

# Social and Livelihood Dependencies on Ocean Ecosystems

Provides guidance on compiling indicators of social and livelihood dependencies on ocean ecosystems, and on quantifying how populations rely on them.

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## OUTCOME

This Circular provides guidance on compiling indicators of social and livelihood dependencies on ocean ecosystems, enabling practitioners to quantify how populations, households, and communities rely on marine and coastal natural capital for economic sustenance, food security, cultural identity, and wellbeing. The indicators are framed in poverty-alleviation terms, following the integrated ocean-poverty account approach of Burnside (2026), and are designed to feed disaster risk reduction processes under the Sendai Framework for Disaster Risk Reduction 2015–2030, where evidence on ocean-dependent populations is required for resilience planning, loss-and-damage assessment, and recovery prioritisation.

The indicators cover four dimensions: employment dependency, nutritional dependency, cultural dependency, and vulnerability (exposure, sensitivity and adaptive capacity of ocean-dependent populations). The guidance supports compilation of indicators aligned with SDG 1 (No Poverty), SDG 2 (Zero Hunger) – particularly Target 2.3, which explicitly references fishers among the small-scale food producers whose productivity and incomes should be doubled – SDG 5 (Gender Equality) through its treatment of women’s roles in fisheries value chains, SDG 8 (Decent Work and Economic Growth), SDG 10 (Reduced Inequalities) through its attention to equity dimensions of ocean access, and SDG 14 (Life Below Water) – particularly Target 14.7 on increasing “the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources”.

This Circular provides decision-relevant indicators for coastal poverty assessment, just transition planning, food security monitoring in fish-dependent populations, and the design of small-scale fisheries co-management arrangements. It connects the ecosystem service flows documented in [TG-3.2 Flows from Environment to Economy](#) to the social accounting approaches described in [TG-3.5 Social Accounts](#), and so supplies the methodological bridge between biophysical ecosystem contributions and human wellbeing outcomes. It draws on the economic activity classifications established in [TG-3.3 Economic Activity](#) and complements [TG-1.5 Fisheries Management](#) by extending the analysis from resource extraction to the full social system of dependencies. For the foundational framework and standards overview, see [TG-0.1 General Introduction](#) and [TG-0.2 Standards Overview](#).

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# 1. Outcome

¶1 This Circular provides guidance on compiling indicators of social and livelihood dependencies on ocean ecosystems, enabling practitioners to quantify how populations, households, and communities rely on marine and coastal natural capital for economic sustenance, food security, cultural identity, and wellbeing<sup>1</sup>. The indicators are framed in poverty-alleviation terms, following the integrated ocean-poverty account approach of Burnside (2026)<sup>2</sup>, and are designed to feed disaster risk reduction processes under the Sendai Framework for Disaster Risk Reduction 2015-2030<sup>3</sup>, where evidence on ocean-dependent populations is required for resilience planning, loss-and-damage assessment, and recovery prioritisation.

¶2 The indicators cover four dimensions: employment dependency, nutritional dependency, cultural dependency, and vulnerability (exposure, sensitivity and adaptive capacity of ocean-dependent populations). The guidance supports compilation of indicators aligned with SDG 1 (No Poverty), SDG 2 (Zero Hunger) – particularly Target 2.3, which explicitly references fishers among the small-scale food producers whose productivity and incomes should be doubled<sup>4</sup> – SDG 5 (Gender Equality) through its treatment of women’s roles in fisheries value chains, SDG 8 (Decent Work and Economic Growth), SDG 10 (Reduced Inequalities) through its attention to equity dimensions of ocean access, and SDG 14 (Life Below Water) – particularly Target 14.7 on increasing “the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources”<sup>5</sup>.

¶3 This Circular provides decision-relevant indicators for coastal poverty assessment, just transition planning, food security monitoring in fish-dependent populations, and the design of small-scale fisheries co-management arrangements. It connects the ecosystem service flows documented in **TG-3.2 Flows from Environment to Economy** to the social accounting approaches described in **TG-3.5 Social Accounts**, and so supplies the methodological bridge between biophysical ecosystem contributions and human wellbeing outcomes. It draws on the economic activity classifications established in **TG-3.3 Economic Activity** and complements **TG-1.5 Fisheries Management** by extending the analysis from resource extraction to the full social system of dependencies. For the foundational framework and standards overview, see **TG-0.1 General Introduction** and **TG-0.2 Standards Overview**.

# 2. Requirements

¶1 This Circular requires familiarity with:

- ¶2 **TG-0.1 General Introduction to Ocean Accounts** – for the conceptual framework connecting ecosystems to economic activity
- ¶3 **TG-0.2 Standards Overview** – for the international statistical standards underpinning ocean accounting, including SNA 2025, SEEA, and classification systems
- ¶4 **TG-3.3 Economic Activity Relevant to the Ocean** – for the ocean economy thematic and extended accounting framework, industry classifications (ISIC), and supply and use table methodology used to measure ocean economic activity
- ¶5 **TG-3.5 Social Accounts** – for the broader framework of social accounting including wellbeing, equity, and vulnerability dimensions

¶6 For guidance on measuring ecosystem service flows from ocean ecosystems to the economy, see **TG-3.2 Flows from Environment to Economy**. For documentation of traditional marine knowledge and customary practices, see **TG-3.6 Traditional Knowledge Accounts**. For detailed guidance on labour market measurement, including the concepts of compensation of employees and employment status, see the 2025 SNA Chapter 16 on Labour<sup>6</sup>.

### 3. Guidance Material

¶1 Ocean ecosystems contribute to human livelihoods through multiple pathways: (1) employment in ocean-based industries, (2) provisioning of food and other marine products, (3) cultural, spiritual, and recreational benefits, and (4) the regulating services that protect coastal communities from hazards<sup>7</sup>. The SEEA Ecosystem Accounting framework describes these contributions as ecosystem services: “the contributions of ecosystems to the benefits that are used in economic and other human activity”<sup>8</sup>. This Circular provides guidance on measuring the human dependencies on these services, focusing on the social and livelihood dimensions that extend beyond purely economic measures.

¶2 Whilst **TG-3.5 Social Accounts** establishes the general framework for social accounting in the ocean context, this Circular applies that framework specifically to the measurement of livelihood dependencies. The distinct contribution of TG-2.3 is its focus on the dependency relationship itself: how populations, sectors, and communities rely on ocean ecosystems, and how changes in ecosystem condition translate into livelihood impacts. Where TG-3.5 asks “what is the social state?”, this Circular asks “how dependent are communities on ocean ecosystems, and what happens if those ecosystems change?”

#### 3.1 Livelihood Dependency Framework

¶1 A livelihood dependency framework organises the multiple ways in which individuals, households, and communities rely on ocean ecosystems for their economic, nutritional, cultural, and social sustenance. The framework distinguishes between direct and indirect dependencies, and between material and non-material dimensions of dependency<sup>9</sup>. The regulating-services pathway shown in Figure 2.3.1 (ocean ecosystems -> regulating services -> coastal protection) is operationalised in Section 3.4 using the SEEA-EA storm-mitigation service flow, rather than as a freestanding dependency indicator.

