Workshop Concept note

Asia and the Pacific Regional Expert Workshop on Ocean Accounts

As part of the Ocean Accounts Partnership for Asia and the Pacific

Date: August 1-3, 2018
Venue: UN Conference Centre, Bangkok, Thailand

Contents

Acknowledgements

1. Objective

The objective of the workshop is to facilitate a community of practice around standards for ocean statistics. We find that statistics are more relevant when statisticians, scientists and policy makers collaborate. For them to collaborate, they need to be speaking a common language. We hope participants will strengthen existing collaborations and develop new ones by:

- Contributing to the development of **international standards** for the measurement of the economic, social and environmental aspects of the ocean and coasts. The approach is to apply statistical, scientific and policy expertise to produce practical guidance for countries on measuring a feasible set of core ocean accounts. Measuring the ocean economy is one component of these accounts. However, to ensure that the guidance is comprehensive and applicable, many other topics (spatial frameworks, ecosystems and ecosystem services, coastal and dependent communities, ocean health, ocean health, climate change, disaster risk, and governance) will also be addressed.
- Participating in **cross-disciplinary lectures** on the three main perspectives on the ocean (statistical, scientific and policy). To this end, each day will begin with a keynote lecture on one of these topics. Poster sessions and side-events will also be available.
- Providing input to **future case studies** for testing the statistical guidance and research projects to fill gaps in knowledge and data.

The UN Statistical Commission (UNSC) has asked ESCAP and UN Environment to take the lead in developing guidance for ocean statistics. The results of the workshop will support regional case studies and contribute to the revision of the SEEA Experimental Ecosystem Accounting for 2020.

We hope to leverage this workshop and its preparation to establish an ongoing community of practice on ocean statistics. **Participation is sought from experts in ocean statistics, science, and policy from national governments and research institutions as well as regional and international organizations**. Those who are interested, but unable to attend will have the opportunity to contribute to the development of issue papers and the resulting guidance documents.

2. Background

One could think of statistics in terms of indicators. However, to compare one indicator with another, we need a measurement framework. Frameworks provide common concepts, classifications and methods to ensure that data collected from multiple sources are coherent[1] and can be harmonized.

Much data exists on the ocean. The First Global Integrated Marine Assessment (2017) is a comprehensive compilation of current data and knowledge on the ocean. However, there is little experience in applying international statistical standards to harmonize that information:

- The System of National Accounts (SNA; United Nations et al. 2008) defines marine fisheries as an industry, but other aspects of the ocean economy are embedded in other industries (e.g., tourism, transportation, energy).
- The System of Environmental Economic Accounting Central Framework (SEEA-CF; United Nations et al. 2014a) provides guidance on measuring ocean-related stocks, supply and use of natural inputs to the economy (e.g., aquatic resources, minerals, energy), as well as residuals (air emissions, solid wastes, wastewater) that impact the ocean, but is not spatially detailed.

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[1] "Coherence" implies the capacity to integrate data. Common concepts, classifications and methods allow data to be interoperable. That is, a statistic on the economy (e.g., GDP) can be divided by a statistic on population only if they both measure a national total for the same period.

- The SEEA-Experimental Ecosystem Accounting (SEEA-EEA; United Nations et al. 2014b; United Nations 2017) provides guidance on delineating ecosystems, their condition, services and benefits, but there has been little experience in applying this to the ocean.
- The SEEA-Agriculture, Forestry and Fisheries (SEEA-AFF; FAO and UNSD 2018) provides guidance on measuring the stocks, supply and use of food (fish and other aquatic resources) as well as on measuring the environmental impact of these industries (e.g., land use, carbon emissions, waste production).
- The Disaster-Related Statistics Framework (DRSF) (ESCAP 2017) provides guidance on compiling relevant statistics that are compatible with existing national statistical systems. It builds upon commonly-accepted definitions towards improving the quality of the underlying statistics. Many disasters (hydro-meteorological events, tsunami) are ocean-related. The DRSF is currently under consultation.
- The Intergovernmental Panel on Climate Change (IPCC 2006) provides guidelines for national greenhouse gas inventories. Work is underway on a "Special Report on the Ocean and Cryosphere in a Changing Climate" (IPCC 2007). This is expected to be completed by September 2019.

None of these frameworks have been applied at the level of detail (e.g., large vs small fishing operations, male/female fishers, coastal communities, technologies used, point sources of pollution) that would support the measurement of ocean-related issues implied in SDG14 and interrelated goals (**Annex 2**).

ESCAP has committed to developing guidance for countries on producing "ocean accounts"—that is, standardized data of national, regional and global importance, so that it can be integrated and thereby provide a comprehensive view (**Annex 1**). The core of this guidance will be the extension, adaptation and testing of existing statistical frameworks. Where these frameworks are insufficient, we will seek to develop new components that can be linked to existing ones.

This is part of the ESCAP Ocean Accounts Partnership. By participating in partnerships on international, regional, and national levels, we will combine forces to strengthen the capacity of member States to address SDG14. The statistical guidance developed as part of this process will be an important coordination tool to foster communication among international, regional and national agencies, to develop regional strategies and technical support for implementation. We recognize the importance of national and regional policy platforms. The workshop will be an opportunity to ensure that the approaches therein are considered.

3. Approach

In advance of the workshop, experts will collaborate to develop presentations on ten key issues where additional work is required to develop measurement guidance. Each issue will be the subject of one presentation, a plenary discussion, focussed group analysis and recommendations.

Side-events and poster sessions will be organized to discuss selected topics in more detail.

Based on the discussions and recommendations of the workshop, ESCAP will coordinate the production of a draft guidance document.

3.1 Keynote lectures

Each day will begin with a keynote lecture providing overviews of the key concepts. The three suggested topics are:

- Statistics: SEEA and ocean-related SDGs, overview of ocean accounts;
- Science: What we know and what we don't know; scientific platforms and networks;
- Governance: Global, regional and national mechanisms, good practices, and challenges.

3.2 Issue presentations

Short "issue briefs" (**Annex 4**) will guide collaborations of experts (3 or more per issue) in co-authoring short (20 minute) presentations for the workshop. Each presentation will:

- consider guidance already in the SNA, SEEA and other relevant frameworks,
- identify the issue in more detail,
- describe alternative approaches with examples and references,
- suggest criteria for selecting one approach over another, and
- recommend which approach should be selected for the guidance document.

