.2.3	Maintenance of biodiversity	Ha of protected ecosystems; Shannon index; number of species per ha or per liter
2.2.6.1	Capture of CO_2	Tons of CO_2 captured	2.2.6.2	Climate regulation	Ha of ecosystems that they regulate
5.1.1.1	Filtration of waste by non-living processes	Ha of ecosystems that they filter; m^3 of filtered water			

CULTURAL SERVICES					
3.1.1.1	Living systems that enable active recreation activities	Number of visitors	3.1.1.2	Living systems that enable passive recreation activities	Number of visitors
3.1.2.1	Living systems that enable research activities	Number of researchers or research projects	3.1.2.2	Living systems that enable educational activities	Number of students or educational projects
3.1.2.3	Living systems that allow cultural activities	Number of visitors	3.1.2.4	Living systems that allow aesthetic experiences	Number of visitors
3.2.1.1	Living systems with symbolic significance	Number of visitors	3.2.1.2	Living systems with religious significance	Number of visitors
3.2.1.3	Living systems for entertainment	Number of visitors	3.2.2.1	Living systems that give existence value	Number of elements / protected areas; Ha of protected area
3.2.2.2	Living systems that grant option or legacy value	Number of elements or protected areas; Ha of protected area	6.1.1.1	Natural and abiotic characteristics that allow active or passive recreation activities	Number of visitors
6.1.2.1	Natural and abiotic features that enable intellectual activities	Number of visitors	6.2.1.1	Natural and abiotic features that enable spiritual activities	Number of visitors
6.2.2.1	Natural and abiotic characteristics that give existence, option or legacy value	Number of elements or spaces protected; ha of protected area			

4.3.2. Guide to monetary accounts

This section describes the **allocation of monetary value to the ecosystem services** identified in the MPA, using different valuation methods.

The economic valuation of each ES will depend on the value that society awards to the benefit it obtains from it. Therefore, there may be some areas with great natural capital, and that provide a high amount of benefits through one or different ecosystem services, but that, since there is no demand for the use of such service(s) for their use or enjoyment, lack economic value. On the contrary, there may be areas whose natural capital is very poor in terms of the number of ESs identified, but which register a great demand for these services, so their social (monetary) value is very high.

This valuation seeks to obtain a measurement, in monetary terms, of the gain or loss of well-being or utility that a person or a group experiences as a result of an improvement or damage to the ecosystem service to which they have access. The valuation is carried out through the assignment of a monetary value to the goods and services, according to their ability to generate profit or satisfy the needs of consumers or beneficiaries.

The Total Economic Value (TEV) is classified into use value and non-use value, according to the following scheme:

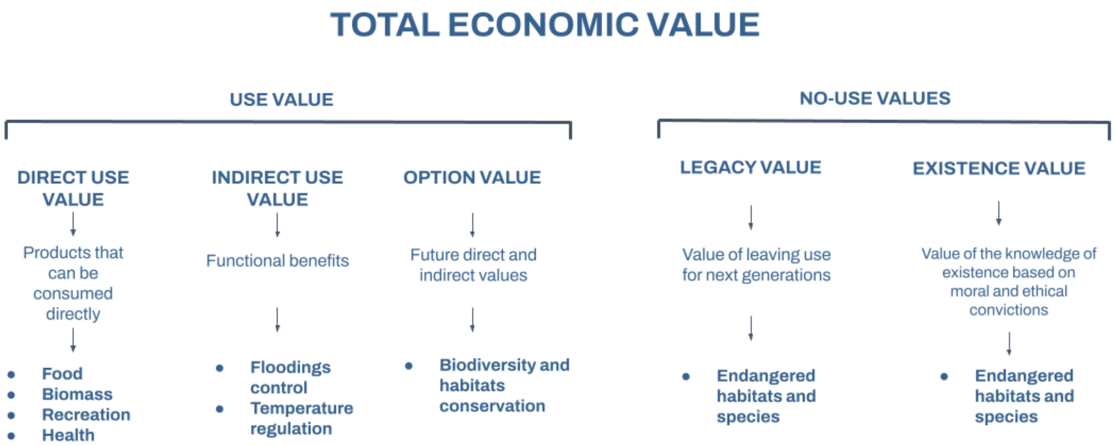


***Figure 11**. Classification of the different types of economic values that make up the Total Economic Value (TEV).*
Source: Own elaboration

Therefore, the TEV is obtained by considering different types of values. The use value is related to the use that is given to the resources of nature, whether for productive, medicinal, construction, contemplation or study purposes.

Direct use refers to resources whose consumption involves direct physical use, such as tourism, walks or rest. Indirect use values are those obtained from resources that do not involve their direct use or consumption, such as climate or microclimate regulation, protection against floods and natural disasters, etc. The option value corresponds to the fact that stakeholders are willing to pay for future use of environmental resources. It refers to the postponement of the use of a certain environmental asset for a future time; by keeping the option to take advantage of said resource open at a later date, it acquires an option value.

On the other hand, non-use values exist when some resources are not in interaction with the individual and, nevertheless, s/he is willing to pay for their improvement or conservation, although s/he may never use them. In this way, non-use values can be divided between existence value and legacy value. Existence value is that which individuals attribute to environmental services simply because they exist, even if individuals do not make any active use or do not receive any direct or indirect benefit from them. The legacy value is the value of bequeathing the benefits of the resource to future generations, expressing the desire that they enjoy a sufficient amount of natural resources.

Once the types of values that make up the TEV of a good or a service are known, the specific economic valuation methods are applied. Figure 12 shows a classification of the different existing valuation methods.