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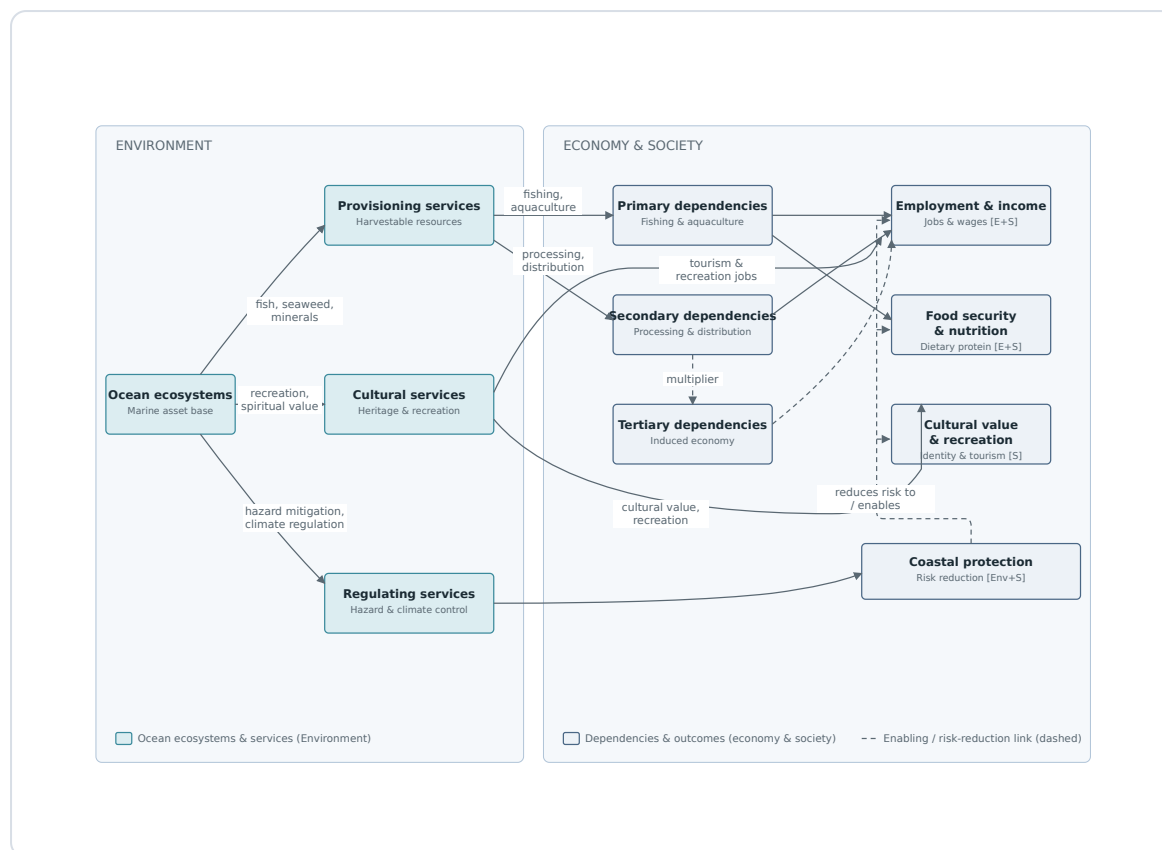


**Figure 2.3.1** Ocean ecosystem services cascade into livelihood dependency tiers, employment, and enabling coastal protection. Dashed edges mark induced multipliers and enabling or risk-reduction links.

**Source:** TG-2.3 (livelihood dependency framework), Section 3 (indicator design).

**Adapted from:** SEEA EA 2024 ecosystem-services cascade, restructured for ocean livelihood applications.

### 3.1.1 Defining ocean-dependent livelihoods

¶1 Ocean-dependent livelihoods encompass all forms of work and subsistence activities that rely substantially on marine and coastal ecosystems. The 2025 SNA recognises that measuring well-being and sustainability requires extending measurement “beyond income and consumption to include...human capital as a produced asset”<sup>10</sup>. That extension covers the skills, knowledge, and capabilities that enable people to derive livelihoods from ocean resources. Human capital in the context of ocean-dependent livelihoods extends beyond formal education to the traditional ecological knowledge, navigation skills, and resource management capabilities that coastal communities develop through sustained engagement with marine environments.

¶2 Ocean-dependent livelihoods can be classified into three tiers. This classification parallels but does not replicate the SF-MST distinction between “direct effects” and “indirect and induced effects”<sup>11</sup>: whilst the SF-MST categories apply to economic impact measurement, the dependency tiers below describe the directness of the livelihood relationship to ocean ecosystems. Compilers should document which classification they adopt and how it maps to SF-MST or other frameworks used in their context.

¶3 **Primary dependencies:** Livelihoods directly engaged in harvesting marine resources or providing services within marine ecosystems. These include:

- ¶4 Commercial fishing (industrial, semi-industrial, and artisanal)
- ¶5 Subsistence fishing and gleaning
- ¶6 Aquaculture and mariculture operations
- ¶7 Seaweed and shellfish harvesting
- ¶8 Marine tourism operations (diving, snorkelling, whale watching, sport fishing)

¶9 **Secondary dependencies:** Livelihoods in sectors that process, distribute, or add value to marine resources:

- ¶10 Seafood processing and packaging
- ¶11 Fish marketing and distribution
- ¶12 Boat building and repair
- ¶13 Fishing gear manufacture and supply
- ¶14 Tourism accommodation and services in coastal areas

¶15 **Tertiary dependencies:** Livelihoods supported by the multiplier effects of ocean-based economic activity:

- ¶16 Retail and hospitality in fishing communities
- ¶17 Transport services for coastal trade
- ¶18 Financial and professional services to ocean industries
- ¶19 Public administration related to marine management

¶20 These tiers correspond to the ocean economy industry classifications detailed in **TG-3.3 Economic Activity**, which provides the ISIC-based framework for identifying and measuring ocean-dependent, ocean-related, and partially ocean-related industries.

### 3.1.2 Dependency indicators

¶1 Dependency indicators quantify the extent to which populations, sectors, or regions rely on ocean ecosystems. Key indicator categories include:

¶2 **Employment dependency indicators:**

- ¶3 Share of employment in ocean-dependent sectors (percent of total employment)
- ¶4 Number of persons employed in fishing, aquaculture, and marine tourism
- ¶5 Share of household income derived from ocean-dependent activities
- ¶6 Employment concentration ratio (ocean employment in coastal areas relative to national average)

¶7 **Nutritional dependency indicators:**

- ¶8 Share of dietary protein from marine sources
- ¶9 Per capita fish consumption (kg per year)
- ¶10 Share of households relying on subsistence fishing for food security
- ¶11 Value of subsistence marine harvests relative to household consumption

¶12 **Economic dependency indicators:**

- ¶13 Ocean sector value added as share of GDP (see **TG-2.5 Ocean Economy Structure**)
- ¶14 Export earnings from marine products as share of total exports
- ¶15 Share of government revenue from marine resource access fees and licenses

¶16 **Cultural dependency indicators:**

- ¶17 Number of communities with traditional marine tenure systems
- ¶18 Participation rates in traditional fishing practices
- ¶19 Cultural sites of marine significance per coastal area
- ¶20 Intergenerational transmission of marine knowledge and skills

¶21 Recording the flows of ecosystem services to human users supports understanding of livelihood dependencies, and extends the logic of SEEA EA para. 2.31 on intermediate service flows<sup>12</sup>.