Discussion of the issues (30 minutes) will focus on points of clarification and additional approaches.

3.3 Group analysis

Each day will cover 3 or 4 of the listed issues. After the issues have been discussed in plenary, participants will be randomly divided into three groups:

(1) Statistics (including data management): Which approach is most feasible?
(2) Science (including economics, sociology): Which approaches are most coherent with existing concepts and knowledge?
(3) Governance (including institutional settings, policy): Which approaches are most amenable to being applied to making decisions?

Each group will consider the issues of the day from that perspective and will narrow the options developed in plenary to one or two main recommendations on each issue. The recommendations will be further focussed in plenary after the group reports. The objective is to agree on "generic" approaches that could be applied in any country, not to provide a shopping list of possible approaches.

4. Issue briefs

The issues have been selected to be complementary with the SEEA-EEA research agenda (Issues 1, 2, 5, 9), but also to expand its scope to explicitly link to disaster risk and climate change, and to consider implementation issues. Issues 1, and 2 address statistical infrastructure, definitions and classifications. Issues 3, 4, and 5 address linkages to existing statistical frameworks. Issues 6, 7, 8 and 9 address setting priorities and implementation. (See **Annex 4** for more detail):

1. Issue 1. Spatial units and ecosystem type classification
   - o Objective: Recommend a standard approach to delineating ocean and coastal spatial units and classifying ecosystem types coherent with international methods and the SEEA.
2. Issue 2. Ecosystem services
   - o Objective: Review ecosystem services classifications with respect to the ocean and recommend adaptations or expansions if required.
3. Issue 3. Disaster risk and climate change
   - o To review existing frameworks of (a) disaster risk and (b) climate change statistics. To suggest where linkages to the ocean exist and where such linkages need to be developed.
4. Issue 4. Links to social concerns
   - o Objective: To integrate social concerns into ocean accounts by distinguishing beneficiaries and populations at risk.
5. Issue 5: Links to economic concerns
   - o Objective: To integrate economic concerns into ocean accounts by (a) ensuring that standard economic accounts (SNA-based) fully include the direct economic benefits

of the ocean, and (b) augmenting standard economic accounts with approaches to valuation of additional (non-SNA) benefits of marine resources.

6. Issue 6: Global data availability
   o Objective: To review sources of global data that could be applied to national, regional or global ocean accounts.
7. Issue 7: Progress on measuring SDG14
   o Objective: Review efforts to develop metadata (measurement standards) for SDG14-related indicators. Can these be linked to specific components of the ocean accounts?
8. Issue 8: Ocean governance
   o Objective: To review international, and selected regional and national governance mechanisms (policy and regulatory frameworks, including transboundary issues) with respect to their approaches, enforcement challenges and information needs. This issue could also include initiatives new technologies, sustainable management approaches.
9. Issue 9: Modelling the ocean
   o Objective: To review existing modelling approaches to the ocean and recommend areas for testing.
10. Issue 10: Outstanding issues and the way forward *(to be prepared during the workshop)*
    o Objective: To summarize the outcomes of the workshop in terms of key data gaps, issues for testing and requirements for further research.

5. Timelines

- Early March 2018: Draft concept note; share with potential partners
- End-March: Final draft concept note (this note); distribute to potential participants
- April: Identify lead and contributing authors for each issue presentation
- April to mid-June: Lead and contributing authors draft issues presentations (e.g., in a PowerPoint format) with research support from ESCAP
- August 1-3: Workshop
- Early September: Circulate draft outcome document
- September to December 2018: test and apply guidance in national and regional case studies
- January to June 2019: revise guidance with insights from case studies; publish case studies and make selected data available.

6. Expected outcomes

We hope that the workshop will result in an ongoing community of practice on ocean statistics with policy experts, statisticians and scientists. This community will be the first to share a common language on the topic. Differences of opinion will remain, but they will be founded in a common understanding of the issues.

The workshop will contribute to strengthening national, regional and international partnerships, including the statistical community, that will focus efforts on compiling, interpreting and applying oceans data and statistics to enhance capacities of member States to sustainably manage the ocean.

The workshop will identify recommendations that are ready to test. These can be applied immediately in ocean accounts pilot studies. It will also identify issues requiring further research and development. These could be incorporated into researchers' ongoing studies, ideally through collaborations within and outside of the community of practice.

7. Provisional agenda

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Begin	End	Day 1	Suggested lead (tbd)
08:30	09:00	Registration	
09:00	09:15	Opening and Introduction	
09:15	09:30	Overview	
09:30	10:30	Keynote lecture: Ocean statistics	
10:30	11:30	**Issue 1. Spatial units and ecosystem classification**	
11:30	12:30	Lunch	
12:30	13:00	Case study: Indonesia	
13:00	14:00	**Issue 2. Ecosystem services**	
14:00	15:00	**Issue 3. Disaster risk and climate change**	
15:00	16:30	Breakout groups	
16:30	17:00	Report of breakout groups	
Begin	End	Day 2	
08:30	09:30	Keynote lecture: Ocean science	
09:30	10:30	**Issue 4. Links to social concerns**	
10:30	11:30	**Issue 5: Links to economic concerns**	
11:30	12:30	Lunch	
12:30	13:00	Case study: Fiji	
13:00	14:00	**Issue 6: Global data availability**	
14:00	15:00	**Issue 7: Progress on measuring SDG14**	
15:00	16:30	Breakout groups	
16:30	17:00	Report of breakout groups	
Begin	End	Day 3	
08:30	09:30	Keynote lecture: Ocean governance	
09:30	10:30	**Issue 8: Ocean governance**	
10:30	11:30	**Issue 9: Modelling the ocean**	
11:30	12:30	Lunch	
12:30	13:00	Pre-assessments for proposed case study countries	
13:00	14:00	**Issue 10: Outstanding issues and the way forward**	
14:00	15:30	Breakout groups	
15:30	16:00	Report of breakout groups	
16:00	16:30	Summary of responses to issue papers	
16:30	17:00	Wrap-up and closing	

Lunch will include posters & side events (e.g., training on SEEA Water in breakout rooms).

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Annex 1.   A set of ocean accounts

Ocean accounts are envisioned, at their core, as an expansion of the SEEA-EEA (**Figures 1 and 2**), linked to:

- spatially-detailed information on drivers and expenditures from other SEEA accounts,
- functionally disaggregated information from the SNA,
- disaggregation of beneficiary, business and household types, and
- contextual information on policies, technologies and management practices.