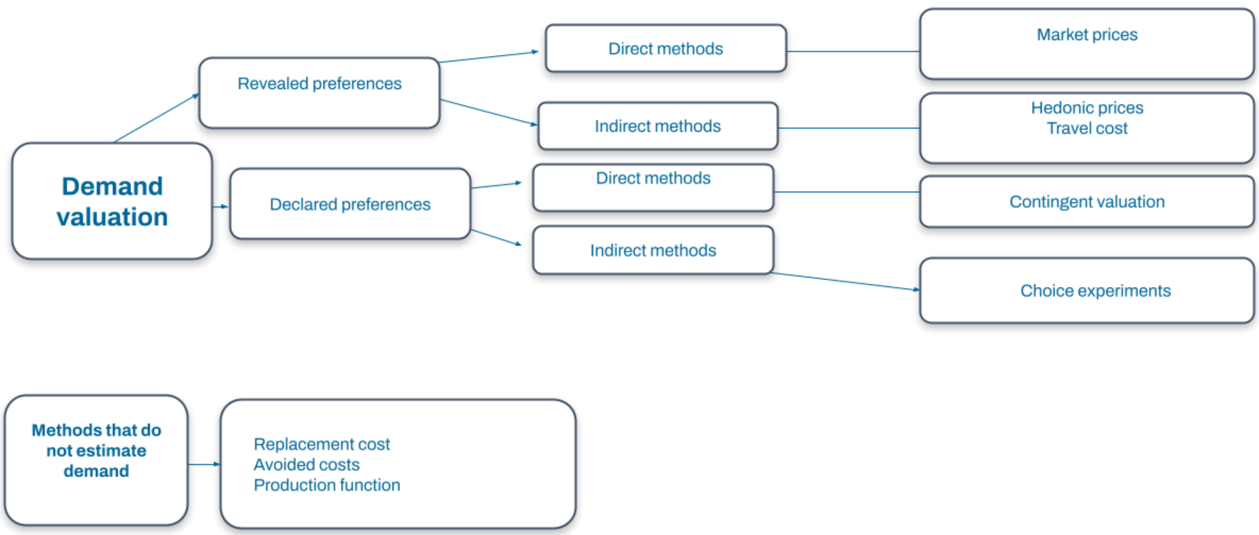


Figure 12. *Classification of the different existing economic valuation methods.* Source: Own elaboration

On the one hand, methods that do not estimate demand - valuation methods whose focus is not centered on the demand curve or the consumers' willingness to pay - are aimed at quantifying the value of the damages, costs or expenses of possible changes in environmental quality.

On the other hand, there are methods of demand valuation. Because it is impossible to value ecosystem services through the use of conventional valuation methods, alternatives have been developed that reveal the preferences of individuals who use and enjoy the benefits of ecosystem services. Environmental valuation methods seek to obtain the willingness to pay for a positive change in an environmental good or the willingness to accept compensation for a negative change. These methods are distinguished by the way in which this measure of value is obtained from the consumer. Thus, the valuation can come from a behavior observed in the market or from a hypothetical behavior, either if this is expressed directly by the consumer (declared preferences), or if it is revealed by the consumer's decisions (revealed preferences). With these methods, the Marshallian demand for environmental goods and services is inferred through the observation of markets that are closely related to them.

Within the methods that require the estimation of a demand curve and that are considered in the case of revealed preferences - i.e. they require the observation of a real market to infer the balance between money and the environment -, the researcher can choose to use direct or indirect methods. The direct ones use the preferences expressed directly by individuals, either by going to real markets or through experimental or hypothetical markets, where the willingness to pay for use and enjoyment of an ecosystem service is evaluated. All direct methods collect information on the environmental service or product in question. Among the direct methods, the best known is the market price valuation method, which consists of using the value for which a sufficiently informed buyer and seller are willing to exchange a good or service. The objective of the valuation is to calculate, record and reveal the exchange price at which an asset could be traded on a given date, according to its particular characteristics. They apply to real and existing market values.

Indirect methods are based on the fact that there are already some revealed preferences of individuals, like the decisions a consumer makes when using or enjoying a natural asset or ecosystem service. In this sense, the value of an ecosystem asset or service is defined by the preferences and decisions made by an individual or consumer when using or enjoying this particular asset or service. These preferences can be defined by a series of attributes that are part of a real market or, failing that, a hypothetical market. The value of the environmental good or service is inferred from the market of another associated product. There are two main indirect methods:

- the travel cost method is a technique that tries to deduce value from the observed behavior of visitors to a place, through the total expenditure made for the visit (money and time allocated to the visit) and, based on this information, generate a demand curve for the services offered by this particular resource. It is a model that seeks to determine the value of, for example, recreational activities through the decision-making behavior of individuals, and to assess qualitative or quantitative changes in the attributes of spaces.
- the hedonic pricing method is used to analyze the contribution of different attributes that make up a good. The idea is based on the possibility of decomposing a total price of the good into the prices of the different components of that good. Such components or attributes may represent environmental conditions that give value to the good. One application could focus on land prices that are affected by certain environmental functions.

On the other hand, within the methods of declared preferences —based on conducting surveys amongst samples of potential consumers of an environmental good, in which they are asked how they value an environmental good—, there are direct and indirect methods. Among the first, stands out contingent valuation, where a series of surveys are carried out to find out how much one is willing to pay for a certain characteristic of the environment, natural asset or resource or ecosystem service. This method uses a direct approach as it asks people what they would be willing to pay for a benefit or what they would be willing to receive, as compensation, for tolerating a cost. They are applied when there is no market to value the ecosystem asset or service, that is, no real data is available. This fact entails working with hypothetical valuation scenarios.

Among the indirect methods of declared preferences is the method of choice experiments. Its application involves conducting surveys to target groups and they are asked about their preferences between attributes at different levels - that is, they are presented with different sets of alternatives that contain common attributes of a good, but with different levels, and are asked to choose the preferred alternative from each set. Each set offers a constant alternative (*status quo*) —that is, the current state in which the good exists, without changes— and a series of options that require payment. Respondents' choices indicate their preferences for the attributes of one alternative over the others, and demonstrate their willingness to exchange one attribute for another. One of the attributes used to describe the alternatives is monetary, and in this way it is possible to estimate the willingness to pay. The benefit of this tool is that it allows the environmental service to be broken down into its different specific characteristics, to analyze the value that society gives to each of its attributes and to estimate the welfare caused by changing its attributes.

Among the valuation methods that do not estimate demand are cost methods. They apply to cases in which ESs have a direct influence on individuals, who are aware of the degradation of the ecosystem and its influence on the services it provides and who, in addition, can adopt defensive measures to avoid or reduce negative impacts resulting from degradation. They measure a behavior already carried out by individuals and, therefore, make it possible to estimate their willingness to pay. This also applies to cases in which the value of having to replace or restore the ecosystem to its original state is considered, since it has suffered a negative impact or damage caused by an anthropic action.

Finally, the production function methods are based on the fact that the ecosystem asset or service is an input within the production function of a good, such as the agricultural production of a certain type of crop. The changes that the asset or ES undergoes will affect its market value; therefore, to apply this type of economic valuation, it is necessary to know or model the behavior of the asset or ecosystem service and its response in the market.

Table 3 includes the **valuation methods that can be used to carry out an economic valuation of each of the 48 ecosystem services present in an MPA**. The method that best suits each ecosystem service and the availability of data in the study area should be chosen. Whenever possible, it is best to use local data specific to the study area.

For provisioning services, the recommended method to use is market pricing. To value regulation services, the most appropriate methods are those of costs, except in the case of CO_2 capture —for whose calculation it is necessary to use market prices—, that of biodiversity conservation —which is valued through of methods of declared preferences—, and the one of climate regulation —valued also through contingent valuation—.

