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Book

Progress on ocean accounting in Norway : paper for the 28th London Group meeting 2022, Siegburg, Germany

Provided in Cooperation with:

Statistics Norway, Oslo

Reference: Randen, Trine Heill Braathu/Grimsrud, Kristine M. et. al. (2023). Progress on ocean accounting in Norway : paper for the 28th London Group meeting 2022, Siegburg, Germany. [Oslo] : Statistics Norway.

https://www.ssb.no/nasjonalregnskap-og-konjunkturer/nasjonalregnskap/artikler/progress-on-ocean-accounting-in-norway/_attachment/inline/df99d004-df1a-4839-9639-aa4ca55e3705:742aef3b1dae70b406bc98831670f3d0d1143371/NOT2023-28.pdf.

This Version is available at:

<http://hdl.handle.net/11159/593786>

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Progress on ocean accounting in Norway

Paper for the 28th London Group meeting 2022. Siegburg, Germany

TALL

SOM FORTELLER

NOTATER / DOCUMENTS

2023/28

Trine Heill Braathu Randen, Kristine Grimsrud, Tarik Ogbamichael and
Tor Kristian Ånestad

In the series Documents, documentation, method descriptions, model descriptions and standards are published.

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Published: 21 June 2023

ISBN 978-82-587-1757-4 (electronic)

ISSN 2535-7271 (electronic)

Symbols in tables	Symbol
Category not applicable Figures do not exist at this time, because the category was not in use when the figures were collected.	.
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Preface

This document provides a description of the current progress on ocean accounting in Norway. It also gives an overview of international processes in the field.

The background for the document is the increasing focus on sustainable ocean management, including commitments through the High Level Panel on a Sustainable Ocean Economy (Ocean Panel). One of the recommendations by the Ocean Panel is that ocean accounts are to be based on internationally determined and accepted accounting frameworks, as it could contribute significantly to the governance and management of ocean and coastal areas.

A set of ocean accounts has not yet been compiled in Norway, but several initiatives have been put in place and advancement towards compiling national ocean accounts has commenced. Hence, the document gives an overview on this progress.

The document was prepared for the 28th London group meeting and presented in September 2022 in Siegburg, Germany.

The document has been written by staff in the division for national accounts and division for development cooperation in Statistics Norway.

Statistisk sentralbyrå, 13 June 2023

Lasse Sandberg

Abstract

This working paper was prepared for the 28th meeting of the London Group held on September 26-29, 2022, in Siegburg, Germany. The paper discusses current progress on ocean accounting in Norway.

The [first Norwegian ocean satellite accounts](#) was published in the spring of 2022, a national scoping assessment for holistic ocean accounts was completed in the autumn of 2021, and the research project [MAREA](#) (MARine Ecosystem Accounting) is contributing to progress in ocean accounting by investigating how ocean accounts can be used in multilevel decision- and policy-making. The national work on ocean accounting has so far received ad hoc funding. Progress in establishing the accounts and developing statistical time series depends on long-term financing, which has not yet been secured.

Statistics Norway is also involved in international work on ocean accounting through its membership of Global Ocean Accounts Partnership [and an international development programme in which it cooperates](#) with Indonesia. In May 2023, Indonesia and Norway signed a mutual agreement for collaboration on ocean accounting with a focus on ocean satellite accounting and ecosystem services accounts - a partnership expected to be mutually beneficial because it will contribute to knowledge exchange and thus progress on ocean accounting in both countries.

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1. Introduction

The relationship between the environmental condition of the ocean, use of the ocean and human well-being is not well accounted for in the System of National Accounts (SNA). While the SNA measures the economic activity of a nation, it does not single out the part of economic activity that is ocean-related. Moreover, the SNA measures human economic activity, it does also omits information on the ocean's contribution to society in terms of the value of many ecosystem services such as recreation and carbon sequestration and storage. The SNA does not capture how economic activity affects the environmental condition of the ocean, and vice versa, nor does it keep account of changes in the asset value of the ocean capital.

Holistic and sustainable management of marine ecosystems and natural resources would be facilitated by the development of accounts that reflect the value of the ocean. Such ocean accounts would yield several indicators that could help to achieve more sustainable ocean management. A nation's ocean wealth is an important indicator of sustainability. This indicator can show how benefits today are balanced against the needs of future generations (Fenichel et al. 2020a; 2020b).

Developing a complete set of national ocean accounts which combines information on economic activities, the environment and society and thereby highlights the relationships between the environmental condition of the ocean, the use of the ocean and the contribution of the ocean to value creation, both economic and other, could contribute to knowledge-based solutions when society trades off economic interests against other interests.

A set of ocean accounts could contribute significantly to the governance and management of ocean and coastal areas. As such accounts provide spatially explicit information on the governance and administration of ocean and coastal regions, in combination with information ecosystem and environmental condition, this information could contribute to more knowledge-based management. Socio-economic statistics for local communities and other relevant societal information could also be linked to these spatially explicit accounts.

The High Level Panel on a Sustainable Ocean Economy (Ocean Panel) was established in 2018 by the then -prime minister of Norway, Erna Solberg. The Ocean Panel member countries have committed to "sustainably manage 100% of the ocean area under national jurisdiction by 2025" (Stuchtey et al., 2020). One of the five main recommendations of the Ocean Panel is to change the way ocean accounts are kept so that they include all the benefits provided by the ocean (Stuchtey et al., 2020). The Ocean Panel recommends that comprehensive ocean accounts be based on internationally determined and accepted accounting frameworks.