These accounts could be compiled for national territories, but regional and global data may also be available for international waters/high seas. It would also be feasible to compile and account for a sub-national area, such as a bay or specific coastline.

The guidelines will provide the "standards" for measurement, but compiling the accounts will require collaboration among data providers, data users and other stakeholders. In the case of the SEEA, such accounts are compiled at the national level and are used in national planning. Collaboration among neighbouring countries to compile comparable accounts would support the analysis of transboundary issues. A partnership to compile ocean accounts at the global level could be instrumental in developing a comprehensive global assessment.

The components of the proposed ocean accounts can be thought of as recording drivers, pressures, states, impacts and responses (DPSIR), while recognizing that:

- "Drivers" and "Pressures" may be necessary outcomes of development,
- "States" are not always linearly related to "Pressures", and may not be well known,
- "Impacts" and "Responses" can be at the global, regional, national, community or individual level.

The proposed accounting structure is not intended to be deterministic or linear. Ecosystems are complex. Increases in pressures may not immediately change the state (cumulative impacts and threshold effects). The supply of ecosystem services may or may not be linked to a change in the condition of the ecosystem (non-linear effects).

The components of the ocean accounts represent themes that are coherent within themselves and linked conceptually to each other: Drivers, Assets (Extent and Condition), Ocean Services (quantity and value), and Governance (including management practices). This provides a broad scope for analysing issues of concern without implying cause-and-effect relationships. Given the modularity of the accounts, individual accounts may be selected based on importance and feasibility.

As in the SEEA-EEA, these components are presented in order of most feasible and essential first. The **Ocean Asset** is a combination of **Extent** and **Condition**. That is, the provision of physical services from a given location depends on the type and condition of the ecosystem at that location. It would be beneficial to designate certain areas, services and species as Critical Natural Capital[2].

Ocean Extent: would maps not only ocean ecosystem types (distinguishing benthic from pelagic), but also other spatial features including locations of protected areas, fishing zones, minerals, ocean communities, coastal and marine infrastructure, depths, shipping lanes, upwelling areas (among others).

To fully account for Ocean Assets, other asset types could be derived from the SEEA-CF: minerals and energy, aquatic resources (fish, crustaceans, molluscs, aquatic mammals, aquatic plants). While the SEEA-CF focuses on aquatic resources as commodities, the SEEA-EEA recognizes the importance of measuring the diversity of all species.

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[2] Critical Natural Capital are designated ecosystems, services and species that are set aside from being traded off for financial capital (Saner & Bordt 2016).

Figure 1 A stylized set of ocean accounts

	Ocean Assets: SEEA-CF Mineral and Energy Assets; Aquatic resources	

Drivers

Specific units	Industry	% to ocean
SEEA Air emissions		
SEEA Effluents[1]		
SEEA Solid wastes[1]		
[1] would benefit from spatial disaggregation		

Ocean Extent

hectares	Ecosystem Type[2]	Minerals (T)	Energy (MToE)	Fish stocks (T)
Beginning of period				
+ additions				
- reductions				
End of period				

Ocean Services Supply (physical)

Service (specific units)	Ecosystem Type
Provisioning	
Regulating and maintenance	
Cultural	
Abiotic: Minerals, energy, medium for transport	

Ocean governance

Specific units	Industry
Policies, plans and regulations	
Institutions	
Management practices	
Technologies	
SEEA Protection Expenditures	
- research	
- enforcement	
SEEA Goods and Services	
- technologies	

Ocean Conditions

Specific units	Ecosystem Type[2]	Minerals (T)	Energy (MToE)	Fish stocks (T)
Acidification (pH)				
Eutrophication (BOD)				
Plastics (T)				
Carbon[3]				
Biodiversity[3]				
Temperature (°C)				
Accessibility/quality				

[2] Including critical natural capital areas, settlements, coastal infrastructure, protected areas, fishing zones, designated tourist areas, coral reefs, mangroves, coastal beaches…

[3] As in the SEEA-EEA, Carbon and Biodiversity could be full accounts.

Ocean Services Use (physical)

Service (specific units)	Beneficiary type[4]
Provisioning	
Regulating and maintenance	
Cultural	
Abiotic: Minerals, energy, medium for transport	

[4] Disaggregated by coastal/urban/rural, high/low income, male/female

Ocean Services Supply (Monetary[5])

Service (monetary unit)	Ecosystem Type
Provisioning	
Regulating and maintenance	
Cultural	
Abiotic: Minerals, energy, medium for transport	

[5] Only some services can be valued in monetary terms.

Ocean Services Use (Monetary[4])

Service (monetary unit)	Beneficiary type
Provisioning	
Regulating and maintenance	
Cultural	
Abiotic: Minerals, energy, medium for transport	

SNA for some services[6]

[6] Would benefit from disaggregation by large/small enterprise and linkage to employment by beneficiary type.

Note: This is a stylistic representation of the SEEA-EEA with additional components required for including sources of land-based pollution, abiotic services (such as minerals, energy and medium for transport), expenditures and governance. This is not as comprehensive as described in the text. Much of the data on flows of land-based pollution, ecosystem types, and condition would be derived from detailed maps and aggregated as shown in the tables for reporting.

Ocean Condition: would map water quality measurements (acidification, eutrophication, plastics, coral bleaching, other pollutants), but also other biophysical conditions (e.g., biodiversity, temperature, currents, frequency of storms, sea level, population and infrastructure exposed to natural hazards) required for the interpretation of ocean services.

Ocean Services (physical supply and use): would include relevant ecosystem services (materials, aquatic resources, coastal protection, carbon sequestration, recreation, climate regulation), but also abiotic services (minerals, energy, and medium for transport). The concept of "beneficiary" would ideally be disaggregated for population target groups (coastal/urban/rural; male/female; high/low income). SEEA-CF provides guidance on measuring stocks and flows of aquatic resources. The SEEA-AFF links these to nutrition.