For cultural services, the most widely used methods are contingent valuation and travel costs, although some can be valued through budgets.

If the services identified cannot be assessed through the methods suggested in Table 3, a transfer of benefits from other studies can always be carried out, making the corresponding adjustments and following the appropriate methodology.

Table 3. Economic valuation methods to value ecosystem services in Marine Protected Areas (own elaboration)

CICES Code	Service Name	Valuation Methods	CICES Code	Service Name	Valuation Methods
PROVISIONING SERVICES					
1.1.2.1	Aquaculture plants for nutrition	Market prices	1.1.2.2	Aquaculture plant materials	Market prices
1.1.2.3	Aquaculture plants as a source of energy	Market prices	1.1.4.1	Aquaculture animals for nutrition	Market prices
1.1.4.2	Materials from aquaculture animals	Market prices	1.1.5.1	Aquatic plants for nutrition	Market prices
1.1.5.2	Aquatic plant materials	Market prices	1.1.5.3	Aquatic plants as a source of energy	Market prices
1.1.6.1	Aquatic animals for nutrition	Market prices	1.1.6.2	Wild animal materials	Market prices
1.1.6.3	Aquatic animals as a source of energy	Market prices	1.2.1.1	Seeds to maintain population	Market prices
1.2.1.2	Plants for new strains	Market prices	1.2.1.3	Plant genes for new entities	Market prices
1.2.2.1	Animals to maintain population	Market prices	1.2.2.2	Animals for new strains	Market prices
1.2.2.3	Genes for new entities	Market prices	4.2.1.2	Water used as material	Market prices
4.2.1.4	Water or tidal energy	Market prices	4.3.1.1	Minerals for nutrition.	Market prices
4.3.1.2	Minerals for materials	Market prices	4.3.1.3	Minerals for energy	Market prices
4.3.2.3	Wind energy	Market prices	4.3.2.4	Solar energy	Market prices

REGULATION SERVICES					
2.1.1.2	Filtration of waste by living organisms	Cost methods	2.2.4.2	Fixation of organic matter in soils	Cost methods
2.2.5.2	Chemical quality control of salt water	Cost methods	2.2.1.1	Coastal erosion protection	Cost methods
2.2.1.3	Regulation of water flows	Cost methods	2.2.2.3	Maintenance of biodiversity	Contingent valuation
2.2.6.1	CO_2 capture	Market prices	2.2.6.2	Climate regulation	Hedonic prices, contingent valuation
5.1.1.1	Filtration of waste by non-living processes	Cost methods			

CULTURAL SERVICES					
3.1.1.1	Living systems that enable active recreation activities	Travel cost, contingent valuation	3.1.1.2	Living systems that enable passive recreation activities	Travel cost, contingent valuation
3.1.2.1	Living systems that enable research activities	Travel cost, contingent valuation, research budgets	3.1.2.2	Living systems that enable educational activities	Travel cost, contingent valuation, education budgets
3.1.2.3	Living systems that allow cultural activities	Travel cost, contingent valuation or cultural activity budgets	3.1.2.4	Living systems that enable aesthetic experiences	Travel cost, contingent valuation
3.2.1.1	Living systems with symbolic significance	Travel cost, contingent valuation	3.2.1.2	Living systems with religious significance	Travel cost, contingent valuation
3.2.1.3	Living systems for entertainment	Travel cost, contingent valuation, entertainment activities budgets	3.2.2.1	Living systems that grant existence value	Contingent valuation
3.2.2.2	Living systems that grant option or legacy value	Contingent valuation	6.1.1.1	Natural and abiotic characteristics that allow active or passive recreation activities	Travel cost, contingent valuation
6.1.2.1	Natural and abiotic characteristics that allow intellectual activities	Cost of travel, contingent valuation or budgets of intellectual activities	6.2.1.1	Natural and abiotic characteristics that allow spiritual activities	Travel cost, contingent valuation
6.2.2.1	Natural and abiotic characteristics that provide existence, option or legacy value	Contingent valuation			

Despite carefully selecting the most suitable valuation method for each ecosystem service, as well as the most reliable and robust data source possible, it **is inevitable that there will be a certain degree of uncertainty in the monetary result obtained for each ecosystem service**. As an exercise in transparency and good practice, it is proposed to apply the following methodology[8], explicitly developed to assign a degree of (un) certainty to each economic result of the study. This methodology allows assigning a degree of confidence calculated from different variables, including: valuation method, source of the data used - interviews, county data, local data, national data, international data -, type of data used - interviews, official data, estimates, transfer of benefits -, sample size and study area. Depending on these variables, a specific score is reached between 0 (very low uncertainty, that is, a positive result) and 100 (very high uncertainty, that is, a negative result). Table 4 shows a summary of the score corresponding to each degree of (un) certainty.

Table 4. Methodology to obtain the degree of (un) certainty of the results of the economic valuation of ecosystem services, depending on the valuation method and the data source used. Source: Own elaboration

Level of uncertainty	
Very high	Score 0-20%
High	Score 20-40%
Moderate	Score 40-60%
Low	Score 60-80%
Very low	Score 80-100%

[8] To know in detail the distribution and assessment of the different variables described, contact the authors of this Methodological Guide.