## 3.2 Employment Indicators

¶1 Whilst **TG-3.5 Social Accounts** covers general ocean sector employment measurement, this section focuses specifically on compiling employment as a dependency indicator. The measure of interest is how reliant communities and populations are on ocean-based employment, which a headcount of jobs alone does not capture<sup>13</sup>.

### 3.2.1 Direct employment

¶1 Direct employment encompasses all persons engaged in activities that harvest marine resources or operate within marine spaces. SDG indicator 14.7.1 measures “Sustainable fisheries as a proportion of GDP in small island developing States, least developed countries and all countries”<sup>14</sup>, whilst employment measures provide the complementary livelihood dimension.

¶2 Key direct employment categories for ocean accounting include:

#### ¶3 Fisheries employment:

- ¶4 Commercial fishing vessel crews (by vessel size category)
- ¶5 Artisanal and small-scale fishers
- ¶6 Subsistence fishers (including those not fully captured in formal employment statistics)
- ¶7 Aquaculture workers (marine and brackish water operations)

¶8 SDG Target 2.3 calls for doubling “the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers”<sup>15</sup>. Employment accounts should distinguish small-scale fisheries from industrial operations to support monitoring of this target.

¶9 The SEEA for Agriculture, Forestry and Fisheries (SEEA AFF) provides an integrated framework describing how “biophysical and management information relevant to agriculture, forestry and fisheries production can be integrated into the statistical framework”<sup>16</sup>. For guidance on integrating fisheries stock assessment data with employment accounts, see **TG-1.5 Fisheries Management**.

¶10 **Marine tourism employment:** SDG Target 8.9 calls for implementing “policies to promote sustainable tourism that creates jobs”<sup>17</sup>. Marine tourism employment includes:

- ¶11 Tour operators for marine activities (diving, snorkelling, boat tours)
- ¶12 Recreational fishing guides and charter operators
- ¶13 Beach and coastal recreation facility staff
- ¶14 Marine wildlife watching operators
- ¶15 Coastal accommodation workers directly serving marine tourists

¶16 Marine tourism employment is commonly seasonal and precarious, with a small core of permanent staff complemented by temporary and on-call workers<sup>18</sup>. This pattern affects vulnerability assessments.

#### ¶17 Other direct ocean employment:

- ¶18 Offshore energy sector employees
- ¶19 Port and harbour workers
- ¶20 Coastal construction and maintenance workers
- ¶21 Marine research and conservation workers

#### ¶22 Classification note – “ocean-operating” versus “ocean-dependent” employment:

Maritime transport workers (ISIC 50) use the ocean as their operating environment but do not depend on ocean ecosystem services in the same way as fishers or aquaculture workers. Accordingly, ISIC 50 is assigned to the secondary tier rather than direct employment. Within ISIC 50, compilers should distinguish two subcategories where 4-digit data are available: inter-island ferry and coastal passenger services (ISIC 50.10) are classified as “high ocean-operating intensity” within the secondary tier. Deep-sea cargo shipping (ISIC 50.20) is classified as “low ocean-ecosystem dependency” within the same tier. These subcategories should be reported separately in secondary em-

ployment tables to enable analysts to identify the sub-population with stronger livelihood dependency on ocean conditions. This classification follows the principle that tier assignment is determined by economic activity type and dependency on ocean ecosystem services, not physical proximity to the ocean. That principle preserves comparability with **TG-3.3 Economic Activity** classification.

### 3.2.2 Indirect employment

¶1 Indirect employment arises in sectors that supply goods and services to ocean-dependent industries. The SF-MST describes these as activities “in the supply chain of tourism characteristic products”<sup>19</sup>. For ocean accounting, the analogous concept encompasses supply chains for fishing, aquaculture, marine tourism, and other ocean sectors.

¶2 Measuring indirect employment requires either:

- ¶3 Input-output analysis to trace supply chain linkages
- ¶4 Establishment surveys that identify suppliers to ocean industries
- ¶5 Employment estimates based on intermediate consumption patterns

¶6 For practical compilation, countries may focus on the supply chain sectors with known connections to ocean industries<sup>20</sup>.

¶7 Key indirect employment categories include:

- ¶8 Maritime transport workers (ISIC 50; subcategory classification: Section 3.2.1)
- ¶9 Fishing equipment and gear manufacture
- ¶10 Boat building and repair services
- ¶11 Seafood processing and packaging
- ¶12 Cold chain and transport logistics
- ¶13 Marine fuel and supplies provision
- ¶14 Professional and financial services to ocean industries

### 3.2.3 Induced employment

¶1 Induced employment results from the spending of wages earned in ocean-dependent sectors. Induced effects are typically estimated using economic multipliers derived from input-output models<sup>21</sup>. For ocean dependency indicators, induced employment estimates can illustrate the broader economic significance of ocean-based livelihoods but should be presented separately from direct and indirect measures.

¶2 Table 1 summarises the data requirements and methodological approaches for compiling employment dependency indicators across the three tiers.

| Tier     | Scope                                                                                   | Primary Data Sources                                            | Estimation Method                                | Key Challenges                                         |
|----------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------|
| Direct   | Persons harvesting marine resources or operating in marine spaces                       | Labour force surveys, fisheries registries, vessel crew records | Direct count from administrative/survey data     | Informal employment, subsistence fishers underreported |
| Indirect | Supply chain employment serving ocean industries (including ISIC 50 maritime transport) | Establishment surveys, input-output tables                      | Supply chain tracing via I-O analysis or surveys | Boundary definition, partial attribution               |

| Tier    | Scope                                          | Primary Data Sources                           | Estimation Method                           | Key Challenges                               |
|---------|------------------------------------------------|------------------------------------------------|---------------------------------------------|----------------------------------------------|
| Induced | Employment from spending of ocean sector wages | Household expenditure surveys, I-O multipliers | Multiplier-based estimation from I-O models | Multiplier uncertainty, double-counting risk |

¶3 *Table 1: Employment dependency indicator data requirements by tier*

### 3.2.4 Employment characteristics

¶1 Beyond counting employment, ocean accounts should characterise employment quality using the decent work framework dimensions described in **TG-3.5 Social Accounts**. The 2025 SNA provides detailed guidance on labour market measurement, including employment status, compensation of employees, and the distinction between formal and informal employment<sup>22</sup>. Key characteristics include:

| Characteristic      | Relevance to Ocean Employment                                                           |
|---------------------|-----------------------------------------------------------------------------------------|
| Sex                 | Women play significant but often under-recognised roles in fish processing and gleaning |
| Age                 | Many fisheries face aging workforce issues; youth employment in marine tourism          |
| Employment status   | High rates of self-employment in small-scale fisheries                                  |
| Full-time/part-time | Seasonal variation particularly in tourism and some fisheries                           |
| Formal/informal     | High informality rates in small-scale fisheries and coastal tourism                     |
| Geographic location | Concentration in coastal communities affects spatial development patterns               |

¶2 *Table 2: Employment characteristics relevant to ocean dependency analysis*

¶3 Such disaggregation reveals patterns that aggregate counts obscure: the high proportion of informal employment in small-scale fisheries, or the seasonal concentration of marine tourism employment<sup>23</sup>.