This paper discusses Norway's current progress in ocean accounting, nationally and internationally, and the way ahead. Chapter 2 provides an overview of the background to the work on ocean accounts in Norway, Chapter 3 covers progress on ocean accounts in Norway, Chapter 4 describes Statistics Norway's pilot on ocean satellite accounts, Chapter 5 provides an outline of relevant research projects, Chapter 6 describes Statistics Norway's involvement in international work on ocean accounting, and Chapter 7 looks at the potential next steps for ocean accounts in Norway.

2. Background

2.1. International progress on ocean accounting

Ocean accounting has achieved prominence as a result of various initiatives and organisations worldwide in recent years. Several countries have been piloting ocean accounts, several financed by UN ESCAP (Economic and Social Commission for Asia and the Pacific), and findings from this work led to the technical guidance entitled "Ocean Accounting for Sustainable Development", which was distributed for comments by the Global Ocean Accounts Partnership (GOAP) in October 2020.

The international work on ocean accounts also increased in relevance in March 2021 when the UN Statistical Commission agreed that the biophysical part of the System of Environmental-Economic Accounting, Ecosystem Accounting (SEEA EA), should constitute a statistical standard, and that resources should be invested in developing a System of Environmental-Economic Accounting for the ocean (SEEA Ocean). The latter decision was made due to the high demand for and importance of such accounts. The published white cover SEEA EA devotes a whole section 13.5 to thematic ocean accounting. An international working group on SEEA Ocean has subsequently been established.

2.2. The Ocean Panel

At the initiative of then Norwegian Prime Minister, Erna Solberg, the High Level Panel for a Sustainable Ocean Economy (Ocean Panel) was established in 2018. Today the Ocean Panel has 17 member countries represented by their heads of state.

The Ocean Panel defines itself as a *"unique global initiative by serving world leaders that is working to build momentum towards a sustainable ocean economy in which effective protection, sustainable production and equitable prosperity go hand-in-hand"* (Ocean Panel, 2022, oceanpanel.org).

One of the five main recommendations of the Ocean Panel is to change the way ocean accounts are kept, so that they include all the benefits provided by the ocean (Stuchtey et al., 2020). The Ocean Panel recommends that comprehensive ocean accounts be based on internationally determined and accepted accounting frameworks: the System of National Accounts (SNA) and the System of Environmental-Economic Accounting (SEEA) (Fenichel et al., 2020b). Economic/monetary value in these accounting frameworks is measured as transaction prices, the prices for which goods are sold/purchased. Fenichel et al. (2020b) propose that ocean accounts be further developed to include other values such as quality of life and human welfare, thereby constituting a holistic set of national ocean accounts. The Ocean Panel also recommends that the ocean accounts figures be made easily accessible to users through visualisation on interactive data dashboards (Stuchtey et al., 2020).

2.3. The structure of ocean accounts

The accounting manual for SEEA Ecosystem Accounting (SEEA EA) summarises the structure of a thematic ocean account (United Nations 2021, chapter 13.5). It is proposed here that thematic ocean accounts be constructed by extracting the ocean-related parts of the System of National Accounts and the System of Environmental-Economic Accounting, both internationally accepted accounting frameworks. A prerequisite for extracting the ocean-related data is that the accounts themselves are kept:

1. **System of National Accounting (SNA) (United Nations et al. 2010).** The marine economic activity must be extracted from the national accounts to create a so-called satellite ocean account.

2. **System of Environmental-Economic Accounting Central Framework (SEEA CF) (United Nations et al. 2014)**. This is an account of human-induced pressure factors such as pollution, harvesting of biological resources, energy production and mining.
3. **SEEA Ecosystem Accounting (SEEA EA) (United Nations et al. 2021)**. The SEEA EA provides a framework for keeping accounts of the extent and condition of ecosystems, and society's use of and benefit from ecosystem services.

These three accounting frameworks are compatible and in principle complementary, although there will be some overlap between the ocean satellite accounts and the other two sets of accounts. This must be considered when compiling the thematic ocean accounts, to avoid double counting. An example of items that appear in all three sets of accounts is the quantity and value of harvested fish.

Pollution and pressure factors: The SEEA CF provide a framework developed for maintaining accounts of pressure factors, and these can be aggregated by catchment area. Examples of pressure factors are discharges and runoff of polluted water from land, disposal of waste on the seabed, pollution from the extraction of minerals from the seabed, plastic litter, and lost/ghost fishing gear.

Ocean services: Information on ocean-related economic activity can be extracted from the SNA. The SEEA CF and SEEA EA can provide accounts for ecosystem services not included in the SNA.

Ocean assets: The SEEA EA employs a spatially explicit accounting framework not used in the SEEA CF and SNA, for ecosystem assets, in which accounts are kept of the location and extent of different types of ecosystem or ecosystem assets such as kelp forest areas and areas with a sandy bottom. The SEEA EA also includes accounts for ecosystem condition as compared with a chosen reference situation, typically what is considered "good ecological condition". The SEEA CF includes the accounting frameworks for certain ocean-related assets such as minerals, oil, energy, and fish stocks. The accounting framework for produced capital is found in the SNA ocean satellite accounts.

Guidelines for extracting ocean-related information from the SNA to set up ocean satellite accounts are provided in the OECD's Blueprint for improved measurement of the international ocean economy: An exploration of satellite accounting for ocean economic activity (OECD 2021). These guidelines are used in the pilot Norwegian ocean satellite account, described in chapter 4.

3. Development of ocean accounting in Norway

Considering the international progress on ecosystem accounting and the Ocean Panel's recommendations, ocean accounting is now more firmly on the agenda in Norway. A question that has been raised in the Norwegian debate is what Norwegian ocean management can learn from the international discussion on ocean accounting. At the same time, knowledge of what ocean accounting is and can be is increasing in Norway. Another question in the debate is what can be learnt from ocean accounting work in other countries and how this can contribute to the further development of ocean accounting in Norway (the Norwegian Environment Agency, 2021).