4.5 Guide for calculating maintenance costs

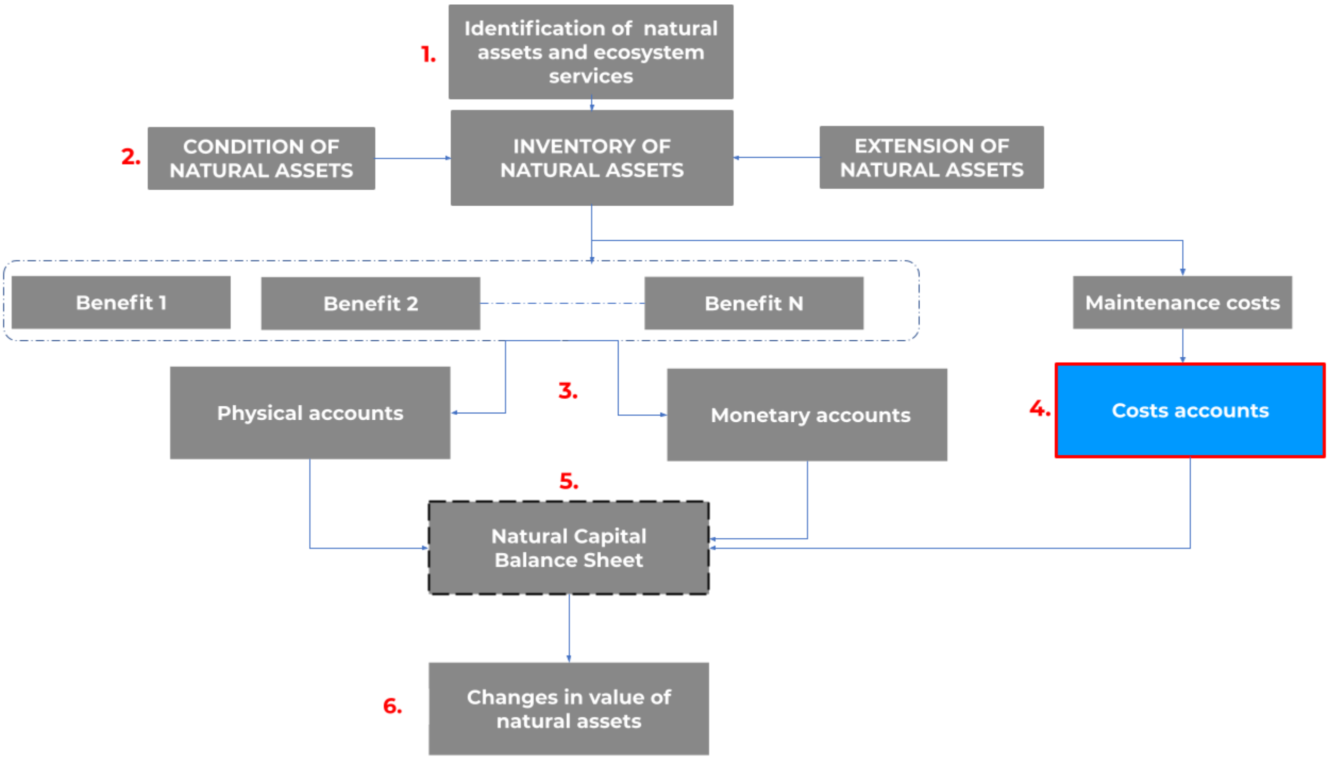


Figure 13. *Fourth step of the accounting process: Calculation of maintenance costs.* Source: Own elaboration

An MPA, in addition to providing benefits to society, also entails the **necessary costs to maintain the natural assets it hosts in an adequate state over time.**

Among these, the legal costs stand out, which cover the proportion of responsibility for natural capital that organizations or the government are obliged to carry out by law or by contract. In addition to these, there are other types of costs such as surveillance within the MPA, derived from due supervision to enforce the regulations of marine reserves. Other examples of costs are those related to fish monitoring (monitoring that is done in fishing reserves) or assistance at anchoring. The latter is an advisory service that is offered to sailors who are going to anchor in order to inform them about the appropriate place to do so.

In any accounting study of marine natural capital, the annual costs necessary for maintenance of the analyzed MPA must be estimated.

4.6 Guide to the *Natural Capital Balance Sheet*

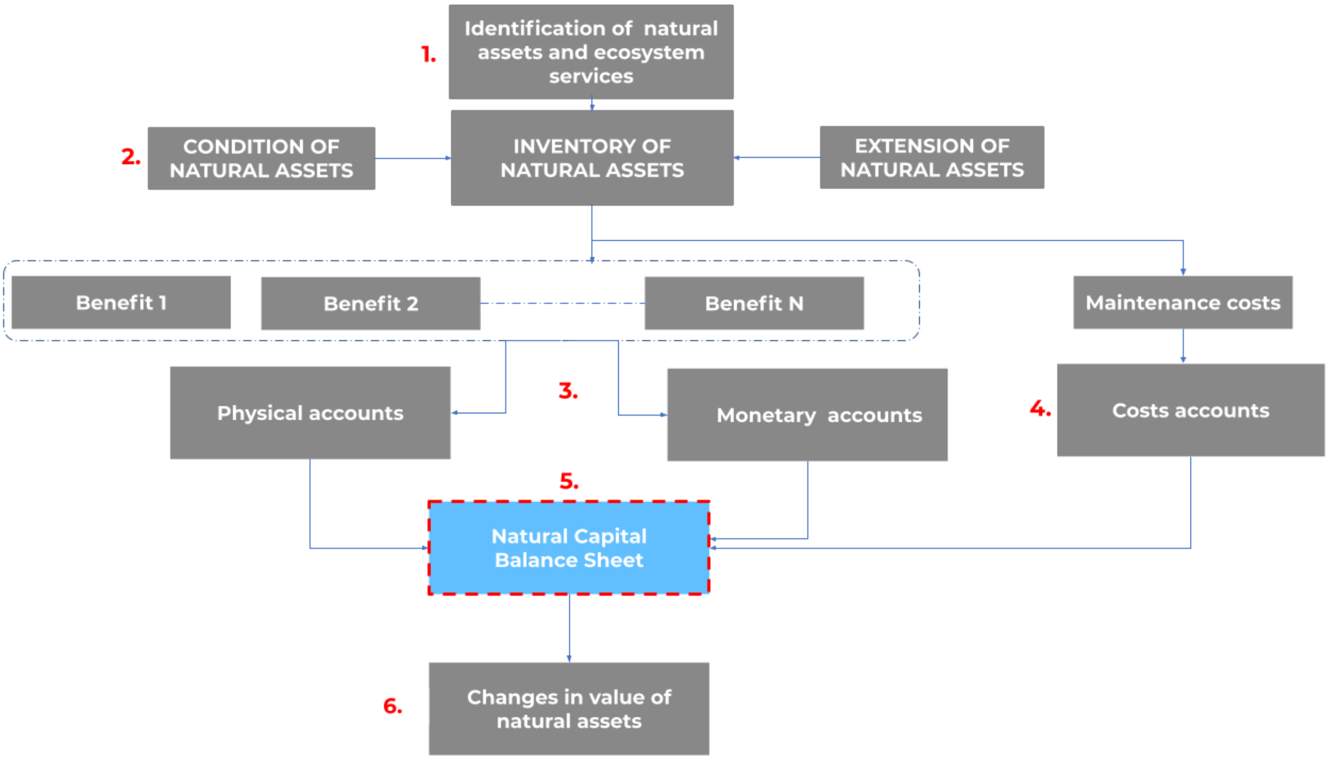


Figure 14. *Fifth step of the accounting process: Construction of a Balance Sheet of natural capital.*

Source: Own elaboration

The *Natural Capital Balance Sheet* is a report that can be used to measure the state of natural capital. It records the value of natural capital at a given time and the costs of maintaining that value, reporting on future flows of benefits and costs for a given state of natural capital.

Once the economic values of the ecosystem services (see section 4.4) and the maintenance costs (section 4.5) have been obtained, the Total Net Value of Natural Capital Assets is calculated. To do this, annual benefit flows are projected for each ecosystem service, as well as its maintenance costs, over 60 years. To do the projection, information on trends and future evolution of the variables of each ecosystem service should be used (depending on the extension and condition of the natural assets), according to the information available. In the absence of information to make projections, constant and real flows (without inflation) should be assumed.