## 3.3 Food Security and Nutrition

¶1 This section addresses the dependency dimension of marine food provisioning. For the ecosystem service flow perspective, see **TG-3.2 Flows from Environment to Economy**, Section 3.1 on provisioning services.

### 3.3.1 Protein dependency

¶1 Fish and other aquatic foods are a primary source of animal protein, with particularly high consumption in coastal regions, Small Island Developing States, and countries with extensive traditional fishing cultures<sup>24</sup>, <sup>25</sup>. SDG Target 2.1 calls for ending hunger and ensuring “access by all people...to safe, nutritious and sufficient food all year round”<sup>26</sup>.

¶2 Key protein dependency indicators include:

¶3 **Per capita consumption:**

- ¶4 Fish consumption in kilograms per person per year
- ¶5 Share of animal protein from aquatic sources
- ¶6 Trend in fish consumption over time

¶7 **Population-level dependencies:**

- ¶8 Number of persons deriving 20% or more of animal protein from fish
- ¶9 Number of persons in fish-dependent communities (where fish provides majority of animal protein)

- ¶10 Geographic distribution of protein dependency (coastal vs inland populations)

#### ¶11 **Nutritional quality:**

- ¶12 Contribution of fish to essential micronutrient intake (omega-3 fatty acids, vitamin D, iodine, zinc)
- ¶13 Role of small fish in addressing hidden hunger (micronutrient deficiencies)

¶14 Nutritional dependency indicators measure the human welfare dimension of the biomass provisioning services described in SEEA EA Table 6.3<sup>27</sup>.

### 3.3.2 Subsistence harvesting

¶1 Beyond commercial fisheries, subsistence harvesting provides essential food for coastal and island communities, often without being captured in formal economic statistics. Subsistence fishing includes:

- ¶2 Small-scale artisanal fishing for household consumption
- ¶3 Gleaning of shellfish, seaweed, and other intertidal resources
- ¶4 Reef fishing and spearfishing in traditional territories
- ¶5 Harvesting of sea cucumbers, sea urchins, and other marine invertebrates

¶6 For subsistence harvesting, the ecosystem service flows directly to households without entering market transactions<sup>28</sup>. This treatment is consistent with the ecosystem service flow accounting in **TG-3.2 Flows from Environment to Economy** and with the artisanal fisheries coverage in **TG-1.5 Fisheries Management**. SDG Target 14.b emphasises the importance of providing “access for small-scale artisanal fishers to marine resources and markets”<sup>29</sup>.

¶7 Measuring subsistence dependencies requires:

- ¶8 Household surveys capturing marine harvesting activities
- ¶9 Participatory assessments with coastal communities
- ¶10 Time-use surveys documenting harvesting activity
- ¶11 Estimation of physical quantities harvested for own consumption

¶12 The monetary value of subsistence harvests can be imputed using local market prices for equivalent products. The 2025 SNA provides guidance on valuing own-account production for inclusion in household income and consumption measures<sup>30</sup>.

### 3.3.3 Food security vulnerability

¶1 Food security encompasses four dimensions: availability, access, utilisation, and stability<sup>31</sup>.

Table 3.3.3 below summarises how ocean ecosystem dependencies affect each dimension.

| Dimension           | Description                                                                                                                                                                  |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Availability</b> | Marine ecosystems supply fish and other aquatic foods. Changes in ecosystem condition (overfishing, habitat loss, climate impacts) directly affect food availability.        |
| <b>Access</b>       | Poverty, market structure, and governance arrangements determine which populations can access marine foods. Equity in access is addressed in <b>TG-3.5 Social Accounts</b> . |
| <b>Utilisation</b>  | Safe food handling, nutritional knowledge, and cooking practices affect how marine foods contribute to nutrition.                                                            |
| <b>Stability</b>    | Seasonal variation in fish availability, stock fluctuations, and climate variability affect the reliability of marine food supplies.                                         |

¶2 Indicators of food security vulnerability related to ocean ecosystems include:

- ¶3 Share of households reporting inadequate fish availability
- ¶4 Price volatility of marine food products

- ¶5 Seasonal patterns in fish consumption
- ¶6 Alternative protein source availability for fish-dependent communities

### 3.4 Coastal Protection – Operationalising the SEEA-EA Coastal Protection Service

¶1 Coastal ecosystems (coral reefs, mangroves, saltmarshes, seagrass meadows, oyster reefs, and coastal dunes) attenuate waves, dissipate storm surge, and stabilise shorelines. Communities behind these features depend on the regulating services they supply for physical protection of dwellings, infrastructure, and lives. The “regulating services -> coastal protection” arm in Figure 2.3.1 is operationalised here.

¶2 The 2019 discussion paper on coastal protection dependency indicators (Crossman, Nedkov, Brander) has been superseded by the adopted SEEA Ecosystem Accounting standard (UN et al., 2021; current consolidated edition December 2024). The standard does not specify dependency indicators in the original proposed form and deliberately does not endorse specific datasets or platforms. SEEA-EA Table 6.3 splits the previously combined “water flow regulation for mitigating river and coastal flooding” service into three separate reference services: **Water flow regulation**, **Flood control**, and **Storm mitigation**<sup>32</sup>.

¶3 **Which of the three applies here.** Coastal protection is a sub-service of **Flood control services**, defined in Table 6.3 as “ecosystem contributions of linear elements in the seascape (e.g. coral reefs, sand banks, dunes or mangrove ecosystems along the shore) to protecting the shore and thus mitigating the impacts of tidal surges or storms on local communities”. **Storm mitigation services** are a different reference service, covering “the impacts of windstorms, sandstorms and other types of storms (*other than water-related events*)”. Wave attenuation and storm surge dissipation are water-related events, so this Circular’s subject is the coastal protection service under flood control. Compilers should record it there, not against storm mitigation, or national entries will not reconcile with Table 6.3 or with cross-country comparisons keyed to it. The two indicators originally considered for a dedicated coastal-protection dependency sub-section (population exposure in the absence of natural coastal protection, and the value of avoided damage) are absorbed into standard service-flow accounting rather than treated as freestanding dependency metrics:

- ¶4 **Population exposure in the absence of natural coastal protection** is the counterfactual baseline for the coastal protection service flow. It is captured in the **service benefiting area (SBA)** dimension of the Chapter 7 physical supply-and-use table, with the **service providing area (SPA)** being the ecosystem asset that supplies the protection (SEEA-EA §7.66).
- ¶5 **Value of avoided damage** is the monetary valuation method covered in SEEA-EA Chapter 9, in particular §9.3.6 (expected expenditure / avoided-damage methods) and §9.4 (service-specific valuation guidance)<sup>33</sup>.

