



Natural capital accounting for Clew Bay, Ireland

Use Case Assessment

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Glossary

Natural capital profile – a set of information that describes ecosystem asset in terms of extent, condition, ecosystem services and their values.

Natural capital accounting is the process of calculating the total stocks and flows of natural resources and services in a given ecosystem or region. Accounting for such stocks and flows may occur in physical or monetary terms. The approach follows the UNSEEA agreed concepts and definitions to ensure consistency across natural capital applications.

Natural capital accounts – a presentation of the natural capital profile in a series of accounting tables. This may include income statements and balance sheets.

UN SEEA – a globally agreed set concepts and definitions to ensure consistency across natural capital profiles.

CEED – a Coherent Environmental- Economic set of data about the total stocks and flows of natural resources and services in a given ecosystem or region. The approach to creating a CEED follows the UN SEEA concepts and definitions to ensure consistency across applications.

NC Valuation – there are generally understood to be two approaches to values including welfare and transaction

Natural capital: the limited stocks of physical and biological resources found on earth, and of the limited capacity of ecosystems to provide ecosystem services

Human capital: the knowledge, skills, competencies and attributes of individuals that facilitate the creation of personal, social and economic well-being

Social capital: Networks, including institutions, that share norms, values, and understandings that facilitate cooperation within or among groups

Produced capital: all manufactured capital, such as buildings, factories, machinery, physical infrastructure (roads, water systems), as well as all financial capital and intellectual capital (for example, technology, software, patents and brands)

Asset manager – an economic actor that managers either natural, social, human or produced capital.

Benefits – the goods and services that are ultimately used and enjoyed by society

Dependency – the assets that an economic actor utilises in their production

Impact – the effect of an event on the economy, society or the environment in a specified area

1 Introduction

Over the past 30 years, the concept of sustainable development has become increasingly embedded in the fabric of society. Global agendas and grassroots action on sustainability, and societal responses to climate change, biodiversity, human rights and gender equality are all examples of sustainable development issues becoming mainstream. Society is beginning to recognise the importance of all capitals (described in Box 1) and their role in human wellbeing and the distribution of wealth.

Box 1 Multiple capitals

Natural capital: the limited stocks of physical and biological resources found on earth, and of the limited capacity of ecosystems to provide ecosystem services

Human capital: the knowledge, skills, competencies and attributes of individuals that facilitate the creation of personal, social and economic well-being

Social capital: Networks, including institutions, that share norms, values, and understandings that facilitate cooperation within or among groups

Produced capital: all manufactured capital, such as buildings, factories, machinery, physical infrastructure (roads, water systems), as well as all financial capital and intellectual capital (for example, technology, software, patents and brands)

Source: TEEB. 2018a. TEEB for Agriculture & Food: Scientific and Economic Foundations. Geneva: UN Environment. (Online). http://teebweb.org/wp-content/uploads/2018/11/Foundations_Report_Final_October.pdf.

Increasing global attention towards sustainable development is providing new challenges and opportunities for consumers, producers, government, non-government organisations and politicians. Transformative change is needed to develop a holistic approach to asset management that considers the distribution of wealth and the intergenerational impacts of our current decisions.

A multiple capitals framing can be applied to formulate an integrated response to the challenges and opportunities that actors face. A powerful entry point is natural capital since all other capitals and the benefits they provide are dependent on it.

A natural capital profile is an evidence base for understanding and responding to these challenges and opportunities in a transparent and systematic way. Natural capital accounting (NCA) is a structured approach to generating quantitative evidence that underpins the natural capital profile. The approach should implement agreed concepts and definitions to ensure consistency across natural capital profiles and enable comparisons between businesses, governments, locations and across time. Implementation of NCA is growing, with companies and governments using a natural capital profile and accounting statements as an input to decision making and communication with respect to sustainable development, natural resource management and biodiversity.

This is the second phase of the BIM Natural Capital project, with the initial phase in 2020 scoping the potential utility of natural capital accounting. This phase provides the opportunity for BIM to explore the utility of natural capital accounting and lead the extension and application

of NCA to Irish marine and coastal areas. BIM's approach will complement existing approaches being undertaken or that have been undertaken by the Environmental Protection Agency, Bord na Mona, Coillte and the Central Statistical Office.