There are several ongoing processes designed to answer these questions. This chapter presents the status of the integrated ocean management plan approach in Norway and the initial processes for exploring ocean accounting. The following chapters elaborate on these processes.

3.1. Norway's ocean management plans

Since 2006, Norway has established management plans for the marine areas in Norway. These include the Barents Sea and the marine areas around Lofoten, the Norwegian Sea, and the North Sea - Skagerrak. In April 2020, the first management plan covering all three areas was published: [Norway's integrated ocean management plans — Barents Sea-Lofoten area; Norwegian Sea; and North Sea and Skagerrak](#).

Integrated, ecosystem-based management

"As an ocean and coastal nation, Norway is responsible for managing a rich and varied natural environment. Norwegian waters support abundant natural resources that have been an important basis for developing the welfare state. Norway's long-term approach to ocean resource management for the benefit of society has a long tradition. Value creation from ocean-based activities now and in the future depends on maintaining good environmental status and high biodiversity in the marine and coastal environment, safeguarding the oceans as a source of food, and using ocean resources sustainably. In the integrated ocean management plans, the Government describes how it intends to continue and consolidate Norway's integrated, ecosystem-based ocean management plan system."

(From Report to the Storting¹; Meld. St. 20 (2019–2020), p. 13).

The integrated ocean management plans are intended to provide an overall balance between use and conservation, based on knowledge about ecological functions and the value and vulnerability of different areas, together with information about current economic activity and forecasts for the future (Meld. St. 20 (2019–2020)). The management plans provide indicators of the environmental status of the Norwegian marine areas, including indicators for different pressure factors like pollution and climate change. Ocean-based industries are discussed, as well as coordinated spatial management and the coexistence of ocean-based industries.

The environmental status

The state of the ocean is monitored by a system that is under ongoing development. The system is set up to monitor indicators of the condition of the marine environment. The ocean management plans provide a comprehensive description of the state of marine areas and of the environment by describing changes over time in the indicators in the monitoring system. When describing the environmental status of the ocean, several aspects and indicators are considered simultaneously.

¹ Norwegian parliament

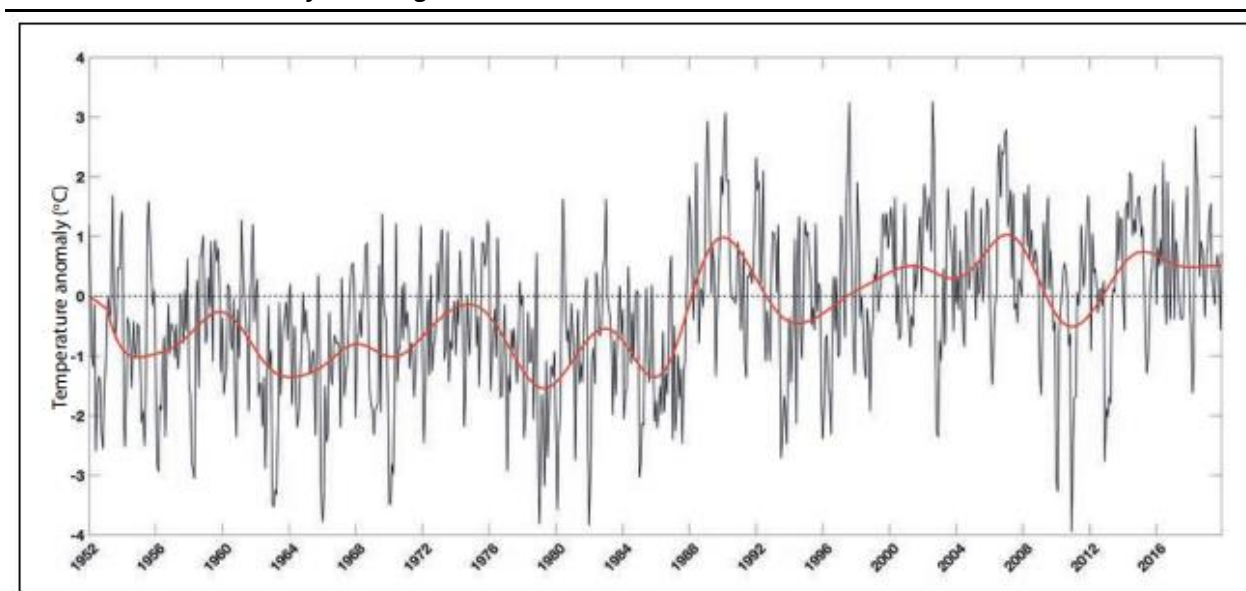
Changes in the indicators will inform decision-makers of whether there is a need to adjust the current management of the oceans (Ministry of Climate and Environment, 2021).

Examples of indicators monitored are:

- Sea temperatures
- The state of sugar kelp forests
- Fish stocks
- Stocks of sea birds and marine mammals
- Pollution via the atmosphere and rivers

The trends of the different environmental indicators are described in detail in the text and illustrated by means of figures and tables. An example is given in Figure 3.1.

Figure 3.1. Temperature time series from 1952 to 2018 for Norwegian coastal waters in the Skagerrak and the North Sea, presented as anomalies relative to the period 1981–2010. Based on measurements by the Institute of Marine Research along the sections Torungen–Hirtshals and Utsira–Orkney (only measuring stations near the coast) and at the coastal stations Flødevigen, Lista, Utsira and Sognesjøen at depths of 0–10 m. The thin black line shows monthly values with the seasonal signal removed, while the red line shows the five-year rolling mean



Source: Institute of Marine Research Meld. St. 20 (2019–2020) Report to the Storting (white paper). Norway's integrated ocean, p. 50.