¶6 Chapter 14 of the SEEA-EA (Tables 14.3–14.4) lists indicator categories but no named indicators of this kind. Reference-list and capacity concepts sit in Chapter 6 §6.5 and Appendix A6.1.

#### 3.4.1 Where the account entry is specified

¶1 The coastal protection service entry in the Chapter 7 physical supply and use table – the service providing area, the service benefiting area, and the physical and monetary service flows – is specified in **TG-3.2 Flows from Environment to Economy** Section 3.3, and the data sources and hydro-dynamic models that populate the counterfactual are in **TG-4.1 Remote Sensing and Geospatial Data** Section 3.2.6. Neither is restated here.

¶2 What this Circular adds is the dependency reading of those entries: how many people the service protects, how much of their exposure it removes, and what happens to that dependency when the SPA degrades. The indicators below take the compiled service flow as their input.

#### 3.4.3 Anchor worked examples

¶1 Three published national-scale applications are recommended as templates:

- ¶2 **World Bank WAVES (Beck & Lange 2016)** – “Managing Coasts with Natural Solutions: Guidelines for Measuring and Valuing the Coastal Protection Services of Mangroves and Coral Reefs.” Sets the methodological frame for SEEA-compatible coastal protection accounts.
- ¶3 **Menéndez et al. (2018)** – national-scale Philippines mangrove storm-protection account, demonstrating the SBA / avoided-damage approach at country scale.
- ¶4 **ABS National Ecosystem Accounts – coastal protection account** – the Australian Bureau of Statistics published a coastal protection account quantifying dwellings and residents protected by mangroves and saltmarsh, populating the SEEA-EA storm-mitigation cell in a national accounting context.

### 3.4.4 Illustrative composite where SBA data are unavailable

¶1 Where the SBA-based service-flow approach cannot yet be populated (typically because elevation, population, or hydrodynamic modelling capacity are unavailable), compilers may report an **illustrative composite dependency index** drawing on the Arkema et al. (2013) approach as an interim measure. The composite is calculated as:

$$\text{Coastal protection dependence} = m \times (n \times (1 - o \times p \times q)) / 2$$

¶2 where:

- ¶3 **m – Magnitude of benefit (dependence):** the proportion of the national population that benefits from coral reefs and mangroves in reducing exposure to storms and sea-level rise (Arkema et al., 2013).
- ¶4 **n – Exposure (LECZ population):** the proportion of the population in the Low Elevation Coastal Zone, i.e. those exposed to storms and sea-level rise (McGranahan et al., 2007).
- ¶5 **o, p, q – Substitutability:** GDP per capita (o), governance quality (p), and density of impervious surfaces (q), capturing the population’s ability to substitute natural protection with built defences, institutional capacity, and infrastructure (Adger et al., 2005; Brooks et al., 2005; Tol et al., 2004).

¶6 The  $(1 - o \times p \times q)$  term lowers the composite where substitutes are strong. o, p and q are proxies for the population’s capacity to replace lost protection or adapt to its loss. That is adaptive capacity, a component of vulnerability (see the livelihood vulnerability index, Section 4.2, Step 3), not of dependence: the service-flow approach in §3.4.1 records the protection a population receives whether or not it could replace it. The composite therefore mixes dependence (m) with exposure (n) and adaptive capacity (o, p, q). Compilers using it should report m, n and the substitutability term  $(o \times p \times q)$  alongside the composite, and should not combine the composite with the livelihood vulnerability index, which would count exposure and adaptive capacity twice. **The illustrative composite is not a substitute for the SPA/SBA service-flow approach in §3.4.1.** Compilers using it should clearly flag the indicator as a transitional measure and document a plan to migrate to SEEA-EA service-flow accounting as elevation, population, and hydrodynamic inputs become available.

## 3.5 Cultural and Recreational Dependencies

¶1 Ocean ecosystems support non-material dimensions of human wellbeing through cultural connections, recreational opportunities, and spiritual significance. The SEEA EA describes cultural services as “experiential and intangible services related to the perceived or actual qualities of ecosystems whose existence and functioning contribute to a range of cultural benefits”<sup>34</sup>. Whilst **TG-3.2 Flows from Environment to Economy** documents the ecosystem service flows themselves

(Section 3.1.3 on cultural services), this section addresses the human dependency dimension – how communities and populations rely on these cultural services for their wellbeing and identity.

### 3.5.1 Cultural ecosystem services

¶1 Marine cultural services encompass:

¶2 **Recreation-related services:** The ecosystem contributions to recreational activities including swimming, diving, snorkelling, surfing, recreational fishing, and wildlife watching<sup>35</sup>. These are considered final ecosystem services since they are directly enjoyed by people<sup>36</sup>.

¶3 Indicators of recreational dependency include:

- ¶4 Visitor days to marine recreation areas
- ¶5 Participation rates in marine recreational activities
- ¶6 Economic expenditure on marine recreation
- ¶7 Accessibility of marine recreation opportunities across population groups

¶8 **Visual amenity services:** The contribution of marine seascapes to aesthetic enjoyment and property values<sup>37</sup>.

¶9 **Education and research services:** The contribution of marine ecosystems to scientific research, environmental education, and the generation of knowledge<sup>38</sup>.

¶10 **Spiritual, artistic, and symbolic services:** The contributions to cultural identity, spiritual practices, and artistic inspiration<sup>39</sup>. For many coastal and island cultures, the ocean holds profound spiritual significance that cannot be adequately captured through quantitative indicators.

### 3.5.2 Cultural identity and traditional practices

¶1 For Indigenous Peoples and traditional coastal communities, cultural dependencies on ocean ecosystems may be the deepest dimension of human-ocean relationships. The TNFD notes that “Indigenous Peoples and Local Communities manage or have tenure over” significant proportions of remaining intact natural areas<sup>40</sup>, with analogous relationships existing for traditional marine territories.

¶2 Cultural identity dependencies include:

- ¶3 Traditional fishing practices and their role in cultural transmission
- ¶4 Ceremonial and ritual uses of marine resources
- ¶5 Oral traditions and stories related to the ocean
- ¶6 Place-based identity connected to specific marine areas
- ¶7 Traditional governance systems for marine resources (see **TG-3.6 Traditional Knowledge Accounts**)

¶8 Measuring cultural dependencies requires participatory and qualitative approaches, as described in **TG-3.5 Social Accounts** and **TG-3.6 Traditional Knowledge Accounts**. Both circulars emphasise the need for community-led methods that respect Indigenous data sovereignty. Quantitative proxies may include:

- ¶9 Number of communities with active traditional marine tenure systems
- ¶10 Participation rates in traditional fishing practices by age group
- ¶11 Documentation of marine cultural heritage sites
- ¶12 Rates of intergenerational transmission of marine knowledge

### 3.5.3 Tourism and recreation economies

¶1 SDG Target 14.7 calls for increasing “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”<sup>41</sup>.