The project will deliver a series of reports namely:

- 1) Use case assessment – this report, which frames natural capital from the perspective of a number of different users and potential applications of natural capital information
- 2) Clew Bay Natural Capital Profile – focusses on the provision of structured information on natural, produced, human and social capital in Clew Bay
- 3) Synthesis report – assessment of the information against the objectives of the project, and the priority applications, and recommendations for improvement in the future.

This report, the use case assessment, expands on the broad benefits of NCA described in the phase 1 project to clearly articulate the potential for NCA to support the seafood sector in Clew Bay, Ireland. Development of the use case can support information collection that is fit for purpose and can provide direction to the scientific community in terms of information gathering. It is common for scientific information to be driven by researchers in the pursuit of new knowledge (a supply side push), and while the research will have utility, the information is often not coherent with other environmental and economic data, and therefore is incomplete for the purpose of building a sustainability narrative. The NCA process supports the integration of data by providing an organising framework which bridges ecology and economics.

This report is structured as follows:

- The asset management paradigm (chapter 2) - frames the challenges in managing Clew Bay sustainably using an asset management based approach
- Asset management in action (chapter 3) - identifying different players in Clew Bay, how they are managing natural capital, and describing what components / themes are important for their management

2 The asset management paradigm

We are all asset managers. Individuals, businesses and governments all manage assets through their spending and investment decisions (Dasgupta, 2021). We manage a portfolio of assets (human, built, social and natural capital) simultaneously to maximise the benefits (monetary and non-monetary) that we receive. For example, an aquaculture operator manages their employees, aquaculture vessels and equipment, water quality, and stock, to ensure the continued provision of benefits over time.

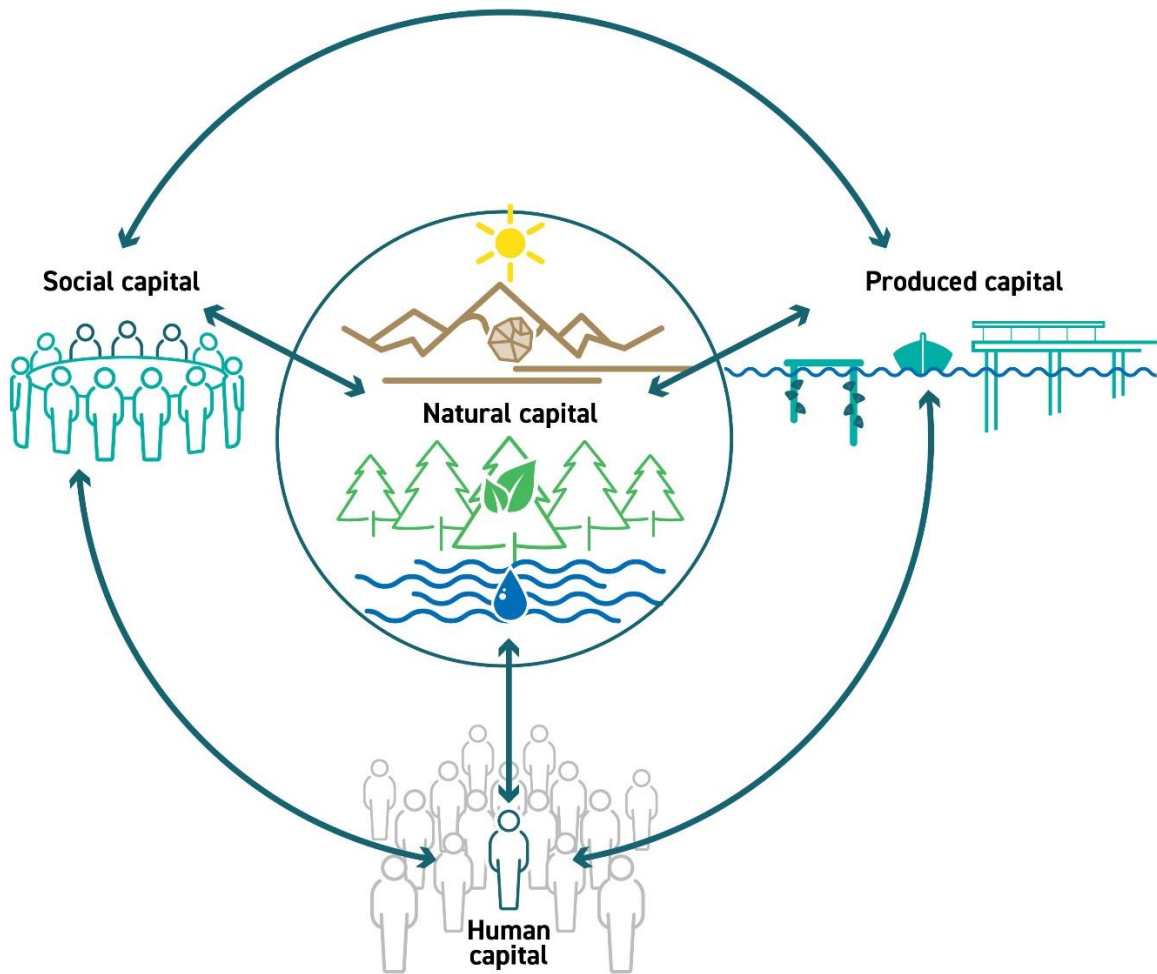
The choices by asset managers in years following the industrial revolution has resulted in disparities in the stock of the world's capital. In the pursuit of economic growth, there has been an accumulation of produced and human capital at the expense of natural capital. Trade-offs have occurred under political and economic objectives that have embodied a low relative value of natural capital. This is due to many things including greed, lack of scientific knowledge and ineffective institutions and policies. Humanity has prospered immensely in recent decades. However, we have failed to manage our global portfolio of assets sustainably (Dasgupta, 2021).