Ocean-based industries

In the integrated ocean management plans, indicators for the economic activity of four ocean industries are discussed to show the part the ocean plays in the economy, see Table 3.1. These four industries are seafood, petroleum, shipping, and tourism. The variables included are value-added and employment. The numbers shown permit comparison across industries and the management plan areas.

Table 3.1 Comparison of value added in four ocean industries in each of the management plan areas and totals for Norway. Value added is shown in billions of NOK (in current prices)

Industry	Barents Sea-Lofoten		Norwegian Sea		North Sea-Skagerrak		Norway, total		
	2010	2016	2010	2016	2010	2016	2010	2016	2019
Seafood	11.9	21.4	12.3	20.3	8.9	16.8	33.1	57.9	64.7
Petroleum	21.2	25.3	143.9	112.0	431.4	341.1	596.6	478.5	566.8
Shipping	1.3	1.0	4.1	4.6	26.7	35.0	32.2	40.7	39.8
Tourism ¹	2.4	3.7	2.5	4.0	9.6	14.2	32.2	45.4	-
Sum	36.8	51.4	162.8	140.9	476.6	407.1	694.1	622.5	671.3

¹ No figures for tourism are available for 2019.

Source: Statistics Norway: Table 5.1 in Norway's integrated ocean management plans – Meld St. 20 Report to Stortinget (white paper), p. 76).

Statistics Norway produces statistics on the ocean-based industries, using data from the regional and national accounts. These statistics have been produced on an *ad hoc* basis for the management plans. In the future, regularly compiled ocean satellite accounts may replace this *ad hoc* production of statistics. It remains to be seen what need there will be to break down the data for allocation to the different ocean areas.

3.2. The Norwegian Forum for Integrated Ocean Management

The Norwegian Forum for Integrated Ocean Management (from here on referred to as the Forum) prepares the ocean management plans discussed in the previous section. The Forum is led by the Norwegian Environment Agency. It reports to a steering group composed of representatives from relevant ministries. Relevant directorates and institutes are members of the Forum.

Every four years the Forum is required to prepare the scientific basis for a report to the government (the Storting, i.e., Norwegian parliament) on comprehensive management plans for the Norwegian marine areas Barents Sea-Lofoten, Norwegian Sea, and North Sea-Skagerrak.

The Forum may also be asked by the steering group to carry out related tasks, such as to improve the data and tools, or other relevant assignments.

In February 2021, the Norwegian Forum for Integrated Ocean Management was assigned by the steering group to:

*"... look more closely at how the international debate on the development of "Ocean Accounts" or a natural capital account for the ocean ("ocean accounting") can be followed up in Norway, and especially how it can contribute to work on the management plan for the ocean areas in 2024 with respect to value creation and ecosystem services. We are therefore asking the Forum to start work on this. The work should describe the knowledge and database that will be necessary, together with possibilities and utility value. The work should also address the uncertainties and limitations of such ocean accounting. If possible, specific examples should be provided of what an ocean account might look like in practice. [...] The work must result in a memo from the Forum to the steering group"*². (Norwegian Environment Agency, 2022, p 3).

Seminar on ocean accounting in August 2021

In order to begin the process of capacity building and to attract possible stakeholders, a seminar and a workshop were held by the Norwegian Environment Agency in cooperation with Statistics Norway. The seminar and workshop were commissioned by the Forum. The aim was to increase expertise on the topic among people involved in Norwegian marine management and other interested parties and to provide an overview of current relevant activities both in Norway and

² Authors' own translation from Norwegian.

internationally. The seminar was open to all interested parties while the workshop was reserved for invited participants.

Both national and international presenters were invited to the digital seminar, including experts from Australia, the Netherlands, Canada, the UK, and the Global Ocean Accounts Partnership.

The seminar and the workshop provided input on the status of ocean-related data, and thoughts, and ideas on how to utilise ocean accounting, and both events raised some relevant questions.

The conclusions of the task given to the Forum

The task given to the Forum in February 2021 resulted in a written document that was submitted to the steering group in April 2022. In addition to the instructions given in the assignment, the document also included recommendations on how to proceed with the ocean accounting work. The following recommendations were made:

1. Make use of the ocean satellite accounts from Statistics Norway
2. Undertake a pilot ecosystem account for marine areas
3. Investigate different concepts for a Norwegian ocean account
4. Prioritise research and development

The first recommendation was followed up by the Forum immediately considering how the ocean satellite accounts could be utilised in the scientific basis for the ocean management plans. The ocean satellite accounts are presented in chapter 4 of this paper.

In August 2022, the steering group adopted the recommendations and asked the Forum to suggest some options for geographical areas to perform a pilot study on marine ecosystem accounting. It was recommended that the selection of alternatives be undertaken in close cooperation with Statistics Norway, and the results will be presented in early December. How the pilot study will be set up and how comprehensive it will be, has yet to be decided, but will be investigated.

The benefits of ocean accounts³

Thematic ocean accounts based on the UN framework will provide quality-assured and standardised information and indicators, including indicators for several sustainability goals. The indicators can be used to make national and international comparisons.

Even though Norway has managed its ocean areas for centuries, there is an urgent need for an ocean account. The seminar/workshop highlighted this, and the Forum made a presentation to this effect to the steering group in May 2022.

Some of the benefits of ocean accounts can be summarised as follows:

Policymaking. Ocean accounts can provide a valuable tool for assessing whether changes in the marine economy are sustainable. They can be used to develop indicators that describe changes in value-added and in certain ecosystem services and environmental conditions, and to contribute to regular measurement of these parameters.