¶2 Tourism dependency indicators connect to the broader ocean economy measurement described in **TG-2.5 Ocean Economy Structure**:

- ¶3 Tourism GDP attributable to marine attractions
- ¶4 Employment in marine tourism relative to total tourism employment
- ¶5 International visitor arrivals motivated by marine experiences
- ¶6 Revenue from marine protected area visitation

¶7 The SF-MST provides the statistical framework for linking ecosystem accounting to measures of tourism activity<sup>42</sup>, enabling integration of cultural ecosystem service flows with tourism economic accounts.

### 3.6 Vulnerability Indicators

¶1 **TG-3.5 Social Accounts** provides the general vulnerability and resilience framework for ocean social accounts. This section applies that framework specifically to livelihood dependencies, focusing on how to measure the vulnerability that arises from reliance on ocean ecosystems. Vulnerability encompasses sensitivity or susceptibility to harm and lack of capacity to cope and adapt<sup>43</sup>.

#### 3.6.1 Exposure to ocean-related risks

¶1 Ocean-dependent communities face multiple risks:

¶2 **Ecological risks:** Overfishing, habitat degradation, pollution, and invasive species can reduce the productivity of marine ecosystems and the services they provide. The SEEA EA describes ecosystem condition indicators that track these changes (see **TG-2.1 Biophysical Indicators**).

¶3 **Climate risks:** Ocean warming, acidification, sea level rise, and changing storm patterns directly affect marine ecosystems and coastal communities. SDG Target 14.2 calls for managing marine ecosystems “including by strengthening their resilience”<sup>44</sup>. SDG Target 1.5 calls for building “the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events”<sup>45</sup>.

¶4 **Economic risks:** Volatile commodity prices, changing trade policies, and market disruptions can undermine the economic viability of ocean-dependent livelihoods.

¶5 **Governance risks:** Weak or inequitable governance arrangements may fail to protect community access rights or ensure sustainable management.

¶6 The following indicators measure exposure across these risk categories:

- ¶7 Share of coastal population in areas exposed to sea level rise or storm surge
- ¶8 Dependence on fish stocks assessed as overfished or uncertain
- ¶9 Share of employment in sectors exposed to climate-sensitive marine conditions
- ¶10 Concentration of livelihoods in single marine resources or activities

#### 3.6.2 Sensitivity indicators

¶1 Sensitivity measures how significantly populations would be affected by changes in ocean ecosystems or disruptions to ocean-based activities:

¶2 **Economic sensitivity:**

- ¶3 Share of household income from ocean-dependent sources
- ¶4 Availability of alternative livelihood options
- ¶5 Asset base and savings to buffer income losses
- ¶6 Access to credit and insurance

¶7 **Nutritional sensitivity:**

- ¶8 Share of dietary protein from marine sources

- ¶9 Availability and affordability of alternative protein sources
- ¶10 Nutritional status (particularly in children and pregnant women)

¶11 **Social sensitivity:**

- ¶12 Poverty rates in ocean-dependent communities
- ¶13 Age structure of workforce (older workers less adaptable)
- ¶14 Social marginalization affecting access to support
- ¶15 Housing and infrastructure quality in coastal settlements

### 3.6.3 Adaptive capacity indicators

¶1 **Human capital:**

- ¶2 Educational attainment in coastal communities
- ¶3 Occupational skills transferable to other sectors
- ¶4 Health status affecting work capacity

¶5 **Social capital:**

- ¶6 Strength of community organisations and networks
- ¶7 Collective action capacity for resource management
- ¶8 Access to information and decision-making processes

¶9 **Financial capital:**

- ¶10 Access to savings and financial services
- ¶11 Insurance coverage for weather and market risks
- ¶12 Access to credit for livelihood diversification

¶13 **Institutional capital:**

- ¶14 Social protection coverage measured by SDG indicator 1.3.1 (“Proportion of population covered by social protection floors/systems”) <sup>46</sup>. SDG 1.3.1 measures institutional reach of social protection systems and is distinct from the poverty headcount ratio (SDG 1.1.1 / 1.2.1), which measures the prevalence of poverty. Both are relevant to ocean-dependent populations but answer different questions: social protection coverage indicates the capacity of formal systems to buffer shocks, whilst the poverty headcount indicates the magnitude of pre-existing deprivation. Compilers should report the two indicators separately rather than collapsing them into a single dependency or vulnerability score.
- ¶15 Governance capacity for adaptive management (see **TG-3.7 Governance Accounts**)
- ¶16 Policy support for livelihood transitions

¶17 Understanding the specific ecosystem services on which livelihoods depend, and the current and projected condition of those services, enables targeted vulnerability assessment <sup>47</sup>.

### 3.6.4 Livelihood vulnerability indicator summary

¶1 Table 3 provides a summary of livelihood vulnerability indicators organised by the exposure-sensitivity-adaptive capacity framework. Each indicator is linked to the account type within the Ocean Accounts framework that supplies the relevant data.

| Vulnerability Component | Indicator                 | Data Source         | Account Link        |
|-------------------------|---------------------------|---------------------|---------------------|
| Exposure                | Storm frequency/intensity | Climate data        | Governance accounts |
| Exposure                | Fish stock variability    | Stock assessments   | Asset accounts      |
| Sensitivity             | % income from ocean       | Household surveys   | Economic accounts   |
| Sensitivity             | Dietary fish dependence   | Consumption surveys | Social accounts     |
| Adaptive capacity       | Skill diversity           | Labour surveys      | Social accounts     |

| Vulnerability Component | Indicator       | Data Source       | Account Link      |
|-------------------------|-----------------|-------------------|-------------------|
| Adaptive capacity       | Asset ownership | Household surveys | Economic accounts |

¶2 *Table 3: Livelihood vulnerability indicators by component*

### 3.6.5 Composite vulnerability indices

¶1 Vulnerability indicators across exposure, sensitivity, and adaptive capacity dimensions can be combined into composite vulnerability indices that identify priority populations or areas for policy attention. Because a composite index aggregates components whose relative importance is contestable, its credibility rests on a single condition: that every methodological choice is transparent and revisable. A defensible index therefore (1) uses a transparent and replicable methodology, (2) weights its components against local context and priorities, (3) documents the theoretical framework underpinning the choice of components and weights, (4) is validated through community consultation, and (5) is updated as conditions change.

¶2 For guidance on integrated indicator frameworks and quality assurance of composite indices, see **TG-0.7 Quality Assurance**.

## 4. Compilation Considerations

### 4.1 Data sources

¶1 Social and livelihood dependency indicators draw on diverse data sources:

¶2 **Household surveys:** Labour force surveys provide employment data, living standards surveys capture consumption and income patterns, and specialised coastal community surveys can provide targeted dependency information.

¶3 **Administrative records:** Fishing licenses, vessel registrations, marine worker registrations, and tourism statistics provide administrative data on ocean sector participation.