Ocean Services (value): would include monetary values of the physical services, but also measures of ocean integrity and social values. Some of the monetary values can be estimated from the SNA (e.g., fishery industry) but would require disaggregation (e.g., large/small scale fishing operations). As in the SEEA-EEA, it is possible to:

- estimate the future flow of ecosystem services to estimate a monetary value of the asset given different scenarios (e.g., restrict fishing/allow unrestricted fishing),
- use these values to estimate the resource "rent" or return on investment given the expected future conditions (e.g., what would be the future value of ocean services with additional investment in pollution reduction?),
- develop economic production functions that include the contribution of the ocean to other economic activities (e.g., food, tourism, energy), and
- include the contribution of the ocean to national wealth (the National Balance Sheet).

Figure 2. A spatial representation of ocean accounts
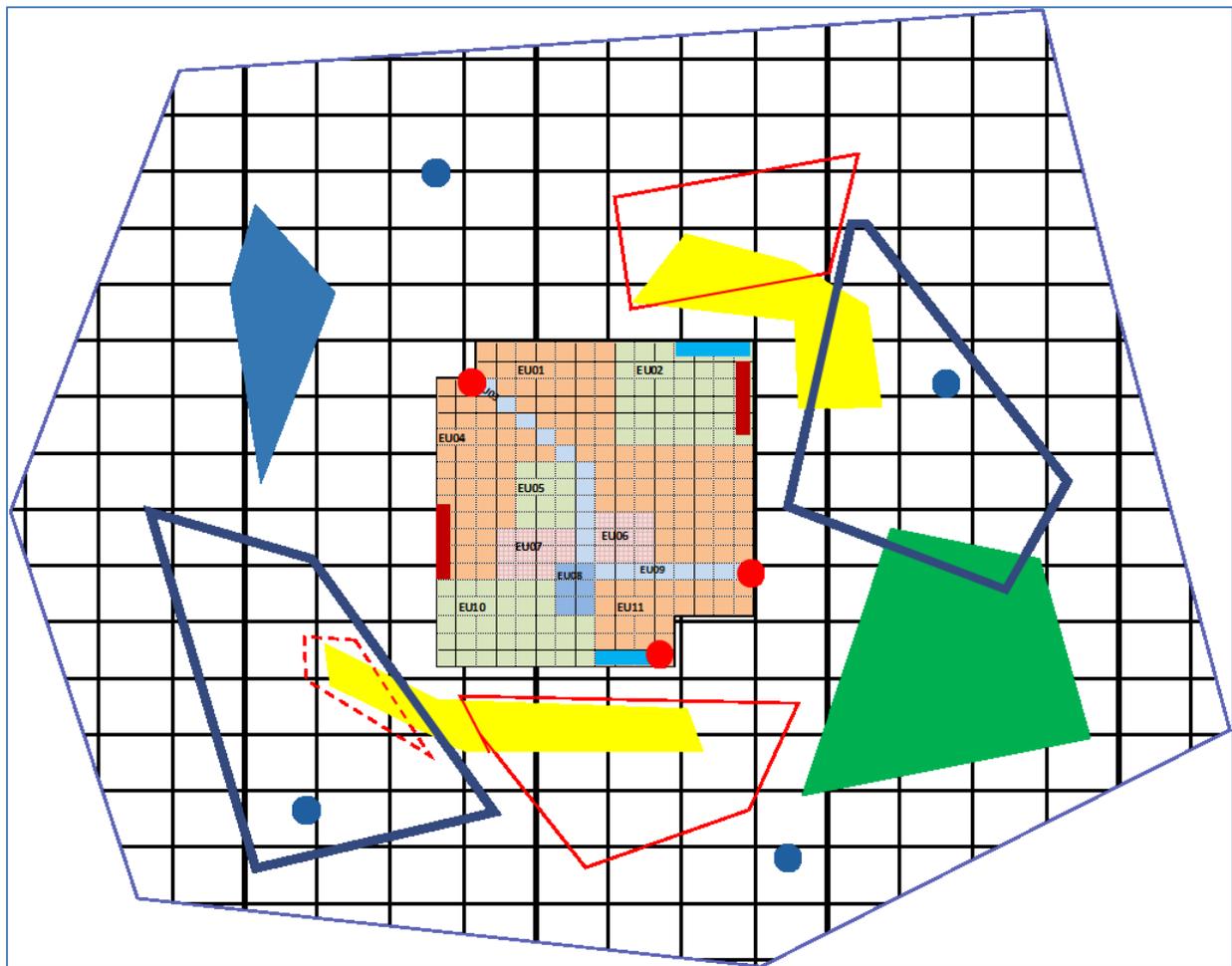
Legend:

	Terrestrial ecosystem types (from Land Account)		Ocean ecosystem types
	Coastal infrastructure		Marine protected area
	Coastal communities		Mining areas
	Point source of pollution		Fishing area
	Ocean spatial units		Water quality, condition measurement location

To provide a comprehensive view of the ocean, datasets on drivers of change and governance could also be linked:

- Ocean Drivers (of change) not spatially detailed:
    - SEEA Air Emissions (GHGs and others);
    - SEEA-AFF provides additional guidance on environmental impacts of agriculture, forestry and fishery industries (land use, GHG emissions, water consumption, energy consumption) and links production in these industries to nutrition;
- Ocean Drivers (of change) spatially detailed:
    - SEEA Water Emissions: would require locating point sources and determining quantities flowing to the ocean;
    - SEEA Solid Wastes (distinguishing plastics, hazardous wastes): would require locating point sources of waste disposal;

- o SEEA Minerals and Energy Assets: to estimate physical quantities and monetary value of ocean mineral and energy assets; and
- o SEEA Material Flows: to link harvesting/exploitation/capture of ocean assets with economic units supplying and using them. This may not be required if the Ocean Services Supply/Use Accounts are sufficiently detailed.
- Ocean Governance (could be spatially detailed if sub-national):
  - o National legislation, policies, regulations and institutions in place for sustainable management of the ocean including effectiveness of enforcement. The SEEA Environmental Activities Accounts provide guidance on measuring Environmental Protection Expenditures (including research), the Environmental Goods and Services Sector, and environmental taxes and subsidies; and
  - o Management practices and technologies in use (including community-based approaches).

Annex 2 provides a mapping to relevant SDG indicators that, among many others could be produced using one or more of the ocean accounts. Beyond the SDG indicators, the accounts could also provide assessments such as the contribution of the ocean to the economy, the beneficiaries of ocean resources, the costs and benefits of rehabilitation and protection, and the main sources of land-based pollution.

