General Introduction to Ocean Accounts

1. Outcome

This Circular provides a foundational understanding of Ocean Accounts as a structured and standardised approach to measuring and managing progress toward sustainable ocean development. Readers will gain clarity on the key characteristics, components, and applications of Ocean Accounts, understand how they integrate environmental, economic, and social information, and learn how Ocean Accounts support evidence-based decision-making for sustainable ocean management. The Circular serves as an entry point to the broader Technical Guidance on Ocean Accounting, which provides detailed methodologies and instructions for account compilers, data providers, and end-users.

2. Requirements to achieve outcome

None—this Circular introduces the Technical Guidance on Ocean Accounts for Sustainable Ocean Development as a whole. Other Circulars elaborate on the general overview provided in this Circular.

3. Guidance material

3.1 Sustainable development of the ocean

Sustainable development is fundamentally about "meeting the needs of the present without compromising the ability of future generations to meet their own needs" [1]. This core principle has evolved through a long series of international frameworks including Agenda 21, the Millennium Development Goals, and most recently the 2030 Agenda for Sustainable Development with its 17 Goals (SDGs) and 169 associated Targets.

Sustainable *ocean* development specifically applies these principles, goals and targets to marine and coastal environments, which cover 71% of Earth's surface, hold 97% of its water, and support 80% of its life forms [2]. SDG 14 "Life Below Water" directly addresses ocean sustainability, though the ocean contributes to numerous other SDGs related to poverty alleviation, food security, climate action, and economic growth [3].

From an operational perspective, sustainable development requires maintaining or enhancing the assets (capital) that are necessary for long-term development. These include not only produced and financial capital but critically, natural capital—the stocks of natural assets that yield flows of abiotic and ecosystem services essential for human wellbeing and economic prosperity [4]. The ocean represents a natural capital asset providing services from fisheries production and coastal protection to carbon sequestration and cultural benefits.

Sustainable ocean development entails three interconnected objectives: (1) advancing ocean-based economic activities that provide sustainable livelihoods, (2) ensuring equitable distribution of benefits across society, and (3) conserving and enhancing marine ecosystems and their ecological processes [5]. This balanced approach recognizes the ocean as a complex socio-ecological system where environmental health underpins both economic productivity and social wellbeing.

3.2 Information requirements for sustainable development decision-making

Effective decision-making for sustainable ocean development requires comprehensive information systems that integrate environmental, economic, and social domains. Traditional economic indicators like Gross Domestic Product (GDP), while valuable for measuring economic activity, fail to capture environmental depletion, equity considerations, or important values that are not traded in markets [6]. The limitations of GDP as a measure of societal wellbeing and sustainable development have led to numerous initiatives focused on developing metrics "Beyond GDP" [7].

Efforts to measure progress Beyond GDP are also now recognized in a range of decisions of international organisations, and intergovernmental commitments. For example SDG 15.9 and the Montreal-Kunming Global Biodiversity Framework both call for the integration of ecosystem and biodiversity values into national and local planning processes, poverty alleviation strategies and accounts. SDG 17.19 calls for the development of measures of progress to complement GDP, and statistical capacity building to that end. Concerning ocean accounts specifically, Decisions 15/24 (2022) and 16/1 (2024 of the Convention on Biological Diversity States Parties calls on countries to implement ocean accounts as a basis for conservation and sustainable management of marine resources and islands.

The information needed for sustainable ocean development decisions must address three critical questions [8]:

1. What is the current economic output or production from ocean-related activities?
2. What benefits (and disbenefits) do people and communities derive from the ocean and how are these distributed?
3. Is ocean development sustainable over time?

Answering these questions requires multiple indicators and knowledge spanning different domains. For example: ocean production indicators measure economic output from ocean activities. Ocean income indicators assess the benefits people receive from the ocean, including physical measures of ecosystem services and monetary measures that can be disaggregated across population segments. Changes in ocean balance sheets provide sustainability indicators by tracking changes in natural capital assets over time.

Beyond these headline indicators, decision-makers need information on specific relationships between human activities and the marine environment, including:

- Dependencies of economic sectors on marine ecosystem services
- Impacts of economic activities on marine ecosystem assets
- Distribution of benefits across different social groups
- Effectiveness of governance arrangements in managing human-ocean interactions
- Resilience of marine systems to natural and anthropogenic pressures

These information requirements demand structured approaches to data integration, processing, and presentation that can handle complex, multi-dimensional relationships while providing clear signals to guide policy choices [10].