¶4 **Fisheries data:** Catch statistics, vessel monitoring data, and stock assessments provide physical measures of resource extraction that can be linked to employment and livelihood data.

¶5 **Participatory assessments:** Community consultations and participatory mapping document dependencies not captured in formal statistics, particularly for subsistence activities and cultural dimensions.

¶6 For detailed guidance on data sources and collection methods, see **TG-4.2 Survey Methods** and **TG-4.3 Administrative Data**.

#### 4.1.1 Community sense-checking of data sources

¶1 Secondary data sources alone are not sufficient to determine which dependencies are captured in the account and which are systematically obscured. Before compilation begins, compilers should undertake a structured sense-check with communities in the spatial units covered by the account. The purpose is not validation of results (which occurs at the compilation stage; Section 4.2), but verification of whether the source list and its assumed coverage match community experience.

¶2 The minimum standard is one structured engagement per spatial unit, disaggregated to include separate sessions or sub-groups for women, youth, elders, and persons with disabilities. Mixed sessions alone do not meet the standard, because the dependency categories most likely to be missed by official sources (e.g. gleaning, shore-based processing, subsistence harvesting by women and children, ceremonial use) are precisely those that mixed sessions are least likely to surface. Where capacity permits, additional disaggregation by livelihood type, migration status, or Indigenous identity is appropriate. The methodological approach is consistent with that established in the

GOAP Social Accounts methodology<sup>48</sup>, which treats disaggregated consultation as a quality assurance requirement rather than a procedural courtesy.

¶3 Three questions structure the sense-check at the source stage:

¶4 **(1) Coverage.** Does each proposed secondary source list or count the people who actually undertake ocean-dependent activities in this place? Findings on systematic undercounts feed directly into the adjustment factors applied in Section 4.2 (in particular Step 1 sub-step 2 on informal and subsistence employment, and Step 3 sub-step 3 on sensitivity indicators).

¶5 **(2) Legitimacy of additional sources.** Are there community-held data sources – community monitoring programmes, women’s cooperative records, traditional catch records, locally maintained registers – that should be incorporated alongside official sources? The conditions under which traditional and Indigenous knowledge holdings can enter the account are governed by **TG-3.6 Traditional Knowledge Accounts**, including Free, Prior and Informed Consent and the principle that the decision to share rests with knowledge holders.

¶6 **(3) Disaggregation that matters.** At what spatial and demographic level does the data need to be disaggregated for the policy question to be answerable? Communities can identify when district-level aggregation obscures settlement-level vulnerability, or when household-head reporting misses the labour of other household members. These findings shape the spatial unit chosen in Section 4.2 Step 3 sub-step 1.

¶7 Each engagement should be documented with the date, the groups consulted, the questions asked, and the findings – particularly any source-coverage gaps that will require adjustment or qualitative annotation downstream. This documentation forms part of the metadata required under Section 4.2 Step 5. For detailed survey and consultation protocols, see **TG-4.2 Survey Methods** and **TG-4.3 Administrative Data**.

#### 4.1.2 Integration with existing survey systems

¶1 The dependency indicators in this Circular are designed as an analytical overlay on existing national household survey systems, not as a new statistical operation. Most of the variables needed are already collected by national statistical offices for other purposes. The compiler’s task is principally one of recoding, cross-tabulation, and concordance, supplemented by a small number of genuinely new variables. Reframing the work in this way – as integration rather than new collection – is essential to keeping it tractable for NSOs already operating at capacity, and is consistent with the integrated ocean-poverty account framework set out by Burnside (2026)<sup>2</sup>.

¶2 The principal survey instruments and their roles are:

- ¶3 **Household Income and Expenditure Surveys (HIES) / Living Standards Measurement Studies (LSMS):** Provide the household-level income, consumption, asset, and dwelling-quality variables required for sensitivity and adaptive-capacity components of the livelihood vulnerability index, and the fish-consumption variables required for the fish protein dependency ratio. HIES also already populates the SDG 1.3.1 social protection coverage indicator referenced in Section 3.6.3. The HIES is the anchor source for the vulnerability index (see Section 4.2 Step 5 on reference-year metadata).
- ¶4 **Labour Force Surveys (LFS):** Provide the industry-by-employment cross-tabulations required for the ocean employment dependency ratio, and the disaggregation by sex, age, formal/informal status, and occupation required for sub-step 2a. The LFS already populates SDG indicators 8.3.1 (informal employment) and 8.5.2 (unemployment), and the relevant variables for occupational diversity required in the adaptive capacity component.
- ¶5 **Population and Housing Censuses:** Provide the small-area population denominators required for spatial disaggregation. They do not serve as anchor sources for dependency indicators because the inter-censal interval is too long.

- ¶6 **Agricultural and fisheries censuses or registers; tourism satellite accounts:** Supply industry-side production, capture, and value-added data used to validate household-side reports and to apportion ocean shares within mixed industries.

¶7 The genuinely new variables for which existing survey instruments typically do not provide coverage – and which therefore require either supplementary modules, dedicated coastal community surveys, or community sense-check engagement (Section 4.1.1) – are limited and identifiable. The principal ones are:

- ¶8 Physical quantities of subsistence marine harvests (including gleaning, shore-based collection, and ceremonial use), in volume or weight terms, for household consumption.
- ¶9 Shannon diversity index of household livelihoods across industries (computable from existing labour-force module data with a small recoding step, but not currently reported in any standard tabulation).
- ¶10 Cultural dependency variables (Section 3.5) where these are not already documented by traditional-knowledge registers.

¶11 The integration approach has two consequences that compilers should make explicit in publication metadata. First, the indicators are an ‘analytical layer’ on existing official statistics – not a separate accounting operation – and so are bound by the reference-year, vintage, and revision conventions of their underlying sources (see Section 4.2 Step 5). Second, the dependency indicators are framed throughout in poverty-alleviation terms and are designed to feed into integrated ocean-poverty assessments rather than to substitute for ecosystem-condition indicators. Empirical illustrations that have driven the indicator design include the Inhambane Bay studies, where small-scale fisheries provide 60–70% of household income and 70–80% of dietary protein in coastal villages; the Lake Illawarra estuary case, where ecosystem degradation translated directly into livelihood loss without the dependency relationship having been measured *ex ante*; and the Nippon Causeway / Tarawa case, where infrastructure decisions taken without dependency evidence led to documented harm to subsistence harvesting (Burnside, 2026)<sup>2</sup>. These cases – where *ex ante* dependency evidence would have changed the decision – are the standing reference for the indicator set.

#### 4.1.3 Institutional coordination and inter-agency data reconciliation

¶1 Compilation of TG-2.3 indicators draws on data held by multiple agencies – the NSO (household and labour surveys, census), fisheries ministry (catch, vessel, licence registers), tourism ministry or TSA compiler (visitor arrivals, accommodation employment), environment or marine affairs ministry (MPA, stock, and ecosystem-condition data), and community-held sources legitimised under Section 4.1.1. Without an explicit coordination arrangement, the dependency indicators will either be incompatible (because no single agency holds the data) or will be compiled inconsistently between cycles (because the agency lead changes). The 2025 SNA provides extensive guidance on inter-agency coordination for satellite accounts (Chapter 21, especially para 21.28; Chapter 4 paras 4.252–4.254), and the SEEA-EA Chapter 14 and SEEA-AFF set out the analogous arrangements for environmental-economic and food-system accounts.