Annex 2. Ocean-related SDG indicators and links to ocean accounts

These are the core indicators that explicitly mention the ocean, fishers or ecosystems. Other goals would benefit from ocean accounts: SDG1 (No poverty), SDGs 5 and 10 (Gender equality and Reduced inequalities), SDG 8 (Decent work and economic growth), SDG11 (Sustainable cities and communities), SDG12 (Responsible consumption and production), SDG13 (Climate action).

Target	Indicator	Custodian	Link to ocean accounts
2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment	2.3.1 Volume of production per labour unit by classes of farming/pastoral/forestry enterprise size	FAO	**Ocean services use** disaggregated by large/small scale fishing.
	2.3.2 Average income of small-scale food producers, by sex and indigenous status	FAO	
9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	9.4.1 CO_2 emission per unit of value added	UNIDO, IEA	SEEA Air Emissions, Material Flows, SNA
13.2 Integrate climate change measures into national policies, strategies and planning	13.2.1 Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)	UNFCCC	SEEA Air Emissions, Ecosystem Carbon, Governance
14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	14.1.1 Index of coastal eutrophication and floating plastic debris density	UNEP (with FAO, UNESCO-IOC, IMO)	SEEA Ecosystem Condition Accounts, Water Emissions, Solid Wastes

Target	Indicator	Custodian	Link to ocean accounts
14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	14.2.1 Proportion of national exclusive economic zones managed using ecosystem-based approaches	UNEP (with FAO, UNESCO-IOC)	SEEA Aquatic Resources, Ecosystem Extent, Environmental Protection Expenditures, Aquatic resources, Ocean Services
14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels	14.3.1 Average marine acidity (pH) measured at agreed suite of representative sampling stations	UNEP (with FAO, UNESCO-IOC)	SEEA Water Emissions, Ecosystem Condition, Biodiversity, Governance
14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	14.4.1 Proportion of fish stocks within biologically sustainable levels	FAO	SEEA Aquatic Resources, Ecosystem Extent, Environmental Protection Expenditures, Governance
14.5 By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information	14.5.1 Coverage of protected areas in relation to marine areas	UNEP-WCMC, UNEP	SEEA Aquatic Resources, Ecosystem Extent, Environmental Protection Expenditures, Aquatic resources, Ocean Services
14.6 By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation[3]	14.6.1 Progress by countries in the degree of implementation of international instruments aiming to combat illegal, unreported and unregulated fishing	FAO	SEEA Aquatic Resources, Ecosystem Extent, Environmental Protection Expenditures, Governance
14.7 By 2030, increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism	14.7.1 Sustainable fisheries as a proportion of GDP in small island developing States, least developed countries and all countries	FAO, UNEP, World Bank	SEEA Aquatic Resources, Ecosystem Extent, Environmental Protection Expenditures, Governance

Target	Indicator	Custodian	Link to ocean accounts
14.a Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries	14.a.1 Proportion of total research budget allocated to research in the field of marine technology	UNEP, World Bank	SEEA Environmental Protection Expenditures, Environmental Goods and Services Sector, Governance.
14.b Provide access for small-scale artisanal fishers to marine resources and markets	14.b.1 Progress by countries in the degree of application of a legal/ regulatory/ policy/ institutional framework which recognizes and protects access rights for small-scale fisheries	FAO	SEEA Environmental Protection Expenditure Accounts, Governance
14.c Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in the United Nations Convention on the Law of the Sea, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of "The future we want"	14.c.1 Number of countries making progress in ratifying, accepting and implementing through legal, policy and institutional frameworks, ocean-related instruments that implement international law, as reflected in the United Nations Convention on the Law of the Sea, for the conservation and sustainable use of the oceans and their resources	UN-DOALOS, FAO, UNEP, ILO, other UN Oceans agencies	SEEA Environmental Protection Expenditure Accounts, Governance
15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	15.5.1 Red List Index	IUCN, UNEP, CITES	SEEA Ecosystem Condition, Biodiversity.
15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	15.9.1 Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011–2020	UNEP-SCBD, UNEP	SEEA Ecosystem Services Supply and Use Accounts.

Annex 3. Regional Seas recommended indicators (1 Oct. 2016)

No.	Category of indicator	Possible regional Seas Coordinated Indicator	SDG	TWAP indicators
1	Total inputs of nitrogen and phosphorus from agriculture, sewage and atmospheric nitrogen	Chlorophyll a concentration as an indicator of phytoplankton biomass	14.1	Chlorophyll time series; DIN, DIP (modelled data) (both concentration and flux
2	Inputs of marine chemical pollution Trends for selected priority chemicals	Trends for selected priority chemicals including POPs and heavy metals	14.1	POPS (Persistent Organic Pollutants) status
3	Overall levels of marine litter Quantification of beach litter items	Quantification and classification of beach litter items	14.1	Marine Plastic Litter
4	Ocean warming	Annual mean sea surface temperature (25m below the surface)	14.3	Sea Surface Temperature (SST)
5	Fish landings	Fish catches within EEZs (tonnes) – total capture production	14.4	Fish landings and Landed Value, Fishing effort, Fish stock status, Primary Production required, Marine Trophic Index, Fishing in Balance Index
6	Aquaculture	Application of risk assessment to account for pollution and biodiversity impacts	14.4	
7	Aquaculture	Destruction of habitat due to aquaculture	14.4	
8	Population pressure / urbanization	Length of coastal modification and km2 of coastal reclamation	14.2	Rural/ Urban population, %poor,
9	Eutrophication status	Locations and frequency of algal blooms reported	14.1	Index of coastal eutrophication
10	Pollution hot spots	1) Concentration of Status of selected pollutant contamination in biota and sediments and temporal trends 2) Number of hotspots	14.1	Floating plastic debris
11	Ocean acidification	1) Aragonite saturation 2) pH 3) Alkalinity	14.3	Pteropods at risk
12	Level of exploitation of commercial fisheries	FAO stock status: % stocks overfished compared to MSY	14.4	Catch Stock Status, Marine Trophic Index, Fishing in Balance Index
13	Species replacement as a consequence of capture fisheries	Marine trophic index	14.5	Marine trophic index
14	Endangered species	Distribution of Red List Index species	14.5	
15	Loss of critical habitat	Trends in critical habitat extent and condition	14.5	Mangrove status; Reefs at Risk Index; seagrass; salt marshes