Asset management requires an understanding of **what** is being managed – that is, the size, type and health of the asset, and the benefits that asset is providing. Typically, businesses have a good understanding of the produced capital that is being managed, including what that asset is (for example, a manufacturing plant), its age (a proxy for health), and the benefits of having that asset (for example, a manufacturing plant provides an efficient way to bottle soft drink). Conversely, businesses and government have a relatively poor understanding of the natural capital that they depend on. For example, our knowledge on ecosystems and their contribution to economic production is relatively poor, as is our knowledge on how close those ecosystems are to critical thresholds which may affect production and broader notions of wellbeing.

The portfolio of assets exist across four broad types of capital (as described in box 1). The assets are interdependent and the quantity and quality of any one capital affects the quantity and quality of another (Figure 1). For example, the quantity of fish that is available for harvest depends on the health of the marine environment, the experience and knowledge of employees that harvest fish, and the equipment used to harvest the fish.

A decision maker can invest in one or many capitals simultaneously to deliver benefits. Within a given budget, a decision maker will need to determine an investment strategy based on the flow of benefits into the future. For example, the benefits from investing in the restoration of oyster beds may need to be compared to the benefits of investing in new harvesting equipment. In some cases, one capital can be substituted for another capital. For example, the returns from oyster aquaculture may be compared to oyster fishing, where aquaculture is a more intensive produced capital system than oyster fishing.

Figure 1 Multiple capitals



The task of managing our assets is challenging and complex because there are numerous dimensions involved. Asset managers operate at different scales – both micro (business and consumers) and macro (governments) – and there is an interplay between the different levels of management across space and time. Sometimes the best intentions can have perverse outcomes, and decisions at different scales can often contradict each other. In addition, there are many players – public, private, industries, special interest groups –with different incentives, interests and understanding of the situation.

The challenge associated with asset management is threefold:

- 1) getting stakeholders to understand that they are asset managers because they are dependent on assets, and that all investment and consumption decisions are by extension asset management decisions that will have future impacts.
- 2) recognising that asset management is integrated, and different assets are linked to others. For instance, to manage natural capital more effectively it may be best to invest in human capital, for example through education.

- 3) getting asset managers at different scales (micro and macro) to coordinate and work together, with economic and political institutions providing the necessary incentives and regulation for businesses and people to thrive in an equitable and sustainable way.