After projecting the flows and costs over 60 years, these are discounted at a previously selected rate to obtain the present value of flows and costs. It is recommended to use a real declining discount rate of 3.5% for years 1 to 30, and 3% for years 31 to 60. This rate is based on the *Green Book Notes* (2020)[9] discount rate, known as the Social Rate of Time Preference

Once the rates are selected and applied, the maintenance costs and the projected profit stream (for all the years) are added separately. The total sum of all ecosystem services (benefit flows) constitutes the present value of the ESs of the study area, and is called the Gross Value of Natural Capital Assets. If from this value we substract the sum of all maintenance costs —calculated for the present, that is, the Present Value of the Maintenance Costs—, we will obtain the **Net Value of the Natural Capital Assets for a given moment.**

[9] HM Treasury and Government Finance Function (2020) *The green book: central government guidance on appraisal and evaluation.*

Below is an **example of the *Natural Capital Balance Sheet* developed for the Marine Protected Area *Llevant-Cala Rajada*, located in the Balearic Islands (Spain)**.

Ecosystem services	Physical flow (units / year)		Monetary flow (EUR / year)	Present value (60 years)
2018				
Benefits				
Aquatic animals for nutrition (1.1.6.1)	7,421	Kilograms	129,646	3,400,426
Posidonia oceanica remains (1.1.5.1 and 1.1.5.2)	800	Kilograms		-
Improvement of water quality (2.1.1.2 and 2.2.5.2)	3,951	Hectares	211,349	5,543,359
Protection from coastal erosion (2.2.1.1 and 2.2.1.3)	3,951	Hectares	772,547	20,262,735
Maintenance of biodiversity (2.2 .2.3)	19,271	People	447,313	11,732,344
CO_2 capture (2.2.6.1)	3,866	Tons of CO_2	19,331	507,012
Active or passive recreational activities (3.1.1.1, 3.1.1.2., 6.1.1.1)	384,143	Number of users	3,141,440	82,395,189
Scientific research and education (3.1.2.1, 3.1.2.2, 6.2.1.1)	3	Number of projects	104,892	2,751,150
Gross natural capital assets			**4,826,518**	**126,592,216**
Liabilities				
Maintenance costs			476,137	12,488,344
Net natural capital assets			**4,350,381**	**114,103,872**

***Figure 15**. Example of a balance sheet of the Natural Capital developed for the Llevant Marine Protected Area, located in the Balearic Islands* (Spain).Source: Own elaboration

Once the accounting sheet is built, it is recommended to carry out a **sensitivity analysis** for different discount rates, in order to see the variation of results for different rates: 3.5% (standard discount rate), 3% (reduced discount rate), 2.5% (French discount rate), 2% (Stern discount rate), 1% (reduced Stern discount rate), 0%, -1% (negative discount rate).

It is worth spending some time in further discussion on discount rates. The discount rate has two components: time preference and wealth effect. Time preference is the rate at which the present is valued over the future, assuming constant per capita consumption. It includes time preference (δ) and catastrophic risk (L). The estimate of time preference in the *Green Book* is 0.5% and catastrophic risk, 1%. Therefore, the estimate of the time preference rate is 1.5%.

The wealth effect reflects the expected growth in per capita consumption over time. As future consumption is expected to be higher relative to current consumption, this will mean a lower utility — and thus a higher rate. It is calculated as the marginal utility of consumption (μ), multiplied by the expected growth rate of future real per capita consumption (g). The estimates of μ and g are at 1 and 2%, which suggests that 2% is a reasonable estimate of the overall wealth effect.

These parameters lead to a rate of 3.5%, which is within a justifiable range. The estimates of the parameters and, therefore, of the Social Rate of Time Preference, have been for years - and still are - subject to debate. However, the 3.5% figure is in the majority of the current literature.

On the other hand, if the discount rate is assumed to be decreasing, it is due to the uncertainty about the future values of its components. This is why, as of year 31, the rate is reduced from 3.5% to 3%. The theoretical and empirical literature has tended to confirm the declining discount rate approach for long-term risk-free discount rates (Arrow *et al*. 2013, 2014[10]; Gollier and Hammitt 2014[11]; Cropper *et al*. 2014[12]). The idea behind this assumption is that a prudent planner would want to save more as a precaution. As a result of persistent growth crises, the future is increasingly uncertain and this precautionary effect increases as the considered time horizon grows. This is reflected in a decreasing time structure of discount rates.

Currently, there are discussions that consider the possibility of lowering the discount rate; for example, the *Green Book* considers a "reduced discount rate of 3%". Following this recommendation, a sensitivity analysis exercise could be carried out, that is, analyzing the impact of a change in the discount rate on the *Natural Capital Balance Sheet*.

The French guidelines, which also follow a Social Rate of Time Preference approach, recommend a rate of 2.5%, compatible with $\delta = 0.5$; $L = 0$, $\mu = 2$ and a growth of 1%. On the other hand, the Stern report (2007)[13] recommends a rate of 2%, following the parameters of $\delta = 0$; $L = 0$, $\mu = 1$, and a growth of 2%. The main differences between the positions of the Stern report and those of the *Green Book* are that the former considers zero time preference for ethical reasons (long-term intergenerational fairness), while the *Green Book* is more concerned with shorter time horizons. Likewise, the Stern report interprets catastrophic risk only as the probability of a social collapse such that there is no society enjoying future well-being, while the interpretation of the Green *Book* is broader. Finally, a more pessimistic outlook for a growth of 1% is found in Groom and Maddison (2018)[14], which shows a Social Rate of Time Preference of 1%.

Another option discussed is the use of a discount rate of 0%, or even negative. The higher rates are related to greater degradation of the environment, as individuals opt for short-term measures to satisfy immediate desires, at the expense of sustainable practices with high costs in the distant future. Rates close to zero or negative take into account a greater importance of conservation for future generations, that is, they take into account distributive impacts.

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[10] J. Arrow, K., L. Croppery, M., Gollierz, C., Groom, B., M. Heal, G., G. Newellk, R., D. Nordhaus, W., S. Pindyck, R., A. Pizeryy, W., R. Portneyzz, P., Sterner, T., SJ Tol, R., y L. Weitzman, M. (2014) Should Governments Use a Declining Discount Rate in Project Analysis? *Review of Environmental Economics and Policy* 8(2):145-163.

[11] Gollier, C. y Hammitt, JK. (2014) The Long-Run Discount Rate Controversy. *Annual Reviews* 6: 273-295.