Comprehensive knowledge base. Ocean accounts can contribute to a more holistic knowledge base by helping to collect and structure data and knowledge across subject areas. New ways

³ The text in this section has been extracted and translated from the memo to the steering group on ocean accounts, April 2022, (Norwegian Environment Agency, 2022)

of putting together existing knowledge can contribute to new knowledge that is relevant for administration. The new knowledge can help to highlight connections between the economy, impact factors and the state of the environment. This concept is supported by countries that have carried out pilot studies that also highlight the benefit of ocean accounting, increasing awareness of the various values and services to which ecosystems contribute.

Spatial planning. Ecosystem accounting is spatially explicit (map-based). It will therefore be useful in spatial planning by improving knowledge of the location of different assets.

New data. The development of ocean accounts is likely to require new data and the development of new knowledge that can be of value to various administrative entities and decision-makers.

In general, the usefulness of ocean accounts will increase with the level of detail and the degree to which data are made available and accessible. An increased degree of detail may also result in some additional benefits.

3.3. The national programme for official statistics

In 2021, a national programme for official statistics was established which defines and delimits official statistics in Norway. It includes statistics on the economy, demographics, and social and environmental statistics. The programme is a result of the Statistics Act, which entered into force in January 2021. Statistics Norway, in cooperation with ten other public authorities, has the responsibility for the official statistics. The current programme runs from 2021 to 2023 and is being revised by Statistics Norway and the Committee for Official Statistics for a new period beginning in 2024.

As a result of the ongoing process of expanding EU regulation 691/2011 on European environmental economic accounts with new modules, including an ecosystem accounts module, there are ongoing processes to also include ecosystem accounts in the official statistics programme from 2024. Ecosystem accounts may then also include ocean accounts. Statistics Norway is currently working on a proposal for developing ecosystem accounts in cooperation with the Norwegian Environment Agency and other stakeholders.

3.4. Further progress

Since the successful seminar on ocean accounting held in August 2021, several other processes have begun. These include the following:

- A pilot ocean satellite account
- International cooperation on ocean accounts
- Membership of international organisations

These topics are further elaborated in the following chapters.

4. Ocean satellite account⁴

The ocean satellite account is a pilot co-financed by the Research Council of Norway and Statistics Norway (SSB). The work was undertaken in 2021 and 2022 and was published in May 2022; see [Ocean satellite account – Description of methods and sources](#) (Statistics Norway, 2022). It forms part of the fourth phase of the OECD project “Future of the Ocean Economy” in which Norway has participated since the beginning in 2013.

Common to many of the satellite accounts⁵ derived from the national accounts is a need to separate out areas of activity from the whole and make them visible as a separate grouping, since in the ordinary national accounts these areas of activity span several different industries in different economic sectors. Determining the size of these areas of activity, such as education, involves calculating the accounting figures by regrouping supporting material or using the national accounts’ supply-use tables. Key users of the satellite accounts are ministries, businesses and interest organisations, researchers, and international organisations such as the OECD, Eurostat and UN specialised agencies.

To reveal the size and structure of the mainland industries linked to the ocean, the satellite accounts are based on figures and concepts from the national accounts that have been processed and reclassified. The figures in the ocean satellite accounts are thus consistent with those in the national accounts, but the presentation is more detailed.

The establishment of an ocean satellite account that shows the ocean's contribution to Norwegian value creation can be seen as a necessary first step on the road towards a comprehensive and unified ocean account, in line with the recommendations from the Ocean Panel.

The pilot is based on the framework presented in the OECD's Blueprint for improved measurement of the international ocean economy: An exploration of satellite account for ocean economic activity (OECD 2021).

4.1. Definitions, sources and calculations

Definitions

Statistics Norway has used the OECD's definition of economic activities related to the ocean, which are activities that

- a) take place on or in the ocean;
- b) produce goods and services primarily for use on or in the ocean;
- c) extract non-living resources from the marine environment;
- d) harvest living resources from the marine environment;
- e) use living resources harvested from the marine environment as intermediate inputs;
- f) would probably not take place if they were not located in proximity to the ocean; or
- g) gain a particular advantage by being located in proximity to the ocean.

As an example, the production of ship propellers by the metal goods industry is included in the satellite accounts, since ship propellers are specially adapted for use on or in the ocean, while the

⁴ The text in this chapter has been largely extracted from the document on ocean satellite accounts published on Statistics Norway's webpage: [Ocean satellite account – Description of methods and sources](#).

⁵ Satellite accounting is the term for accounting that is based primarily on national accounting concepts and figures, but which is specially adapted to shed light on a specific economic phenomenon or area in more detail, or from a different point of view than in the ordinary national accounts. Statistics Norway currently produces satellite accounts for tourism, education, health, non-profit and voluntary organizations.

production of electricity or diesel on the mainland is not included, as these products are not "tailored" for use at sea, even though many of the end users of these products are ocean industries. It is more difficult to assess whether some activities are specially adapted for ocean use: marine insurance and the production of bunker oil are included in this pilot, while cleaning and freight forwarding services are not included.

Data sources

The national accounts' supply-use tables form the basis for the calculation of the ocean satellite accounts. These tables provide a detailed description of the supply (production and import) of goods and services in the Norwegian economy, and how they are used (consumption, export, intermediate consumption or investment) and by whom (Norwegian industries and consumers and the rest of the world). The supply-use system is updated every year in connection with the publication of the final national accounts.

From the supply-use tables, information is obtained on production, intermediate consumption and investment for the industries defined as core the ocean industries.

4.2. Step-by-step description of constructing the ocean satellite account

Using data currently available in Norway, the work of creating an ocean satellite account can be roughly divided into four processes:

1. Make a list of predefined marine industries. All production delivered by ocean industries is included in the accounts. The ocean industries use a number of goods and services to manufacture their products, i.e., intermediate consumption and investment.