No.	Category of indicator	Possible regional Seas Coordinated Indicator	SDG	TWAP indicators
16	National Action Plans to reduce input from LBS	% National action plans ratified / operational	14.1	Transboundary Legal Instruments
17	Waste water treatment facilities	1) % coastal urban population connected to sewage facilities 2) % of waste water facilities complying with adequate standards 3) % of untreated waste water	14.1	
18	Incentive to reduce marine litter at source	1) % port waste reception facilities available 2) Incentives to reduce land based sources 3) Amount of recycled waste on land (%)	14.5	
19	Climate change adaptation	1) % national adaptation plans in place 2) Sector based national adaptation plans 3) Number of existing national and local coastal and marine plans incorporating climate change adaptation	14.2	Transboundary Legal Instruments
20	Fish harvested within safe ecological limits	Fisheries measures in place (by-catch limits, area-based closures, recovery plans, capacity reduction measures) and multilateral/bilateral fisheries management arrangements	14.4	Catch Stock Status, Marine Trophic Index, Fishing in Balance Index; Fishery Production Potential of LMEs
21	Critical marine habitat under protection	% Marine protected areas designated	14.5	Change in Protected Area Coverage
22	National ICZM in place	National ICZM guidelines and enabling legislation adopted	14.2	

Annex 4. Issue briefs

The issues have been selected to be complementary with the SEEA-EEA research agenda, but also to expand the scope to explicitly link to disaster risk and climate change, and to consider implementation issues.

Many of the issues have already been considered from a scientific, economic or policy perspective (e.g., the OECD Ocean Economy and Innovation initiative, and the First Global Integrated Marine Assessment). However, many recent initiatives further suggest the need for a comprehensive statistical framework to help standardize and integrate the expanding wealth of data and knowledge. Implicit in the further development of these issue briefs is the need to consider current initiatives that could benefit from and contribute to strengthening ocean data and statistics for sustainable management.

1. **Spatial units and ecosystem type classification**
    1. Objective: Recommend a standard approach to delineating ocean and coastal spatial units and classifying ecosystem types coherent with international methods and the SEEA.
    2. Existing guidance: "Spatial units" is the hierarchy of statistical units for which data are collected or to which information is attributed. "Ecosystem type" (ET) is a class of ecosystem assets with comparable ecological attributes. The two topics would benefit from being treated separately since they involve different expertise (geographic versus ecological) and time scales of change (long-term versus short-term).
        a. Spatial units: The SEEA-EEA delineates Basic Spatial Units (BSUs) as a pixel (100m^2 or smaller) of land cover from satellite imagery that can be aggregated to higher levels (Ecosystem Assets, EAs) by common properties and proximity.
        b. Ecosystem type classification: The basic SEEA-EEA ecosystem type classification is land cover, based on the SEEA-CF classification. The SEEA-CF classifies land cover into 14 distinct classes; there are no sub-classes. "Sea and marine areas" was added post-publication.
    3. Issue in more detail:
        a. Spatial units for the ocean are not comparable with land cover pixels since, on the surface, all pixels are "water". Further, characteristics are different at different depths. Higher level reporting units in the SEEA are terrestrial (catchment area or ecozone) and administrative (state, province). Are there equivalents reporting units for the ocean and coasts?
        b. Delineating ecosystems in coastal and marine areas would benefit from a recognition of distinct benthic (sea bottom), pelagic (surface), coastal and open ocean ecosystems. Many countries have delineated coastal and marine ecosystem based on ecological and physical properties or management areas within their EEZs.
    4. Alternative approaches:
        a. Consideration of this issue may benefit from recent advances in three-dimensional visualization (see Sayre 2017). This approach incorporates measures (temperature, salinity, phosphorous, nitrates, silicates, etc.) taken at various depths and locations. Also to be considered are Longhurst biogeographical provinces and the Open Data Cube (ODC) initiative of the Committee on Earth Observation Satellites (CEOS). Would such a global grid system be appropriate? Many international organizations (e.g., One Shared Ocean) report by Large Marine Ecosystems (LMEs) plus separate statistics for open seas. Can these be applied to delineating spatial units for ocean accounts? Would ocean mapping benefit from standard approaches (i.e., such as National Spatial Data Infrastructure (NSDI))?
        b. South Africa (SANBI 2012) distinguishes 58 coastal and inshore, 62 offshore benthic and 16 offshore pelagic habitat types based on physical and biophysical

characteristics. Marine ecosystems common to several global ecosystem services assessments are: coastal areas (pelagic and benthic) and intertidal areas (lagoons, rocky shores, beaches, coral reefs, seagrass beds, estuaries and coastal dunes) (Bordt 2017b).

2. **Ecosystem services**

   1. Objective: Review ecosystem services classifications with respect to the ocean and recommend adaptations or expansions if required.
   2. Existing guidance: The SEEA-EEA bases its examples on the Common International Classification of Ecosystem Services (CICES). The European Environment Agency (March 2016) concluded that the CICES did not cover all ocean-related ecosystem services (e.g., tidal and wave power generation, receiving discharge, placement of infrastructure, medium for transport, medium for cultivation…). Biodiversity is generally treated as an ecosystem condition.
   3. Issue in more detail: The concept of "ecosystem services" is often portrayed as a "boundary object"—intentionally imprecise to foster communication between the multiple disciplines (Bordt 2018). However, statistical measurement requires precise definitions and classifications. Work is ongoing to develop an international statistical classification (UNCEEA 2017).
   4. Alternative approaches: The US has developed the Final Ecosystem Goods and Services – Classification System (FEGS-CS) (Landers & Nahlik 2013). FEGS-CS and CICES have different scopes and approaches (Bordt 2016). The CICES has since been updated based on, among other inputs, reviews of its applicability to ocean and marine ecosystem services. In the development of the SEEA-EEA, the importance of tracking ecosystem processes (e.g., primary production, nutrient cycling, decomposition) was recognized, but not incorporated. A review of ocean-related ecosystem services research would support the development of this international standard (Bordt 2017b; Mace et al. 2012).