[12] Cropper, Maureen L., Freeman, Mark C., Groom, Ben and Pizer, William A. (2014) Declining discount rates. *American Economic Review: Papers and Proceedings,* 104 (5): 538-543.

[13] Stern, N. (2007) Stern Review on the Economics of Climate Change. *Cambridge University Press*.

[14] Groom, B. y Maddison, D. (2018) New estimates of the elasticity of marginal utility for the UK. *Environmental and Resource Economics* 72: 1155-1182.

4.7 Guide for future movements in the Balance Sheet of Natural Capital

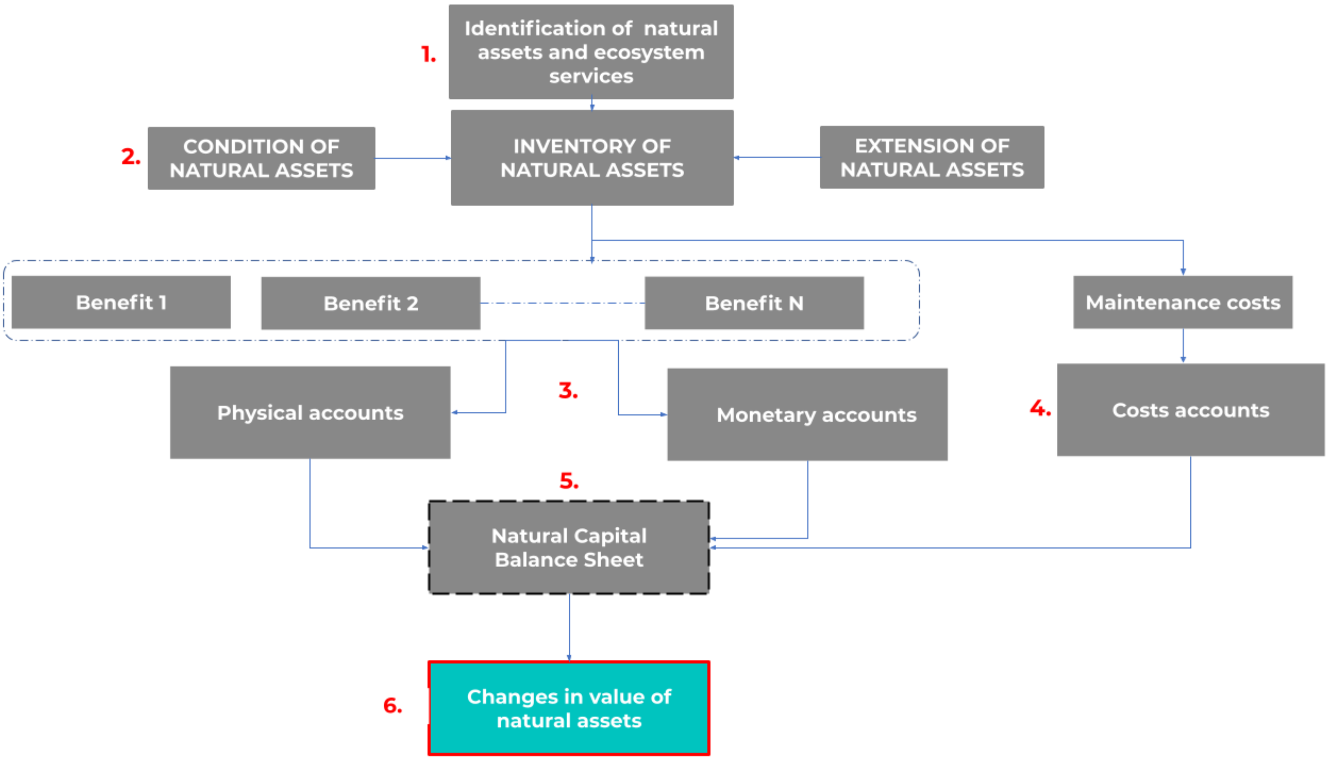

Figure 16*. Sixth step of the accounting process: Updating and inclusion of changes in natural assets in the Natural Capital Balance Sheet.* Source: Own elaboration

The example *Natural Capital Balance Sheet* shown in section 4.6 indicates the value of Net Natural Capital Assets in a study area for a given time. It is a baseline that provides a reference scenario for a given month or year, and thus establishes an asset value against which subsequent changes in the state of natural capital can be measured in monetary terms. Any improvement or deterioration in the value of natural capital will be reported in the future as an accumulated gain or loss in relation to this baseline.

To monitor the state of natural capital going forward, it is necessary to report changes in the quality and quantity of natural capital assets relative to the baseline.

Three types of changes that natural assets can undergo in an MPA are identified:

- **Assets quality:** driven by exogenous or endogenous changes, including any anticipated improvement or deterioration (changes in the condition of natural capital assets). This change is reflected in the accumulated profit or loss line on the balance sheet.
- **Assets quantity:** derived from additions, usually through acquisition, but possibly through creation / transformation or new discoveries, land transfers (either by transfer or sale) or, in the case of non-renewable assets, by extraction / consumption. Value of the additions, disposals or consumption of natural capital assets over the period.
- **Revaluations or adjustments:** derived from other changes that affect the value of the assets, usually exogenous changes (such as prices and market preferences), but can also include any adjustments, such as relevant changes in the valuation methodology, in the starting point valuations or in the change of use or uses with different values.

5. Data and information requirements

5.1 Data and information on the extent of assets

The extent of assets must be measured and recorded with the magnitudes and in the most appropriate units for each case.

For those assets that respond to spatial dimensions, normally surface or volume, cartographic tools should be used to determine the surface or volume occupied by each ecosystem, habitat, geological resource deposit or body of water. The extension will be expressed in the units of those magnitudes (surface area in ha, volume in hm^3, for example).

Some assets that can be classified as dynamic should be expressed with magnitudes such as flow velocity (sea current speed (m / s), wind speed (km / h), significant wave height (m)), but they should be qualified with vectorial information, specifically with the predominant direction over time, which can refer to annuities or longer periods of time.

Assets made up of discrete units, typically, populations of species, must be treated using population variables (such as density of individuals per unit of surface, abundance, degree of coverage of the substrate), and be linked to geographic information, to limit the areas where they are considered. Complementarily, when calculating the density of individuals or the abundance of a certain species, the number of individuals must be related to the space occupied by the species, excluding from the computation those areas that are not their habitat. Data on the number of individuals should be obtained by carrying out the corresponding censuses and inventories, with direct or indirect observation methods, or else inferred from sources such as catches from common fishing or experimental fishing.