3.3 Definition and scope of Ocean Accounts

Ocean Accounts constitute a structured framework for compiling and integrating data about marine and coastal environments and their relationship with human societies and economies. They represent a statistical framework for measuring the ocean, its importance to people, and what people are doing to change it. Ocean Accounts are distinguished from other ocean-related information compilations by three key characteristics:

1. Organization according to the Ocean Accounts Framework presented in this Technical Guidance, which enhances consistency, comparability, and coherence across social, environmental, and economic domains

2. Compatibility with international statistical standards, in particular the System of National Accounts (SNA) and System of Environmental-Economic Accounting (SEEA)

3. Adherence to principles of official statistics, ensuring information is fit-for-purpose for policy decision-making [12]

The framework covers marine and coastal areas within national jurisdictions (territorial waters, exclusive economic zones, continental shelves) and can be applied to particular areas within these zones (e.g., bays, protected areas). It is also applicable to activities functionally connected with but spatially separate from the ocean (e.g. nutrient pollution), and to areas beyond national jurisdiction though with added conceptual challenges.

Ocean Accounts are not merely collections of ocean-related statistics. Rather, they provide a coherent structure that:

- Applies accounting principles to ensure completeness and internal consistency
- Uses standardized classifications, definitions, and measurement approaches
- Enables spatial and temporal comparisons
- Facilitates the production of indicators that track progress toward policy objectives
- Supports integrated analysis of tradeoffs and synergies across different goals

While Ocean Accounts can include economic valuation of some ocean assets and services, they do not aim to determine a single "total value" of the ocean, which would be both conceptually problematic and practically impossible [14]. Instead, they provide a framework for understanding the many ways oceans contribute to human wellbeing and for tracking changes in these contributions over time.

3.4 Functional components of Ocean Accounts

Ocean Accounts function as an information system that transforms diverse data inputs into standardized, decision-relevant outputs through several interconnected processes, which are illustrated summarily in Figure 1 below:

Figure 1: Summary functional structure of Ocean Accounts

The construction of Ocean Accounts begins with data collection and compilation from numerous sources: government agencies, research institutions, industry bodies, citizen science programs, and indigenous knowledge systems. These data span environmental monitoring, economic statistics, social surveys, governance information, geospatial observations, customary knowledge, and many

others [15]. A critical step is aligning these heterogeneous datasets to common spatial boundaries, classifications, and accounting periods, through data sharing and validation processes that apply the relevant international statistical principles and standards (in particular the SNA and SEEA).

Raw data are then organized into standardized accounting tables or other data structures (e.g. non-relational JSON objects) in accordance with the Ocean Accounts Framework. These structures make several conceptual distinctions, in particular between:

- Stocks of assets: with levels measured or valued at a point in time (for example fish biomass, coral reefs, or coastal infrastructure).

- Flows of goods, (dis)services or activities: physical or monetary transfers, measured or valued at a point in time, between assets and/or social or economic sectors (for example fish harvest, coastal protection from mangrove forests, pollution of the environment by economic activity).

From these tables, analysts or automated systems derive indicators and visualizations that condense complex information into decision-relevant metrics. Modern technology enables the creation of interactive dashboards that allow users to explore relationships between variables, compare scenarios, and monitor trends over time [17]. These outputs support a wide range of decision contexts including planning, investment, regulation, monitoring and evaluation, and reporting.

3.5 Conceptual components of the Ocean Accounts Framework

The Ocean Accounts Framework comprises several sub-component accounts that are together designed to provide a coherent and comprehensive view of ocean-society-economy interactions, as illustrated in Figure 2 below. The Framework distinguishes between stocks (measured in terms of their status, extent and/or condition) and flows (measurements of supply, use or activity) concerning the economy, society beyond the scope of the economy (defined by the SNA 2025 production boundary) and the environment beyond the scope of society. Recognising that in many countries, traditional knowledge systems do not make clear distinctions between people and nature, the Framework also supports integrated accounting for qualitative and quantitative data drawn from multiple knowledge systems.[18]

Figure 2: Key conceptual components of the Ocean Accounts Framework

The sub-component accounts illustrated in Figure 2 are described in detail in other Technical Guidance Circulars, and can be summarised for the present purposes as follows:

- **Spatial data framework:** The Framework employs a spatially explicit approach with Basic Spatial Units (BSUs) as the foundation. These units may be differentiated into terrestrial, coastal, and marine BSUs, establishing connections between terrestrial activities that impact the ocean, coastal transition zones, and marine environments. Depth layers within BSUs enable a three-dimensional perspective that accommodates the complex spatial nature of ocean systems.