3. **Climate change and disaster risk**

   1. Objective: To review existing frameworks of (a) disaster risk statistics and (b) climate change statistics. To suggest where linkages to the ocean exist and where such linkages need to be developed.
   2. Existing guidance:
      a. Disaster risk: The SEEA-EEA provides a spatial framework for delineating ecosystems (e.g., mangroves, coastal beaches) that mitigate or are affected by ocean-related disasters. The Sendai Framework provides several disaster-related definitions and indicators. The Disaster-Related Statistical Framework (DRSF) (ESCAP 2017) provides guidance on measuring disaster risk and impacts.
      b. Climate change: The SEEA Central Framework provides guidance on calculating GHG emissions. The SEEA-EEA includes guidance on tracking biocarbon (Carbon Account) as a component of ecosystem condition. The UN Economic Commission for Europe has developed a set of key climate-change related indicators, many of which can be derived from the SEEA.
   3. Issue in more detail:
      a. Case studies using the DRSF have been conducted and could be investigated for standard measures that could be used in an Ocean Account.
      b. COP23 recently recognized the important role of the ocean in mitigating climate change (Fiji Ocean Pathway). The appropriateness of the existing IPCC framework (IPCC 2006) to measuring ocean carbon and its sources should be investigated. It would an opportunity to review plans for the forthcoming (2019) IPCC "Special Report on the Ocean and Cryosphere in a Changing Climate" (IPCC 2017).

4. Alternative approaches: One area of investigation could be to determine a core set of statistics common to the three themes (ocean, climate change and disaster risk); for example, delineating costal communities, infrastructure and ecosystems, and measures of ocean conditions (e.g., temperature change, frequency of storms, currents, phytoplankton distributions).

4. Links to social concerns

1. Objective: To integrate social concerns into ocean accounts by distinguishing beneficiaries and populations at risk.
2. Existing guidance: This issue overlaps with **Issue 5: Links to economic concerns**, which considers benefits of oceans to people beyond economic ones. To reduce this overlap, it is suggested that this issue focus on approaches to distinguishing beneficiaries and populations at risk, rather than the benefits. Parallel to the SNA (UNSD 2008), the SEEA-CF and SEEA-EEA consider the supply, use (e.g., water, energy, materials, ecosystem services) and activities (expenditures) by economic units (businesses, governments and households). Businesses are generally disaggregated by significant industry sector (e.g., main suppliers and users of the natural input). However, there is no guidance on disaggregating households or individuals by target demographics (age, income, sex, urban/rural/coastal, disability status, indigenous status, industry of employment) required for many of the ocean-related SDG targets (**Annex 2**). The Social Accounting Matrix (SAM, also in UNSD 2008) is an approach for disaggregating economic activities (employment, payments) in the SNA by these target demographics (sex, income).
3. Issue in more detail: Many related statistics are collected using household and business surveys, but are not always linked to existing frameworks (SNA, SAM, SEEA). Development of ocean accounts could establish approaches for spatially linking disaggregated social data with location (upland/coastal), ecosystem condition (degraded/pristine) and sources of natural inputs (coastal/marine fisheries, aquaculture). The approach has been incorporated into the [Poverty Environment Accounting Framework](#). This issue links with "Climate change and disaster risk", since disaggregated demographic data is one of the common requirements.
4. Alternative approaches: Many countries have ongoing large-sample household surveys and Censuses that could be exploited. Ideally, respondents to these are georeferenced. Many case studies exist that link target populations with environmental conditions in specific locations, but few (if any) at the national level. These could be reviewed in terms of establishing good practices. Alternative data sources (spatial, crowdsourcing, big data, analytics) could be explored.

5. Links to economic concerns

1. Objective: To integrate economic concerns into ocean accounts by (a) ensuring that standard economic accounts (SNA-based) fully include the direct economic benefits of the ocean, and (b) augmenting standard economic accounts with approaches to valuation of additional (non-SNA) benefits of marine resources.
2. Existing guidance: The SNA (UNSD 2008) conceptually includes all marine and ocean-related economic production including subsistence, informal and illegal activities. The International Standard Industrial Classification of All Economic Activities ([ISIC Rev. 4](#)) includes categories for marine fishing (0311), marine aquaculture (0321), sea and coastal water transport (501), and other ocean-related industries. The SEEA-CF provides guidance on measuring the physical and monetary supply and use of water, energy and materials (conceptually including all natural inputs in including aquatic resources). SEEA-AFF provides additional examples of the supply and use of aquatic resources for food. Work is [ongoing](#) to expand the Tourism Satellite Accounting approach to include a broader view on the impacts, conditions

and beneficiaries of tourism activities. The SEEA-EEA provides guidance on valuing ecosystem services that is coherent with the SNA (see **Issue 2: Ecosystem services**).

3. Issue in more detail:
   a. Including direct benefits in standard economic accounts: The SEEA approach to linking up measures of physical natural stocks (e.g., timber stocks), their supply to the economy, and their use within the economy has been used to correct for undercounting in the SNA. This is done by (i) expanding the scope of measurement beyond the main industry and (ii) by comparing these changes in stocks with the supply implied in the SNA. An example of (i) is that the logging industry does not account for non-timber forest products (NTFP) such as fuelwood, bark and sap. Quantities of values of NTFPs may be derived from sources other than industry surveys (e.g., household surveys, case studies) and used to correct for undercounting in the SNA. An example of (ii) is that a physical assessment of timber stocks may imply a certain reduction due to logging. The SNA, based on industry surveys, would not capture all that reduction. The difference could be illegal or unreported logging. This approach could be applied to fish stocks as well, but would require an understanding of the spatial and population dynamics of fish stocks.
   b. Accounting for non-SNA benefits: The SEEA-EEA discourages monetization of non-SNA ecosystem services such as most regulating and maintenance services, and some cultural services. Monetization of non-SNA services is often done in ecological economics using approaches such as contingent valuation. The rationale for not monetizing regulating and maintenance services (such as water purification and coastal protection) is that they are not traded on the market but are essential to long-term ecosystem integrity. Many cultural services, as well, are not traded on the market (e.g., spiritual significance of an area). Approaches that could be explored include the development of non-monetary aggregates of non-SNA benefits (e.g., contribution to ecosystem integrity, social preferences) and the designation of Critical Natural Capital.

4. Alternative approaches:
   a. Comprehensive Wealth Accounting can take a longer-term perspective on maintaining natural resource stocks. It can do so by comparing future returns on investment on the exploitation of natural resources. For example, countries may be investing in the fishing industry while at the same time polluting the waters. Comprehensive Wealth Accounting would calculate whether the net "rent" or return on investment is positive or negative. Several approaches (OECD, Wang 2016) have been developed or are being developed to better measure the ocean economy.
   b. TEEB (The Economics of Ecosystems and Biodiversity) has a plan for TEEB-Oceans. The Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) has also considered assessing the ocean. The Natural Capital Coalition is developing an Ocean Supplement.