Despite the above considerations, for certain species, such as algae, clonal plants, colonial or recurrent invertebrates, it may be better to express their abundance using magnitudes such as biomass per unit of seabed surface, biomass per volume of sediment or biomass per unit of volume of water. Observation is not enough to obtain these data and it is necessary to go for biological sampling and processing of the samples.

There is still a group of assets that is not included in the previous categories and that, due to their unique nature, must be treated with specific variables, such as the concentration of dissolved substances in water, which will be measured in g / l, molarity, ppm, or its lower units; or the intensity of solar irradiation, which will be measured in W / m^2 and which must be qualified with monthly data.

5.2 Data and information on the condition of assets

The condition of assets is usually determined by comparing local data with a reference condition or appropriate condition that serves as a contrast. Aspects like the population density of a species, the coverage with which a habitat occupies the space, the concentration in which a certain substance is dissolved in water, the average size of the individuals of an exploited species and the biological diversity of a specific community, are parameters whose values are used to determine the condition of the assets, if reference values are available to compare them with. It is highly desirable to consider in depth the existing bibliographic information regarding these assets before launching new field data programs.

When undertaking the task of establishing the condition of the assets in a given MPA, there are three possibilities. The first and simplest is to use existing information, coming from the MPA itself or from its surroundings, which has been generated in the MPA's own monitoring programs or those belonging to third parties. The second is obtaining data from the MPA in question and comparing them with the reference values available in the bibliography. Thirdly, and in the absence of own and reference data, the task of defining the reference states and obtaining the data from the AMP itself, should be undertaken.

5.3 Data and information on the ecosystem services

Data on **provisioning services** should be available from entities, companies, professional associations or other groups that benefit from such provisioning.

For extractive activities, which undoubtedly require an authorization, it is likely that the managing administration of the MPA (or other administrations) will demand that the items extracted are declared, whether they are abiotic resources (water, salt, aggregates, minerals, fossil fuels) or biotic (extraction of flora and fauna). In the event that the administration does not have this information, it will be necessary to target the resource operators themselves to obtain it, although they may be less reliable. Finally, if the information is not obtained from the operating entities either, it is possible to do surveys in the operating activities themselves. A typical example is that of professional or recreational fishing. In a given MPA, it is likely that the catches will have to be declared to the Administration. If not, or if the Administration is reluctant to release this information, it is possible to interview the fishers themselves (the more interviews carried out, the better) to obtain an estimate of their catches. Obviously, uncertainty increases with this method. In the event that the information transmitted by the fishers is considered unreliable, specialized observers can be set onboard the fishing fleet to determine first-hand the volume of the catches. The information on the samples in this case will be very precise, but it is statistical in nature, and it will be necessary to infer the total catches of the fleet from the samples obtained, which increases the level of uncertainty. If using observers is not possible either, experimental fishing can be carried out with the same gears. In this case, inference will also be necessary to extrapolate the catch data from the experimental fisheries to the total fleet. Finally, it is relatively common that the total resource extracted or captured is not declared, because the authorized quota has been exceeded or for tax avoidance reasons.

In the first case, it may happen that the declared quantities do not coincide with the registered sales, because the marketing channel has been maintained. In the second case, non-declared catches are marketed through irregular channels and there are no records. In such cases, it may be appropriate to enter a correction factor if it can be estimated. The uncertainty is minimal if the practices described do not exist, it increases if they exist and the correction factor is applied, and it is maximum if these practices exist, but no correction factor is applied.

In the case of energy provisioning, the operating companies will provide the energy generation data.

The primary data corresponding to **regulation services** are based on geographic information on the extent of the natural systems that provide them, from the MPA under study. But the information to interpret these data is likely to come from scientific studies conducted elsewhere, although it is always preferable to develop similar studies in the MPA itself to minimize uncertainty. Thus, it is convenient that the interpretation information used come from studies developed in places the closer, the better, and on habitats that are most similar to those of the studied MPA. In the same vein, it will be better to include as many habitats as possible, as long as the information is robust. For example, the CO_2 capture capacity of the different habitats present in an MPA may be determined from the area occupied by each one of them and the capture rates that have been determined in scientific studies carried out in the same MPA, or elsewhere (in the latter case, the degree of uncertainty increases). As a last option, reference values or the values proposed by the Intergovernmental Panel on Climate Change (IPCC) may be used.

Although it is always preferable to have direct information concerning the study area, probably the data related to services such as the capacity for self-purification of marine waters, the fixation of organic matter and chemical substances in the sediments and protection against coastal erosion come from complex studies developed elsewhere, which will require adaptation to the characteristics of the MPA under study.

In contrast, biodiversity data is relatively easy to acquire by developing local studies that are not very complex.

The data belonging to the group of **cultural services** will be mainly composed of statistics on the number of users, visitors or participants in the different recreational, cultural, scientific and educational activities. They will come from the entities that organize these activities, whether commercial or not. For the number of projects or activities, these data may be obtained from the government administrations that authorize those activities or finance them. Mainly, the surveillance and control programs established in the MPA, as well as its managing body, should be informed of all the activities carried out within the protected area. In addition, it is possible that other activities (talks, technical conferences, workshops, etc.) related to the MPA take place outside its limits, although it is likely that the same managing body has promoted or, at least, participated in them.

Finally, for option, legacy and existence services, the number of elements or protected spaces or the number of protected areas must be reported. The competent administrations in matters of protection of the marine environment, fisheries management, natural environment planning and Natura 2000 Network can provide information on this matter.

5.4 Data and information on the monetary accounts

Provisioning services meet the needs of well-defined markets, where it is possible to determine the prices of extracted resources. If the economic data are obtained from interviews or from the registry of local markets, the level of uncertainty is low, but it increases progressively if the markets consulted are local, regional, national or international. Returning to the example of fishing from the previous section, the ideal situation is that there is a traceability such that it allows to know the sale price of each batch of product in the local market. If that is not possible, you can work with average daily, weekly, monthly or annual sale prices, although in every increase of the time period considered, uncertainty is gained, since the prices of products, especially artisanal fishing, vary considerably throughout the year, or due to factors such as the size of the pieces or even the vessel that made the catch. In the same way, the ideal is to have access to local prices, although it is also possible to work with local, regional, national prices, thereby increasing uncertainty.

Most **regulation services** are valued using cost methods, estimating the values of the services based on the costs of damage avoided by the presence of the service, the costs of defending the services, of replacing them or repairing them, or replacing them with other artificial alternatives. There must always be a real predisposition to invest in these types of measures. The type of information obtained will determine the degree of uncertainty of the method: for example, if they are data from the same study area, if they are data from another area, if they are from the same community, the same country or another nation, if it applies only to one habitat or to a large number of habitats. In most cases, it will be information imported from other places, since the evaluation of the economic consequences derived from environmental impacts that have caused deterioration or loss of ecosystem services is not standard practice..