2.1 Asset managers

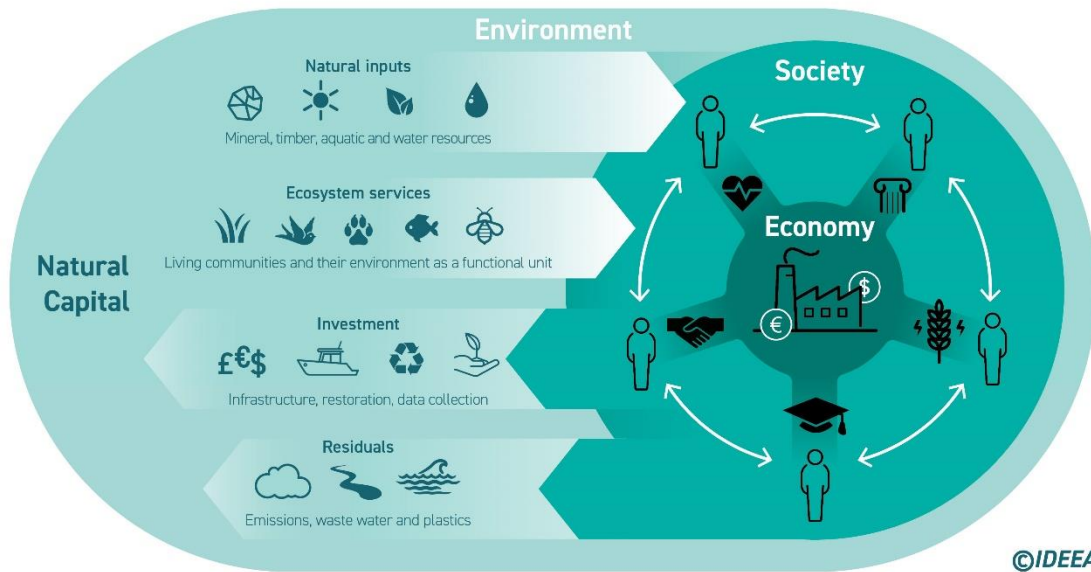
The assets in Clew Bay are being managed in different ways to sustain the benefits that they provide (see Figure 2). There are many decisions for asset managers, including where and how to reduce pressures (see residuals, Figure 2), invest in the asset portfolio (see investment, Figure 2), and moderate the extraction/harvest of natural capital (see natural inputs and ecosystem services, Figure 2).

Asset managers make decisions about investment and consumption regularly. For example, asset managers may make a decision that directly affects the level of capital (for example, restoration of natural capital), or make a decision which indirectly affects the level of capital (for example, new technology that increases production efficiency and by extension reduces the impact on our assets). The decision not to act, is also an asset management strategy. Asset management depends on the benefits being sought by the manager, the manager's connection to location and their perspective on natural capital, and the incentives, policies and regulation that apply. Asset managers exist on a spectrum: extractive managers that want to exploit the capitals for their own short-term gain, through to managers that have an interest in maintaining the asset to make sure it continues to be valuable in the long term.

There are three aspects of expenditure that are tied to asset management decisions:

- 1) A direct investment in the stock (to enhance it or prevent it from degrading). This includes expenditure directed at investment focused on changing the stock and or the condition of a capital.
- 2) Expenditure focussed on the use of a capital to provide goods or services. Expenditure directed at use is about the employment of existing capital (for example, labour) to provide services and benefits.
- 3) Expenditure focused on the use of a capital to reduce pressures and impacts on natural capital. For example, investment in a water filtration plant which removes affluent before it enters the bay.

Figure 2 The relationship between asset managers and natural capital



Asset managers depend on their own assets together with assets managed elsewhere, to derive benefits (for example, some livelihoods depend on the commons that are managed by public institutions). An asset manager should consider two things when focussing on dependencies:

- the quantity and quality of their own assets and
- the role of assets that they do not control that they are dependent on.

Asset managers make strategic and tactical investment decisions across their asset portfolio (dependencies) to provide benefits both now and into the future. These strategic and tactical investments are based on preferences and the information available to them. An asset manager should maintain the assets they are dependent on. For example, a business that depends on a common resource, such as wild fish stocks, may want to participate in habitat restoration and rehabilitation programs to maintain or improve the health of the fish stock.

A manager's dependency on assets mean that any impact (negative or positive) on those assets is important. An asset manager may consider two things when considering impacts:

- the impact of other managers on their assets and
- the impact of their activities on the assets of others.

Asset managers consume goods and services from their assets. Current consumption activities, which have an impact on natural capital now, affect the consumption of natural capital in the future if it is unable to regenerate. Asset managers should minimise the negative impacts, and maximise positive impacts on the assets they depend on. For example, a business that depends on a common resource, for example, an intertidal marine environment to support shellfish stocks, will want all negative impacts, such as reduced water quality point and diffuse effluent sources, to be minimised.