- **Environmental assets:** The Framework accommodates both discrete environmental assets (as defined in the SEEA Central Framework) and ecosystem assets (as defined in SEEA Ecosystem Accounting). Discrete assets can include minerals, energy resources, land, soil, and aquatic resources that provide inputs to economic activities. Ecosystem assets are conceptualized as spatially-defined areas containing combinations of biotic and abiotic components that function together as a unit, potentially supplying a range of ecosystem services. For the ocean domain, these may include coral reefs, seagrass meadows, mangroves, coastal wetlands, pelagic and benthic marine ecosystems, and other

categories recognised in the Global Ecosystem Typology [40]. The Framework enables tracking of both the extent and condition of these assets, with their condition potentially measured through variables like biodiversity indices, water quality parameters, and other indicators relevant to ecological functioning and supply of services.

- **Social assets and conditions:** The Framework provides structures to incorporate social dimensions affecting and affected by ocean environments and economies. This can include measures of wellbeing, vulnerability, and resilience in coastal communities—such as poverty rates, food security, and disaster risk exposure. Social indicators may be disaggregated by demographic factors to facilitate equity analyses. Governance accounts can complement these metrics by documenting institutional arrangements, legal frameworks, customary practices, and policy instruments that shape human-ocean interactions. These qualitative descriptors can provide context for understanding how governance mechanisms mediate relationships between communities, economies, and marine environments across scales—from local management systems to international ocean resource conventions.

- **Produced and financial assets:** The Framework enables the inclusion of stocks of built capital (infrastructure, vessels, equipment) and financial capital (investments, funds, securities) relevant to ocean activities. These assets, traditionally captured in the SNA's balance sheets, can be adapted to highlight their ocean-specific dimensions and spatial distribution. Coastal infrastructure such as ports, coastal defenses, and tourism facilities may be documented alongside offshore installations for energy, aquaculture, and other maritime industries. Ocean-related financial assets could include fishing quotas, resource extraction rights, conservation financing mechanisms, and investments in blue economy sectors. The Framework allows for representing the maintenance state and depreciation of these assets, facilitating assessment of their sustainable management over time. Physical inventories of vessels, platforms, and other mobile assets can supplement monetary valuations, providing a more comprehensive picture of the human-built capital supporting ocean economies.

- **Flows within the economy:** The Framework enables the representation of economic transactions related to ocean activities as defined in the SNA, including production, consumption, income, and capital flows. These accounts can track the supply and use of ocean-derived products through value chains, from extraction or harvesting through processing, distribution, and final consumption. They can document the contribution of ocean sectors to gross value added, employment, wages, taxes, and international trade through exports and imports. The Framework facilitates disaggregation of conventional economic statistics to highlight ocean-specific activities that are often embedded within broader sectoral classifications. This includes identifying ocean components within complex sectors like tourism, transportation, and manufacturing. Intermediate consumption relationships between ocean sectors are particularly important, potentially revealing functional dependencies such as fisheries' reliance on boat building and maintenance services, or tourism's connection to seafood production chains. Taking advantage of the 2025 revisions to the SNA, the Framework also accommodates non-traditional economic arrangements such as community-based enterprises, cooperatives, and subsistence activities that may be significant in coastal economies to the extent they fall within the SNA production boundary.

- **Flows and activities within society beyond the SNA:** The Framework allows for the inclusion of important social activities that fall outside the SNA production boundary but significantly impact ocean sustainability. These may include unpaid household labor such as subsistence fishing, food preparation from ocean resources, and customary marine stewardship activities. Also potentially included are community volunteer efforts like beach cleanups, citizen science monitoring, and collective resource management. The Framework provides structures to document governance activities spanning policy development,

enforcement, monitoring, and scientific research that shape ocean resources yet often lack market valuation. By enabling the incorporation of these non-market activities, the Framework offers a more complete understanding of human-ocean interactions beyond conventional economic measurements.

- **Flows and interactions within the environment:** The Framework provides structures to represent ecological processes and interactions occurring within marine environments that maintain ecosystem functioning. These can include biogeochemical cycles (carbon, nitrogen, phosphorus), energy flows through food webs, species migrations, larval dispersal, and other dynamic processes that connect different ecosystems. Natural disturbance regimes like storms and seasonal upwelling patterns could be documented alongside long-term oceanographic processes and climate regulation functions. The Framework allows for distinction between final ecosystem services delivered to humans and intermediate ecosystem services that support other ecosystems—such as nursery habitats providing recruitment to adult fish populations elsewhere. By facilitating the accounting for these environmental flows, the Framework helps identify critical ecological connections that can underpin ecosystem resilience and the sustained provision of benefits to society.