In the case of valuation of the biodiversity maintenance service, the most accurate method of economic valuation is contingent valuation, and the best thing in this case is to conduct surveys amongst people about their willingness to pay for maintaining biodiversity in the area of study. In this case, it is important to have a representative sample of the studied population, so that the level of uncertainty is as low as possible. If surveys cannot be conducted, the next step will be to use public budgets for biodiversity maintenance projects, as these are a reflection of individuals' willingness to pay. With this type of information, the level of uncertainty increases and it increases even more the older the budgets are. Budgets can be the responsibility of local, regional, national or international administrations. For this reason, consultations should be made at the different levels of the Administration that are related to the geographic site. In addition, marine research organizations and NGOs can also provide information on their conservation projects. The last option, and the one with the highest degree of uncertainty, is to use surveys or budgets from other study areas and adapt them to our study area by means of a correction factor.

The climate regulation service can also be valued through the method of contingent valuation, asking a sample of people about their willingness to pay to receive the benefits of climate regulation. In this case, there are no budgets that can be applied, so it can only be assessed through surveys or by carrying out another study in this area. For this service, the hedonic price method can also be applied, which consists of assessing how climate regulation in a given place influences house prices. For this, information on a representative sample of homes, their prices and characteristics must be available. Generally, this information is obtained from home or real estate web search engines.

The CO_2 capture service is usually valued by the market price method since there are prices due to emission quotas and credits from voluntary markets.

In the valuation of regulatory services, uncertainty will always increase when reference information is not available on the valuation of a given service for all the ecosystems present in the MPA. Similarly, the economic information of certain services can always be adapted from one MPA to another, with what is known as transfer of benefits. This valuation case also introduces a higher level of uncertainty.

Cultural services can be assessed through contingent valuation, travel cost or project budgets.

The contingent valuation method requires surveys, as explained in the information on the biodiversity maintenance service.

To apply the travel cost method, it is also ideal to conduct surveys on a sample of visitors to find out the number of visits each one made to the study area in a year and the expense associated with each visit. This method assumes that the money used to make the trip to the site under study and to carry out the activities, represents the price of access to it. Here we can include: travel expenses, accommodation, subsistence and all the expenses required to carry out the activity. It is also important to obtain socioeconomic information from the respondents. From these surveys, an individual demand curve, consumer surplus and the total value of the considered ecosystem service can be estimated. In case the surveys cannot be carried out, the zonal demand curve can be estimated, which requires information on the visitation rates of the different zones. Very precise information is required to be able to estimate the visitation rate (from the percentage of visitors to an area over the total population of the area) and the associated costs of each area, to then estimate a demand curve for the area and the consumer surplus. In both cases, it is important to have a representative sample of the population so that the level of uncertainty associated with this method is low. Many protected areas keep a daily control of visitors, or do this control periodically, even filling in questionnaires with information about hobbies and interests, motivation for the visit and other personal data. In Marine Protected Areas, it is common for certain regulated activities to be subject to the presentation of identity documents, qualifications, sports insurance, etc., for which the information record of the participants in those activities is obtained.

In case it is not possible to carry out surveys or obtain official information that allows estimating the demand curve, estimates can be made to calculate the travel budget associated with each recreational activity. If it is not possible to interview the users of a certain recreational activity, for example recreational diving, the managers of the diving centers operating in the area could be interviewed to obtain the necessary information. In this case, the consumer surplus will not be obtained, because a demand curve could not be estimated, but the total budget spent on this type of activity will be obtained, including travel expenses, accommodation, subsistence and all the expenses required to carry out the exercise. Finally, if you do not have any data on the study area, you can always estimate this service from the transfer of benefits from another study, making the necessary adjustments.

The project budgets method can also be used to value some cultural services, such as education and research. In this case, information must be available on the amount of money invested in one year in education or conservation projects in the study area. Marine research organizations, educational administrations and NGOs that carry out activities in the MPA and can provide information on their research and education projects, should be consulted. Also other types of entities)such as sports federations, nautical clubs or associations), have environmental education sections or similar departments that can also carry out educational activities in the MPA. As a general rule, these activities must be authorized by the managing body of the MPA, which means that it should be able to provide the initial information to carry out the search.

6. Lessons learned and future considerations

This report is a guide for the implementation of natural capital accounting in Marine Protected Areas. Natural Capital Accounting is a very useful tool for political and management decision-making, and also provides the necessary monitoring elements to track changes in natural capital over time. It shows the future impact, both physical and economic, of any change or new scenario that takes place with respect to the management of a marine protected area.

In the process of preparing this methodological guide, a series of lessons learned have been identified. In the first place, it has been deemed necessary to count on a developed methodology in order to identify natural assets and ecosystem services, that incorporates **participatory processes** with different stakeholders and agents. It is considered essential to carry out workshops for the pre-identification, identification and ranking of ecosystem services during the first phases with local agents, with the aim of benefiting from local knowledge and experience that cannot be found through other methods such as bibliographic reviews. Likewise, it is highly recommended that participants in the workshops intervene and be involved throughout the accounting process.

On the other hand, in order to obtain robust accounting, it is relevant to have access to **specific and verified information on the study area**. In terms of the extension of natural assets, it is important to have an *ad hoc* mapping of the study area, as well as studies that determine the state (condition) of the marine habitats. To establish and follow their condition, it is a priority to have data from monitoring and follow-up programs for marine assets.

Regarding the economic valuation of services, it is essential to **measure the level of (un)certainty of each valuation method and economic result**, as an exercise in transparency and good practice. The uncertainty of the results of the valuation will be lower if the information necessary for the calculations comes from the study area. In the case of travel cost valuation methods and contingent valuation, it is suggested to carry out the necessary surveys to build demand curves.

Once obtained, the *Natural Capital Balance Sheet* is a **very useful tool for decision-making**. Just like considerations on environmental impact, the safety and health of people or climate change, it is necessary to gradually incorporate the accounting of natural capital into the procedures for processing plans, projects and strategies. The natural capital accounting approach should be introduced into these procedures as yet another tool for decision-making that encourages, in the medium and long term, the optimization and efficiency in the use of natural resources. Likewise, reports that include the economic value of the natural assets of a specific marine protected area, as well as their maintenance costs, may be used in order to monitor their status, condition and value over time, which will help encourage greater investment to improve their conservation and sustainable management.

Finally, the usefulness of having a natural capital accounting model lies in the fact that the data obtained in the first balance sheet are regularly updated. By **registering changes in the value of assets** over the years, it is possible to go from having a "fixed" image of a marine protected area to a "dynamic" one, that allows making the correct decisions for its optimal management.