There are over 120 industries in the national accounting system in addition to a number of consumer groups. About 15 of these, such as fishing, shipping, and aquaculture, will be defined as marine industries.

Table 4.1 Core ocean industries

Industry	Standard Industrial Classification (NACE / SN07)
Fishing	03.1
Aquaculture	03.2
Extraction of crude petroleum and natural gas	06
Support activities for petroleum and natural gas extraction	09.1
Processing and preserving of fish, shellfish, and molluscs	10.2
Construction of ships and boats	30.1, excluding 30.113 and 30.116
Construction of oil platforms and modules	30.113 and 30.116
Pipeline transport (of oil and gas)	49.5
Shipping	50
Services related to maritime transport	52.22

2. Define goods and services in the national accounts as marine, partially marine or fully marine. Many of the products that are partially linked to the ocean are produced by industries that are not defined as ocean industries. For example, most animal feed is produced by the industry 'Manufacture of prepared animal feeds' (NACE 10.9). This industry and all other industries that produce goods and services that are partially linked to the ocean, but which are not defined as a core ocean industry are defined as "suppliers." Their marine production is included in these accounts. There are also some products where;

- the product satisfies enough criteria in section 4.1 to be considered a marine product per se, regardless of its end use or producer, or
- it is not possible to extract an ocean portion using the supply-use framework.

The national accounts consist of just over 900 goods and services, all of which must be reviewed to identify marine goods and services so that these can be categorized into the following three groups:

1. Fully marine: all products which, by definition, are marine regardless of their manner of use in marine industries, such as boats, cod, and sea transport.
2. Non-marine: all products that cannot be said to have any marine use that requires them to be especially adapted for such use. Examples of such products are Christmas trees and buses. This means that even if a predefined marine industry (see step 1) such as shipping uses Christmas trees, Christmas trees will nevertheless not be considered part of the Norwegian ocean economy. In the pilot, these evaluations may require an expert opinion, as many products are ambiguously marine: for instance, is repairing electronic equipment on a ship a marine activity, i.e., are the adaptations needed to perform this activity on a ship sufficient for this to be called a marine activity?
3. Partially marine: to the extent that a product in this category is used by one of the marine industries listed in step 1, it will be marine. For example, if the marine industry 'aquaculture' uses animal feed, then animal feed will be considered partially marine, because animal feed is included in the list of goods and services that have a marine adaptation when used by a marine industry (fish feed production is a special adaptation of animal feed production for maritime use. Had fish feed been identical to pig feed, the situation would have been different). To summarise this point: the contribution to the marine economy of a wide range of goods and services will be assessed according to the degree to which they are used (such as intermediate input, investment, consumption, etc.) by the predefined marine industries (or consumer groups).

The following product categories belong to the third group of products, for which external sources are used rather than the supply-use framework.

Table 4.2 Ocean activities where the source is not the national accounts

Ocean activity	Source
Education (vocational schools, upper secondary, higher education)	Admissions data, Directorate of Education
Sports activities	Membership of the relevant athletic associations that are part of the Norwegian Sports Association
Offshore catering	Business and enterprise information
Construction of port facilities	Business and enterprise information
Loading and unloading	Business and enterprise information
Storage	Business and enterprise information
Tourism	Map data
Research and development	Business and enterprise information

3. Design a program/model, which performs the calculations described above when the list of products as well as the marine industries is defined. The program will calculate the marine share for each product, based on the production and import shares (supply) used by the predefined marine industries. For instance, if the share of the animal feed supplied to the predefined marine industries is 60 per cent in 2020, the satellite accounts say that animal feed is 60 per cent marine in 2020, regardless of which industry produces it. The advantage of developing such a program is that it enables quick annual updates of the accounts. This is because the supply-use framework of the

national accounts forms the basis for the model's calculations. These supply-use tables are updated annually along with the national accounts.

4. There are products for which information other than the national accounts must be used.

This applies to products such as defense (e.g., the navy's share of the defense budget), education (identifying maritime-focused institutes and educational courses) and hotel accommodation. For the latter, geographical information systems in combination with the business registry can be used to include all hotels located within a certain distance of the waterfront.

The marine share generated by the supply-use framework in point 3 will be compared, if possible, with alternative information to assess the quality of the results. If there are large discrepancies, the supply-use framework must be adjusted. This supply-use framework is useful in the production of quarterly national accounts, economic ripple effect analysis, etc.

4.3. Main results

The ocean is a major contributor to the Norwegian economy, representing 22 percent of total GDP in 2019. By way of comparison, the ocean economy accounted for 1.7 percent of US GDP in 2020. The highly lucrative petroleum and gas extraction industry contributes most of the value added; however, as it is a capital-intensive industry, the majority of employment is connected to industries not related to oil, such as aquaculture, fishing, tourism, shipyards, and shipping. When oil and gas extraction is excluded, the gross product from ocean related activities amount to 7 percent of total GDP.