2.2 Integrated management

Many businesses operations focus on the management of natural capital, but their operations will also depend on produced capital, social capital and human capital. Connections between the different assets provide both challenges and opportunities for asset managers. Understanding these connections (and how these connections affect the business) enables a better targeting of investment. It also supports an understanding of how the assets we depend on may be impacted and how the assets of others might be affected. For example, the fishing of seed mussel for on growing at aquaculture sites is a regular practice in Ireland. The source of the seed mussel is important as there is a risk that the seed mussel is a vector for invasive alien species.

Introduction of invasive alien species to new areas by seed transport can have a range of impacts on aquaculture operators, other users, and on the condition of the natural capital (environment). Investment in the education of fishers and aquaculture operators about the risks associated with invasive alien species on the natural environmental and their operations can help to improve management practices. Because of these relationships, a comprehensive approach to asset management that focusses on multiple capitals simultaneously should be taken.

Figure 3 shows how investment in a single capital can have a primary and / or secondary benefit. Primary benefits are changes in the capital that are created from the investment and secondary benefits are changes in other capitals that are linked to or a direct result of the primary benefit. This differentiation of benefits is important because it recognises that for any given investment an integrated capitals analysis needs to be undertaken and there are often flow on effects to other capitals.

Figure 3 Integrated capital accounting – investing in the stock of a capital*

	NATURAL CAPITAL	HUMAN CAPITAL	PRODUCED CAPITAL	SOCIAL CAPITAL
INVEST IN NATURAL CAPITAL >	PB – More and improved natural capital	SB – better health and wellbeing for people	SB – reduced produced capital inputs	SB – better health and wellbeing that supports social cohesion
INVEST IN HUMAN CAPITAL >	SB - better management of natural capital	PB - Better education for people	SB – produced capital is employed and used more effectively	SB - Individual capacity / capability contributes to social capital and networking
INVEST IN PRODUCED CAPITAL >	SB – the produced capital helps to conserve natural capital	SB – less time is required for people using the built capital	PB - Better technology embedded in produced capital	SB – networking (via computer) is easier to the social capital
INVEST IN SOCIAL CAPITAL >	SB – knowledge is transferred between human capital faster benefiting natural capital	SB – Human capital gains knowledge via networking faster and more efficiently	SB – produced capital is better utilised via shared knowhow between human capital	PB – better social networking

Note: PB = Primary Benefit, SB = Secondary Benefit

2.3 Coordination

A challenge in managing natural assets is getting all stakeholders to coordinate their investment and consumption based on a shared understanding of the value of the assets that they depend on. Assets can be managed by public institutions (for example, a marine protected area) or by private institutions (for example, an aquaculture site), and goods and services are consumed by many. There are several initiatives within Clew Bay developed by different actors across different scales from international through to local. For example, Natura 2000 sites are managed nationally to meet with European legislative requirements and standards, the CLAMs process is managed at bay level, the Clew Bay Oyster Co-op work within the Oyster Order area, and individual aquaculture businesses management their own licensed sites.

Investments, use and pressures can also occur at different scales. For example, at the macro level, there are weather shocks that affect the entire marine area of Ireland, and regulation that determines what a business can or can't do. At the micro level there are individual objectives for businesses, and different ways of life, beliefs and biases of households. A coordinated approach that changes behaviour across all elements can support the best return on investment on assets.

Government policy and regulation are central to delivering a coordinated response across different actors. Businesses and households respond to incentives, which are formed by policy and regulation, social norms and price. Because of the range of influences, incentives are different for managers. Policy and regulation need to be flexible enough to promote sustainable management, but also to prevent unsustainable practices. Public investment in natural capital should complement and support private investment in natural capital.

For example, a seafood operator may care less about a healthy stock of fish if they have no connection to the local environment / have a business model that relies on mobility, and can move to another location to harvest fish. There can sometimes be conflict when an asset provides benefits that are sought by many, but the manager's approach is concerned with their own private benefits. For example, a farmer may remove mangroves to provide more land for grazing cattle, which in turn reduces the water quality and affects the fish farmer.

3 Asset management in action

The Clew Bay natural capital project aims to contribute to the application of the asset management paradigm in Ireland's ocean economy. Identification of the dependencies and impacts on natural capital is a key step in asset management. A natural capital profile presents information across a number of these topics:

- 1) Where is the area of interest and what are the key characteristics?
- 2) Who is managing the area of interest?
- 3) What is being managed in the area of interest?
- 4) What are the key dependencies in the area of interest? This builds on an understanding of who is managing the area, and what is being managed to describe the key dependencies on assets for their ecosystem services. Dependencies can change over time.
- 5) What are some of the key pressures in the area of interest? How are these changing over time?
- 6) What are some of the key impacts in the area of interest? Impacts have a time dimension and require an understanding of how assets and services are changing over time.