- **Flows of pollution, waste and other residuals from economy and society to the environment:** The Framework systematically enables recording of human-generated outputs that affect marine environments, including point-source pollutants (industrial effluents, sewage discharge), diffuse pollutants (agricultural runoff, urban stormwater), solid waste (plastics, debris), noise, heat, and other emissions. These accounts can document both the origin of residuals—potentially tracked by economic sector, geographic source, and pathway—and their destination within marine environments. The Framework allows for quantification of both stocks (accumulated pollutants) and flows (annual discharge rates), potentially connecting them to economic production and consumption activities. This linkage may enable attribution of environmental pressures to specific economic sectors or consumption patterns, supporting targeted policy interventions. By facilitating measurement of these negative externalities alongside economic benefits, the Framework can enhance comprehensive assessment of trade-offs in ocean resource use and management strategies.

- **Monetary flows between assets and economic sectors within scope of SNA:** The Framework allows for tracking monetary transactions associated with produced and financial ocean-related assets within the SNA production boundary. These may include capital investments in maritime infrastructure (ports, vessels, offshore platforms), financial exchanges through leasing or purchasing of ocean-related equipment, and depreciation of fixed capital in ocean industries. The accounts could document financing flows for blue economy development, including loans, bonds, and equity investments in ocean sectors. Insurance transactions protecting against maritime risks, financial services supporting ocean commerce, and market transactions of ocean-related property rights (like vessel licenses and quotas) may be incorporated. The Framework can facilitate recording of public expenditures on ocean infrastructure maintenance and development alongside private capital formation in maritime sectors. By enabling monitoring of these monetary flows, the Framework provides opportunities for insights into investment patterns, capital accumulation, and financial sustainability of ocean economic activities, complementing the separate accounting of environmental asset values and ecosystem service flows covered elsewhere in the Framework.

- **Contributions of social conditions (stocks) to social activities and economic activities, and vice versa:** The Framework facilitates capturing the bidirectional relationship between social conditions and various activities in both social and economic domains. Social capital —including community networks, cultural institutions, educational levels, and traditional

knowledge—can enable and shape ocean-related activities from community-based conservation to commercial fisheries. For example, indigenous knowledge systems may inform sustainable harvesting practices, while educational attainment may influence participation in maritime industries. Conversely, social and economic activities can transform social conditions over time. Ocean-based employment opportunities might affect demographic patterns in coastal communities, while marine resource access regimes could influence social equity and cohesion. The Framework enables documentation of these complex feedbacks, acknowledging how social structures both enable economic production and are themselves produced through human activities. By allowing for tracking of these relationships, the Framework can help identify leverage points for enhancing social resilience and equitable development in ocean-dependent communities.

- **Supply and use of final ecosystem services from environmental assets to economy and society:** The Framework enables capturing the flow of services from marine and coastal ecosystems directly benefiting human wellbeing and economic activity. These may include provisioning services (fisheries production, genetic resources, medicinal compounds), regulating services (coastal protection, carbon sequestration, water filtration), and cultural services (recreation, aesthetic enjoyment, spiritual significance). The accounts can quantify both the biophysical supply of these services from specific ecosystem types and their use by different economic sectors and social groups. Physical measures (tons of fish harvested, hectares of storm protection, recreational visitor-days) may be complemented by monetary valuation where appropriate. The Framework allows for disaggregation of service flows by ecosystem type, geographic location, and beneficiary group, potentially revealing patterns of access and dependence across populations. By enabling explicit connections between ecosystem assets and their service flows, the Framework helps identify critical natural capital that supports human wellbeing and economic activity, informing sustainable development decisions that maintain these essential ecosystem functions.

- **Supply and use of intermediate ecosystem services between different environmental assets and the wider environment:** The Framework allows for accounting of ecological processes that support ecosystem functioning but do not directly benefit humans. These intermediate ecosystem services represent the flows between different environmental assets that maintain their condition and productivity. Examples include pollination of coastal vegetation, nutrient cycling between connected ecosystems, sediment transport that maintains coastal morphology, and larval dispersal that supports population connectivity. The Framework enables documentation of how specific ecosystem types contribute to the functioning of others—such as mangroves providing sediment stabilization that benefits adjacent seagrass beds, or offshore reefs reducing wave energy reaching coastal habitats. These interconnections often cross ecosystem boundaries and jurisdictional lines, creating complex dependencies that traditional environmental accounting may overlook. By providing structures to recognize these supporting services, the Framework can offer a more complete picture of ecosystem dynamics and help identify critical ecological processes that underpin the sustained provision of final ecosystem services to humans. This approach aligns with ecological understanding that ecosystem resilience depends on maintaining these foundational processes that often operate without direct human awareness or valuation.