Table 4.3 Summary: Ocean-related activities, by industry. NOK million and full-time equivalents. 2019

Industry	Production	Intermediate consumption	Gross product	GFCF	Full-time equivalents
Aquaculture		59 700	27 600	7 000	8 600
Fishing	22 300	6 800	15 500	2 400	8 600
Processing and preservation of fish shellfish and molluscs, fish feed	109 700	93 900	15 700	3 700	12 200
Tourism	15 100	8 200	6 900	600	12 400
Foreign shipping	130 600	104 000	26 700	25 100	20 800
Domestic shipping	16 600	13 100	2 000	9 200	9 100
Services related to maritime transport	13 500	7 300	6 200	1 200	5 700
Transportation offshore services	20 600	12 700	8 000	2 700	5 600
Extraction of crude oil and natural gas	532 300	58 500	465 800	178 800	24 300
Services related to the extraction of crude oil and natural gas, geological surveys, etc.	185 700	119 600	66 100	6 700	54 300
Oil platforms and modules	27 000	17 600	9 400	900	9 600
Shipyards (excluding oil platforms and modules)	29 300	22 400	6 900	900	7 700
Equipment suppliers, repair and construction activities	42 400	29 300	13 100	5 800	16 000
Research and teaching	4 900	1 700	3 200	1 600	2 300
Other service production	37 200	27 800	9 400	5 500	33 900
Total without oil and gas extraction	742 300	524 200	215 100	73 300	206 800
Total without oil and gas extraction and closely related industries	508 900	374 200	131 700	62 900	137 300
Overall total ¹	1 274 800	582 600	680 900	252 100	231 100

¹ The individual figures in fixed prices do not add up to the sum due to chaining and rounding deviations

5. The MAREA research project (MARine Ecosystem Accounting)

Statistics Norway is participating in the MAREA research project, which is exploring the potential for regional marine ecosystem accounting for the Oslo Fjord. The ecosystem condition of the Oslo Fjord, including the coastal areas, has degraded due to several pressure factors such as polluting emissions including nitrates, overharvesting, destruction of underwater habitats, invasive species, and real estate development. The Government wishes to improve the condition of the Oslo Fjord and has made an integrated plan that describes measures that can be used. MAREA explores how ecosystem accounting can contribute to decision-making in the context of the integrated plan for the Oslo Fjord by taking advantage of science-local planning collaborations. The project also aims to find potential solutions for handling the uncertainty of monetary value estimates when these estimates are used for accounting purposes. The project aims to contribute to ecosystem accounting research by producing results that can be transferred to other settings. The MAREA project (2021-2025) is being led by the Norwegian Institute of Water Research in collaboration with the Norwegian Institute of Nature Research.

Previous research projects related to marine ecosystem accounting

In 2019, the Norwegian Institute for Water Research (NIVA) published the collaborative report *Verdier i Oslofjorden: Økonomiske verdier tilknyttet økosystemtjenester fra fjorden og strandsonen* [Values from the Oslo Fjord: Economic values associated with ecosystem services from the fjord and the coastal zone] (Chen et al., 2019). The report was produced in collaboration with the Norwegian Institute for Nature Research (NINA), Menon Economics AS and Statistics Norway, and used several data sources. Although this report is not an ecosystem account per se, its structure follows the SEEA EA framework. The report collates knowledge about the available figures on economic assets (market and non-market values) where the assets are to some degree dependent on the condition of the ecosystems in the Oslo Fjord, including in the 100-metre coastal zone. In addition, the report identifies potential user conflicts concerning the Oslo Fjord, both current and future. To the extent possible, the report divides the asset value estimates geographically into two regions, based on proximity to the capital city of Oslo.

Chen et al. (2019) also tested parts of the SEEA EA accounting framework in a study of Norwegian kelp forests. The study confirmed that SEEA EA will confer many benefits by highlighting relationships between ecosystems and the economy and that such accounting helps improve government transparency.

6. International processes

Statistics Norway is involved in international work on ocean accounting through its membership in Global Ocean Accounts Partnership [and international development programmes in which it cooperates](#) with several countries, including Indonesia. In May 2022, Indonesia and Norway signed an agreement for collaboration on ocean accounting, with a focus on ocean satellite accounting and ecosystem accounts, a collaboration that is expected to be mutually beneficial because it will contribute to knowledge exchange, and thus to progress on ocean accounting in both countries.

6.1. Membership of the Global Ocean Accounts Partnership

In June 2022, Statistics Norway accepted an invitation to become a member of the Global Ocean Accounts Partnership (GOAP). GOAP is a coordination and communication structure for its member institutions, which have a common interest in ensuring that the assets associated with the ocean are made visible and form the basis for decisions on social and economic development. More specifically, "GOAP develops a common technical framework for ocean accounting and contributes to collaboration that supports capacity building, development, maintenance of comprehensive ocean accounting that links social, environmental, and economic statistics that can be used continuously in decision-making." (GOAP, 2021).

For Statistics Norway, the benefits of membership in GOAP will help support the work to further develop the various components of ocean accounts linked to SNA, SEEA EA and SEEA CF (Central Framework) for Norway. Ongoing work at Statistics Norway as of today includes Statistics Norway's Investment Proposal. This is intended to lay the foundation for work to guide the preparation of the SEEA EA in the long term, the ocean satellite account and work on the Oceans for Development programme, as well as research projects that include testing and work with the ocean accounting research agenda (MAREA). This will hopefully contribute to international work and the experience gained will be shared with GOAP.

6.2. International development programs – Oceans for Development

It is increasingly recognised that the oceans play a critical role both in supporting life on earth and in mitigating climate change. Improved ocean management and governance are therefore vital for ensuring sustainable use of the oceans. Recognition of these facts has prompted the Norwegian Agency for Development Cooperation (Norad) to establish the Oceans for Development programme (OfD). As stated by Norad: "*The overarching objective of the Oceans for Development programme is to promote a strengthened, sustainable and inclusive ocean economy in the cooperating countries*" (Norad, 2020). The OfD is also one of Norway's contributions to achieving Sustainable Development Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development, as well as the broader United Nations 2030 Agenda. The programme is demand-driven and an important aspect of it is to establish cooperation between Norwegian institutions and counterpart institutions in cooperating countries.