The natural capital profile is presented in the Clew Bay Natural Capital Profile. A quantitative approach will be taken where possible by considering the stocks (extent and condition) and flows (ecosystem services and their values) in Clew Bay, which is the case study site. The quantitative information contained in the natural capital profile can be used in many different applications, by different managers, given that the data available to produce the information is of the required quality.

Natural Capital Accounting is the process of calculating the total stocks and flows of natural resources and services in a given region. NCA organises data on the environment into a framework that can be readily integrated with financial information, to support sustainable decision making and enable a holistic approach to management across multiple stakeholders.

3.1 Asset managers and their management actions

There are multiple managers simultaneously managing assets in Clew Bay. Table 1 provides an overview of each asset manager and their policies within Clew Bay. Because of the numerous seafood operators in Clew Bay, and the links between Clew Bay and the broader society, there are many different initiatives focussed on the management of the marine environment (see Table 1 – column 2). Each initiative may have a different entry point (for example, social, human, natural and produced capital, see Table 1– column 3) but will ultimately affect natural capital.

For example, the marine spatial planning process is an approach which builds social capital so all parties can coordinate to deliver environment, economic and social objectives.¹

Each initiative may have a positive or negative impact on the seafood sector (see Table 1 – column 4). For example, licensing can potentially have negative consequences for the profitability of seafood sector by reducing the limits on catch. Conversely, it can have positive impact on the seafood sector by maintaining the marine resource for the future.

Natural capital accounting provides a tool for BIM and the seafood sector to objectively track their sustainable development, effectively manage assets, reduce negative impacts and promote positive impacts. Table 1, column 5, suggests how the accounting information may be used in relation to a range of initiatives linked to the seafood sector in Clew Bay. This is not an exhaustive list but serves to provide current and tangible examples. A list of the different managers and their management interventions is provided in the appendix.

¹ For the purpose of this report, social capital is considered as the links, shared values and understanding in society that enable individuals and groups to trust each other and work together (see <https://www.oecd.org/insights/37966934.pdf>). In liberal, democratic countries the rules and processes (institutional arrangements) should be representative of the population's values. Therefore, social capital is embodied in the institutional arrangements that support the collective to live under those values.

Table 1 Asset managers and their management actions in Clew Bay

Who	Initiative (how)	Capital entry point	Potential impact on seafood sector	Use of accounting information set*
Aquaculture sector	Capital investments Gear improvement / upgrade – production efficiency, product quality, environmental performance.	Produced capital	Improves efficiency, safety and environmental performance	Tell sustainability story using outcome-based information – cite examples where environmental performance has improved
Aquaculture and Oyster Fishing Sectors	Habitat Restoration Projects including Spat deployment	Natural capital	Increase oyster stock and fisheries potential, improve habitat, and maintain local way of life (cultural connections) with the marine environment	Sustainability story, co-benefits (cultural connections) and profitability / productivity.
Inshore fisheries	Capital Investments Continued gear improvement (for example, net technology)	Produced capital	Likely positive impact, with some upfront costs - Maintain fish stocks, improve habitat	Sustainability story, co-benefits
Inshore fisheries	Lobster v-notching	Natural capital	Improve stocks and maintain sustainability of the fishery, profitability	Sustainability story, profitability for farmer
Seafood sector	Education	Human capital	Safety is core, environmental performance is something that could be an opportunity under the EMFAF programme.	Tell sustainability story - potential, but hard to draw out the links
Coordinated Local Aquaculture Management System (CLAMS)	Bringing aquaculture operators together – enhancing local knowledge of industry	Social capital (local coordination)	CLAMS supports a sustainable seafood sector through various initiatives (for example, lobbying, shore cleaning, training, navigation). CLAMS is a network that reduces the costs of disseminating information, getting support / feedback and enables collaboration on a variety of initiatives.	Demonstrate the positive impact of CLAMS on natural capital and aquaculture. Receive funding through EMFF (all BIM projects are through EMFF). Contribute positively to the local aquaculture sector and wider community.
Gov (DHLGH)	Marine Spatial Planning	Social capital (coordination process to manage marine resource)	Positive or negative, depending on the evidence provided during the MSP process and the subsequent plan that is developed.	BIM and seafood sector negotiates with concrete evidence about the relationship of the seafood sector and marine resources