3.6 Relationship to other standards and approaches

Ocean Accounts build upon and interact with several established international standards and emerging approaches:

- The **System of National Accounts (SNA)** [26] provides the foundational structure for measuring economic activity. Ocean Accounts extend this framework to better capture ocean-specific economic activities, while maintaining compatibility with macroeconomic statistics. The limitations of SNA in addressing environmental factors—including its treatment of natural resource depletion as income rather than capital consumption—motivate some extensions in Ocean Accounts [27].

- The **System of Environmental-Economic Accounting (SEEA)** includes two complementary standards: the SEEA Central Framework (SEEA-CF) [28] and SEEA Ecosystem Accounting (SEEA-EA) [29]. SEEA-CF provides methodology for measuring environmental assets (e.g., fish stocks, minerals) and their flows into the economy. SEEA-EA focuses on ecosystem accounting, including ecosystem extent, condition, and services. Ocean Accounts adapt these approaches specifically for the marine domain, addressing challenges such as three-dimensional ecosystem delineation and fluid boundaries [30].

- **Ocean Economy Satellite Accounts** are specialized economic accounts that disaggregate and measure ocean-related economic activities. These complement traditional national accounts by providing greater detail on maritime sectors that are often hidden within broader classifications [31]. Ocean Accounts provide guidance on developing these satellite accounts consistently with international standards.

- **Natural Capital Accounting (NCA)** broadly refers to approaches that measure natural assets and their contributions to the economy. Ocean Accounts represent a specific application of NCA principles to the marine domain, with particular attention to spatial detail and ocean-specific challenges [32].

- **Corporate disclosure frameworks** like the Task Force on Climate-related Financial Disclosures (TCFD) and emerging frameworks for nature-related financial disclosures focus on enterprise-level reporting. While Ocean Accounts primarily support public policy at national and subnational scales, the concepts and data can inform corporate reporting on ocean dependencies and impacts [33].

- **Marine Spatial Planning (MSP)** frameworks organize the spatial allocation of ocean activities. Ocean Accounts can provide standardized data inputs to MSP processes and help evaluate outcomes of spatial planning decisions over time [34].

This range of complementary frameworks continues to evolve, with Ocean Accounts serving as an integrating approach that adapts established standards to address the specific challenges of measuring and managing progress towards sustainable ocean development.

3.7 Implementation approaches and starting points

Ocean Accounts implementation can follow diverse pathways tailored to national contexts, policy priorities, and resource constraints. Countries typically adopt modular approaches, building accounts progressively rather than attempting comprehensive implementation from the outset. Common entry points for Ocean Accounts implementation include:

- **Thematic focus**: Countries often begin with accounts addressing specific policy priorities such as: Marine protected area management; Sustainable fisheries; Coastal tourism development; Marine pollution reduction; Climate change adaptation; Blue economy development strategies [35].

- **Geographic scope**: Implementation may initially target specific geographic areas: National level (whole exclusive economic zone); Subnational regions (provinces, states); Specific ecosystems (coral reefs, mangroves); Marine protected areas; Areas of high economic significance or environmental vulnerability.

- **Existing data availability**: Countries typically leverage existing information systems: National statistical compilations; Environmental monitoring programs; Economic surveys; Marine spatial data infrastructures; Research programs; Administrative datasets [37].

- **Institutional arrangements**: Implementation models vary based on governance structures: National statistics office-led, typically focusing on economic aspects; Environment agency-led, emphasizing ecological dimensions; Multi-agency collaborative efforts under high-level coordination; Research institution partnerships supporting government implementation.

The modular, adaptive nature of Ocean Accounts allows for a "learn-by-doing" approach. Initial pilot studies often focus on feasibility assessment and capability development before scaling to more comprehensive implementation. Countries with limited resources may begin with rapid assessments using global datasets before developing more detailed national accounts [39].

Implementation typically progresses through several phases: scoping and diagnostics, pilot studies in priority areas, methodological refinement, institutional coordination mechanisms, data improvement strategies, and gradual expansion of account coverage. Throughout this process, maintaining alignment with international standards while accommodating national circumstances remains a guiding principle.

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