A technical agreement was signed between Norad and the Ministry of Marine Affairs and Fisheries (MMAF) of the Republic of Indonesia on May 19, 2022. The agreement constitutes the overall framework for the OfD programme between Norway and Indonesia, and ocean accounting will be fundamental in the future collaboration. Statistics Norway and Statistics Indonesia (BPS) together with the Indonesian Directorate General for Marine Spatial Management under the MMAF are collaborating in this work. As members of the High Level Panel (HLP) for a Sustainable Ocean Economy, both countries are committed to improving management of the ocean. With the HLP recommendations and the emphasis on developing ocean accounts, important steps have already been taken. As this work is still under development, the potential for synergies is high. Potential

areas of collaboration between Statistics Norway, other Norwegian institutions and our Indonesian partners will be further developed as the planning continues and a programme document is developed. Technical meetings with Statistics Indonesia, Statistics Norway and the MMAF have already identified important areas for collaboration, such as ocean satellite accounting, ecosystem services accounts for marine protected areas (MPA's), ocean economy data visualisation, and exploring how ecosystem accounting methods can provide support for decisions at different levels.

Exploring a new form of peer-to-peer learning on ocean accounting with Indonesia

Statistics Norway's Division for International Development Cooperation, a specialised division working with international development cooperation projects, will have the responsibility of coordinating Statistics Norway's contribution to the OfD programme. Subject matter expertise from the Department of Economic, Business and Environmental Statistic, the Research Department and the Communications Department will be used in the OfD collaboration with Indonesia. The technical cooperation employs a mixed mode of online and shoulder-to-shoulder cooperation.

The work of developing complete ocean accounts is still at an early stage in both Indonesia and Norway, so that using advances in each other's comparative knowledge offers a potential for very high synergies. One theme that will be further explored is using the accounts as a basis for policy support combined with Indonesia's practical experience in the implementation of Ocean Accounts in MPAs (MMAF, 2022). The knowledge gained from the MAREA research project on testing and evaluating how ecosystem accounting methods can provide decision-making support at different planning levels will be of great importance in the sharing of experience with Indonesia. This will apply both to further work on piloting ocean accounts for other MPAs and to the development of accounting at national level.

The national accounts experts of Statistics Indonesia and Statistics Norway will cooperate at a detailed level on developing the ocean satellite accounts of Indonesia. An important starting point here is developing the supply and use framework. There are several ocean activities that cannot be estimated by means of this framework. Hotels and restaurants are one example, since it is their geographic location that determines their relationship with the ocean. Estimating these activities will also be an area of cooperation between Norway and Indonesia.

Statistics Norway plans to provide technical assistance on assembling the ecosystem services accounts in both physical and monetary units for the MPAs. Of importance here will be the sharing of experience of the different valuation techniques that have been used and will be used within the SEEA EA framework. This will also give Norway valuable input for developing ecosystem accounts for Norwegian marine areas.

7. Future plans

The ocean satellite account is the area of Norwegian ocean accounting for which there are the most concrete plans. However, the very positive signals from the steering group of the Norwegian Forum for Integrated Ocean Management regarding the conducting of pilot ocean accounts in the near future is a great second step towards the development of ocean accounts for Norway in line with international frameworks.

It is a question of *when*, rather than *if*, an ocean account will be developed in Norway.

7.1. Ocean satellite account⁶

The ocean satellite account is a pilot and will be subject to improvements and audits in connection with further quality work. The accounts are only as good as the National Accounts' supply-use framework, and improvements of the former thus imply improvements of the parts of the framework where the estimates are more uncertain, i.e., the service industries, and especially intermediate consumption.

A useful extension of the ocean satellite account would be to prepare an input-output matrix. Such a matrix combines the supply and use tables in a matrix with supply-use coefficients. It would provide a basis for analysing ripple effects in the economy due to external shocks in an ocean industry.

Many users want regional figures. The supply-use estimates are based on national figures, where it is known that a certain proportion of the production of an industry is linked to the ocean at national level. If the ocean share is 20 per cent, the supply-use tables cannot answer whether all production related to the ocean originates from Western Norway (for example) or whether the share is 20 per cent in all counties in which the industry operates. If one assumes the latter, such accounts can be prepared relatively quickly, as the National Accounts produce county-level figures each year, and ocean activity could be distributed proportionally on the basis of these. If county-level ocean accounts are to be prepared, the validity of this assumption must be reviewed, which will require a review of company-level data.

Finally, there is the question of whether the satellite accounts will become official statistics and thus be published every year. This question concerns, among other things, the use of resources. As an IT system has been developed that does much of the calculation of the accounts producing the accounts is not resource-intensive, but if the system is to be quality-assured and improved (which includes improving the entire National Accounts' supply-use system), it will require more resources.

7.2. Pilot marine ecosystem accounts

The first step in producing a pilot ocean account for Norway is currently being taken. As stated previously, the steering group has asked the Forum for Integrated Ocean Management to suggest some potential geographical areas for performing pilot marine ecosystem accounting. The selection of areas was recommended to be made in close cooperation with Statistics Norway, and the results of the work are to be presented in early December. How the pilot should be set up and how comprehensive it should be has yet to be determined, but this will happen within the next few months.

⁶ The text in this section has been largely extracted from the document on ocean satellite accounts published on Statistics Norway's webpage: Ocean satellite account – Description of methods and sources.

A pilot will increase knowledge of how the different components of a Norwegian ocean account may look in practice and how the account can contribute to various management needs, and it will help reveal areas in which we lack the necessary data and knowledge. Furthermore, it will contribute to building up capacity and expertise in ocean accounting in Norway. This will be useful for the implementation of holistic ocean accounts and put Norway in a better position to contribute to and influence the development of international standards. The adopted UN standard for ecosystem accounts, the OECD standard and GOAP's technical manual, will form the basis, while at the same time it will be important to test alternative solutions where a standard has not been adopted or where the standard is not well adapted to Norwegian conditions.

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