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Who	Initiative (how)	Capital entry point	Potential impact on seafood sector	Use of accounting information set*
				Presenting evidence that is understandable and comparable with other activities within the scope of the MSP.
Gov (DAFM)	Licensing	Social capital (regulation to manage resource) SC > NC	Potential negative consequences for seafood sector, depending on evidence provided to Licensing arrangements Potential positive consequences for seafood sector, by maintaining the marine resource for future generations and providing a fair income for those involved in the sector and acting responsibly.	Licensing of spatial area for aquaculture – understand relationship between area licensed: benthic habitat extent and condition; water quality; stock of species such as fish, birds and other mobile species. Linked to conservation management also Licensing of taking fish – understand relationship between fish catch, fish stock and condition of ecosystem (Complex system linked to vessel size, gear, quotas, days at sea, fishery open / closed periods)
Gov (general – cross departmental)	Conservation management – designation and management of protected sites for example, Natura 2000	Social capital SC > NC	Reduce space that seafood sector is operating in. Maintain a higher condition environment. Increase fish stock and other co-benefits linked to higher condition assets.	Define the optimal spatial configuration / usage, noting that a balance between profitability and social and environmental issues is required. Understanding source of impacts on natural capital extent and condition.
Gov (cross departmental)	Water designations – for example, Shellfish waters, Bathing waters. Water Framework Directive	Social capital SC > NC	Improves water quality and therefore productivity.	Sustainability story about water purification services provided by shellfish and how this links to the condition of marine ecosystems and productivity
EU and DAFM	European maritime and fisheries fund	Financial capital (funding to spend on fishers to adopt sustainable fishing practices and coastal communities to diversify their economies)	Positive – sustainable fishing.	Demonstrating performance – with the potential to increase funding
Gov (Marine Agencies)	Monitoring of environment and economy	Produced capital (information assets)	Positive or negative, depending on the story that the data tells. If business believe there is a positive story, then they should take the lead.	Improvement in accounting information set which enables all other rows.

Natural capital accounting for Clew Bay, Ireland

Who	Initiative (how)	Capital entry point	Potential impact on seafood sector	Use of accounting information set*
Cooperative	Clew Bay Oyster Co-op (manage the oyster fishery)	Social capital	All producers within the Oyster Fishery Order area must be members of the Coop and must comply with the Rules and Regulations set out by the Coop. As a Registered Co-operative it is recognised by all institutions of the State as the legitimate custodian of the oyster fishery order. Manage the order – the coop works on managing the order, works with government to determine the extraction of stock	
Marine Agencies and Industry	Seafood certification Origin Green Clean Green Seafood Organic certification		Enhance operations for environmental perspective – feed into licencing	Use to demonstrate environmental performance, product quality and safety at a level over and above legislative requirements.

3.2 Demonstrating the utility of natural capital accounting

As presented in Table 1, column 5, an accounting information set can be used at both the micro and the macro level and for both government and business. Table 2 links some of the policy and decision-making challenges to accounting information. There are many potential applications of coherent accounting information across the decision-making process including problem diagnosis, forecasting, target setting, scenario analysis, monitoring and reporting, and impact evaluation. The suitability of the accounting products to different applications will largely depend on the availability of fit-for-purpose data.

Table 2 Linking decision making to accounting information

Decision element	Description	Accounting information application
Problem diagnosis	Quantify trends in physical and environmental state and build business case for policy intervention	Interpret accounting information to assist with diagnosis
Problem diagnosis	Understand how a problem may manifest in the future, building additional evidence for action	Forecast based on accounting information: forecast outcomes associated with business-as-usual scenario
Design solution	Set target to help guide policy	Identify a practical target by considering accounting information
Design solution	Understand the influence of specific drivers in problems – for example, to identify which policy levers will be most influential in solving the problem.	Use accounting information as inputs to scenario analysis to estimate outcomes associated with different actions (for example, business as usual or interventions) Use accounting information to estimate the relative efficiency of alternative solutions for example, trade-offs between economic benefits of planned urban development versus degradation of ecosystems or loss of biodiversity that may result
Design solution	Establish relationships between key variables	Use consistent accounting information combined with statistical techniques to establish relationships (for example, increased temperature affects ecosystem health which affects yield)
Evaluate success of solution	For reporting purposes – for example, to demonstrate progress in solving the problem along a time series	Use accounting information to monitor performance against projected outcomes Use accounting information for evaluation of performance against targets – for example, to demonstrate progress against a target and/or attribute influence of policy
Evaluate success of solution	Understand the effectiveness and efficiency of different investments across the landscape	Use accounting information to demonstrate return on investment Use consistent accounting information to underpin quasi-experimental approaches to evaluate impacts

There are a number of opportunities for demonstrating the utility of the accounting system in Clew Bay. Two case studies were selected to build on the natural capital profile and link more specifically to two applications.