6. Global data availability

1. Objective: To review sources of global data that could be applied to national, regional or global ocean accounts.
2. Existing guidance: UN Oceans has produced an inventory of the mandates of its members. These members and other communities have also produced ocean data portals and conducted global assessments of specific topics. The First Global Integrated Marine Assessment provides a wealth of knowledge on many of the issues discussed here and suggests further work on integrating existing data and filling gaps for the next UN World Ocean Assessment.

3. Issue in more detail: ESCAP is compiling an inventory of spatially-detailed global data with the intent of identifying ongoing global ocean measurement activities compatible with the ocean accounts. This will identify and assess global data on spatial units, ecosystem types, ecosystem conditions and services. Such data could be integrated into a pilot global ocean account. Global data may not be sufficiently detailed (spatially or temporally) or comprehensive for national analysis. However, it could provide a starting point for countries with incomplete national data.

4. Alternative approaches: A global database could also be compiled from country-level or regional data. This is already being done for some global datasets (e.g., fish catch) and other topics (e.g., FAO Soil and Land Cover). The Ocean Health Index uses country-level and open seas data to assess national performance. NOAA's World Ocean Atlas provides *in situ* temperature, salinity, dissolved oxygen, Apparent Oxygen Utilization (AOU), percent oxygen saturation, phosphate, silicate, and nitrate at standard depth levels.

7. Progress on measuring SDG14

1. Objective: Review efforts to develop metadata (measurement standards) for SDG14-related indicators. Can these be linked to specific components of the ocean accounts?

2. Existing Guidance: Metadata for most SDG14 indicators are still under development.

3. Issue in more detail: Metadata for 14.4.1 (proportion of fish stocks within biologically sustainable levels; custodian FAO) and 14.5.1 (protected areas, custodians UNEP-WCMC, Bird Life International and IUCN) is reasonably mature, well applied and data exist for many countries. UN Environment has been developing metadata for 14.1.1 (coastal eutrophication and floating plastic debris), 14.2.1 (proportion managed using ecosystem-based approaches) and 14.5.1 (protected areas). The UN Environment Regional Seas Working group has also suggested a complementary indicator set (**Annex 3**).

4. Alternative approaches: Many other indicators on ocean state, ecosystems, their services and governance are collected across many international, regional and national stakeholders (See **Issue 6: Global data availability**). One objective of the ocean accounts is to provide a coherent measurement framework to support the production of SDG14 indicators. However, other indicators may be of national relevance and provide a broader picture of the dynamics, tipping points, and services. One outcome of the workshop could be to agree on a "dashboard" (e.g., 30 indicators) of existing indicators as "core ocean indicators" that would include social, environmental and economic measures based on the ocean accounts. Alternative data sources, such as crowdsourcing, "big data" and earth observation (see EO4SDG) will also be explored.

8. Ocean governance (international, regional and national)

1. Objective: To review international, and selected regional and national governance mechanisms (policy and regulatory frameworks) for the sustainable management of the ocean. This issue could also include reviews of new technologies and sustainable management approaches.

2. Existing guidance: SDG 14 implies a set of sustainable practices [14.2, 14.4, 14.7], policy directions [14.6, 14.b, 14.c], and technologies [14.a].

3. Issue in more detail: This session is an opportunity to review these governance mechanisms in terms of approaches, gaps, information requirements, enforcement challenges and good practices. It will also review new technologies that will have implications for measurement. For example, if community-based quotas are in place, how could they be measured and enforced? This would also be an opportunity to discuss the data/policy linkage: applications of integrated statistics in policy. It would also be an opportunity to review how stakeholders (government, business, civil society) can deliberate on producing and interpreting data and supporting common policy initiatives.

4. Alternative approaches: This presentation will likely follow a keynote lecture on ocean governance and at least two national case studies. It is an opportunity to review methodologies to prioritize needs for strengthened governance and information, and to better understand the links between data and policy. For example, assessing data requirements implied in the policy. ESCAP is developing [approaches](#) to assess the requirements of a policy for disaggregated social, economic and environmental data.

9. Modelling the ocean

1. Objective: To review existing modelling approaches to the ocean and recommend areas for testing.
2. Existing guidance: The SEEA-EEA Expert Forum (UNSD 2015) suggested a review of ecosystem services models with the intent of better understanding opportunities for applying them for official statistics. A review was initiated, but not completed (Bordt, Jackson and Ivanov 2015). The SEEA-EEA Technical Recommendations (United Nations, 2017) include a brief review of some ecosystem services-related biophysical models.
3. Issue in more detail:
   a. The term "modelling" for the purposes of this paper is intended to include any quantitative or qualitative approach used in the absence of measured data. This would include estimation, interpolation, projection and scenario approaches.
   b. Other than estimating or projecting the provision of ecosystem services, models have also been developed to estimate fish stock dynamics, economic production/consumption, ocean and climate dynamics and potential impacts from natural disasters.
   c. As with the ecosystem services-related models reviewed, it is expected that other models and the accounting approach could be mutually reinforcing: (a) estimating accounts data where data are unavailable and (b) using accounts data and classifications in models. Projecting future conditions are generally out of the scope of the SEEA itself, but the calculation of asset values depends on assumptions about the future stream of services. It has been suggested that to accomplish this, a baseline future scenario would be required. For example, estimating a future stream of services based on expected changes in the extent and condition of the stock.
   d. Better linking accounts with models is one approach to linking individual models together. For example, models focussing on stocks could be linked to models on production and consumption if concepts and classifications were aligned.
4. Alternative approaches: Options to be explored include (a) using modelling approaches to estimate missing data in accounts, (b) using accounts to provide data to models, (c) using scenario approaches to estimate future conditions, and (d) other projection approaches.

10. Outstanding issues and the way forward

1. Objective: To summarize the outcomes of the workshop in terms of main recommendations, key data gaps, issues for testing and requirements for further research.
2. Existing guidance: The preceding nine issue discussions will have identified main recommendations and data gaps.
3. Issue in more detail: This will be an opportunity for participants to engage in (a) further testing by participating in pilot studies and (b) discuss how they may collaborate in apply the recommendations in their future research to fill data and knowledge gaps.