It is important to note that this is a journey and the accounting outputs are only as good as the data that underpins them. Further investment in data will be required if comprehensive accounting is seen as valuable to the applications discussed above. Investing in this information with accounting as your framework will enable connections to be made between financial, economic and environmental domains.

3.2.1 Seafood sector

The seafood sector has a relationship with marine resources: it depends on a healthy stock of fish and shellfish to generate high quality and safe seafood, which is influenced by the quality of water, as well as habitats that provide nursery services.

The seafood sector is managed at multiple levels by a range of asset managers. In addition to business level management by fishers and aquaculture operators, there are a range of policies and legislation managed and enforced by government (for example, licensing and marine spatial planning) and which influence the primary production of seafood from these businesses. It can be difficult to tell its story within all these different programs. Within these programs, policy makers are diagnosing problems (sometimes with incomplete information) and are reacting accordingly. Having an information set across the environment and the economy enables the seafood sector to better tell their story and negotiate across different programs.

The accounting system will organise data on ecosystems, management areas and water quality in Clew Bay. While cause and effect between the seafood sector and ecosystem health cannot be established without additional design and data collection, general trends in health may be established with appropriate data, and relationships between water quality and the seafood sector can be inferred.

Information: ecosystem extent, management areas, and water quality

3.2.2 CLAMS

CLAMS plays an important role in CLEW Bay, supporting the aquaculture sector to sustainably manage the resource. There is an opportunity to tell the story of CLAMS within the wider context of environmental, economic, and social development. The role of CLAMS as a network for ensuring the aquaculture sector can operate effectively can be considered by:

- Determining the additional costs of performing activities in CLEW Bay without CLAMS. For example, the costs of marking sites for navigation purposes compared to the costs of doing it collectively via CLAMS. These reduction in costs are because of coordination.
- Determining the additional benefits provided by having CLAMS operating (for example, multiplier effects where operators share information – multiplier effect). Coordinated threat observation – jointly detecting things and minimising threats.

Information: experimental social capital account. Link to economic, environmental, and social outcomes in the bay.

3.2.3 Native Oysters restoration

“Native Oysters a New Pathway’ is a joint operation to develop both a commercial farming model for native oysters to supplement the expanding Pacific Oyster industry and provide restorative spat settlement at the same time. The project encompasses all aspects of culture. Starting with broodstock selection to create a complex genetic profile to ensure a robust regenerated

population. The Jasconius ponds in Co.Clare have been bought back into production to develop a mix of traditional and developing techniques for spat production. The spat produced is then transferred to sites in Clew Bay using the Jersey Sea Farms ORTAC and Microreef systems. Currently there are three-year classes in trial production at various sites.

The native oyster, *Ostrea edulis* fishery in Clew Bay, is governed by an Oyster Fishery Order granted to the Clew Bay Oyster Cooperative Society Ltd in 1979. The fishery thrived for nearly a decade before *Bonamia Ostrae*, a lethal shellfish parasite was inadvertently introduced into Clew Bay in the late 1980s. This devastated the oyster stocks, and the local fishing sector was negatively impacted being drastically reduced in some years and voluntarily closed in others. A range of fishery development work was carried out to try and restore stocks. Such work has been subject to available funding over the years and has ultimately led to the current habitat restoration project. In addition to fishery development, the CBOC are also supportive of protecting the ecology of the area and have welcomed the Natura 2000 designations together with dredge closure areas.

Two sites were selected for the 2020 trial cultch deployment work. One in Newport Bay (Inishloy South) and one in Westport Bay (Inisheeney East). These are both sites that have been the focus of attention in previous years. Both were recommended by Co-op members. An initial survey was done at these two sites by the Co-op, supported by scientists and equipment from BIM.

The program is a solution and the monitoring / description of outcomes can be used to tell a story about the project.

Information: extent, ecosystem services