¶2 **Compiling lead.** The default compiling lead for TG-2.3 indicators is the **National Statistical Office**, in its role as the institutional custodian of the survey programme on which the indicators principally depend (Section 4.1.2) and the convening authority for satellite-account work under SNA 2025 Chapter 21. Where this default does not hold – for example, where the NSO does not have the marine-domain capacity or where another agency (a national ocean accounts unit, a Ministry of the Sea, a Pacific Community statistical hub, a research institute compiling on behalf of government) is better placed – the alternative arrangement must be documented and the rationale recorded, consistent with **TG-0.1 General Introduction to Ocean Accounts** §3.7 on compiling-lead determination.

¶3 **Minimum coordination arrangement.** A standing coordination mechanism is required. The minimum acceptable form is a written instrument – a standing inter-agency working group or a Memorandum of Understanding – with the NSO and at minimum the fisheries, tourism, and environment portfolios as parties, with a documented process for incorporating community-held sources legitimised under Section 4.1.1. The instrument should specify:

- ¶4 data flows and update cycles;
- ¶5 the agency authoritative for each variable;
- ¶6 the procedure for resolving inconsistencies between sources; and
- ¶7 the publication and revision schedule.

¶8 SNA 2025 Chapter 4 paras 4.252–4.254 set out the institutional sectoring underlying these arrangements.

¶9 **Reconciliation hierarchy for same-population-in-multiple-registries.** A common compilation problem is that the same population (typically small-scale fishers) appears in multiple registries (fisheries licence register, LFS, fishing-cooperative records, community catch registers) with different counts and different coverage definitions. The recommended reconciliation hierarchy is:

1. ¶10 **Source closest to the dependency relationship.** Where one source is operationally closer to the activity being measured (e.g. a community catch register for subsistence harvesting; a fisheries licence register for licensed commercial activity), that source takes precedence for the relevant sub-population.
2. ¶11 **Broadest informal coverage where (1) does not discriminate.** Where multiple sources are equally close to the relationship, the source with the broadest informal coverage takes precedence; the resulting gap relative to narrower sources is recorded in metadata.
3. ¶12 **Cross-tabulation where unique IDs permit.** Where personal or vessel identifiers allow linkage across registers, the indicator is compiled from the cross-tabulated unique-person count rather than from any single register.
4. ¶13 **Reported as range where unresolvable.** Where steps 1–3 do not resolve the inconsistency, the indicator is reported as a range bounded by the highest and lowest defensible source counts, with metadata identifying the sources and the unresolved coverage difference.

¶14 **Concordance table.** Each compilation cycle should publish a concordance table mapping the operational definitions used in the dependency indicators to ISIC Rev. 4 industry codes, ISCO occupation codes, national fisheries register categories, and the TSA tourism-characteristic-activity classification. This concordance is the practical instrument that makes inter-agency reconciliation possible and is consistent with the satellite-account requirements in SNA 2025 Chapter 21 paras 21.59–21.62 and Chapter 16 on labour.

## 4.2 Compilation Procedure

¶1 **Note on thresholds:** All thresholds in this section are illustrative. Compilers must derive context-specific thresholds using local data and expert judgement before applying them to national or sub-national reporting.

¶2 **Note on community sense-checking.** The compilation procedure below produces preliminary indicator values from secondary data. These preliminary values must be sense-checked with communities in the spatial unit before publication. Sense-checking is not a sign-off: findings from sense-check engagements must be capable of revising preliminary values, flagging them with qualitative annotation, or adding supplementary indicators. A sense-check that cannot change the published account is not meeting the standard. Sense-check engagements at the compilation stage build on the source-level sense-check described in Section 4.1.1 and should, where possible, reach the same groups consulted at that stage. Compilers should treat findings under one of four categories, documenting which applies to each indicator:

1. ¶3 **Confirmation.** Community feedback corroborates the preliminary value. The indicator is published with metadata recording the validation date and groups consulted.
2. ¶4 **Calibration within documented bounds.** A specific component is identified as over- or under-stated for a known reason (typically a systematic undercount in the secondary source). The value is revised within a documented range – the secondary source providing one bound, the community estimate providing the other – and published as a range with a reported point estimate. The metadata records the reason for adjustment.
3. ¶5 **Flagging without revision.** The community identifies that the score, whilst numerically defensible from secondary data, misses a dimension that cannot be quantified within the indicator set (for example, spiritual ties to a particular reef, intergenerational transmission of marine knowledge, displacement losses already absorbed). The numerical score is published unchanged with a qualitative annotation explicitly naming what the score does not capture.
4. ¶6 **Supplementation.** A community-identified indicator is added as a supplementary measure alongside the standard set. It does not replace a standard indicator, but appears in the national table and feeds into the next revision of this Circular and the forthcoming Accounting for People Circular<sup>49</sup>.

¶7 This section provides a step-by-step procedure for compiling the core livelihood dependency indicators described in Section 3. The procedure assumes that basic ocean economy accounts have been compiled following **TG-3.3 Economic Activity** and that relevant household survey data are available. Compilers should adapt the procedure to national data circumstances.

### Step 1: Compile ocean employment dependency ratio

¶1 **Objective:** Measure the share of total employment attributable to ocean-dependent sectors.

#### ¶2 **Data requirements:**

- ¶3 Labour force survey with industry classification at ISIC Rev. 4 4-digit level
- ¶4 Fisheries registry or administrative records for fishing employment
- ¶5 Tourism employment data disaggregated by coastal/marine tourism

#### ¶6 **Procedure:**

##### 1. ¶7

Extract employment counts for ocean-dependent industries from labour force survey:

- ¶8 ISIC 0311 (Marine fishing)
- ¶9 ISIC 0321 (Marine aquaculture)
- ¶10 Coastal tourism share of ISIC 55 (Accommodation), 56 (Food and beverage services), 79 (Travel agencies)

Note: ISIC 50 (Water transport) is assigned to the secondary tier, not this direct employment list (see Section 3.2.1 for full ISIC 50 classification).

##### 2. ¶11

Adjust for informal and subsistence employment using fisheries registry:

- ¶12 Cross-check survey totals against fishing license/registration counts
- ¶13 If survey underestimates artisanal/small-scale fishers, apply adjustment factor based on registry coverage
- ¶14 Document adjustment methodology in metadata

#### ¶15 2a. **Compile post-harvest and value chain employment with sex/gender disaggregation.**

Direct-harvest employment counts (sub-step 1) systematically understate the labour engaged in ocean-dependent livelihoods because the post-harvest and shore-based value chain is disproportionately performed by women and persons in informal arrangements. Compilers must compile a separate count of value-chain employment, with the following scope and disaggregation:

- ¶16 **Scope.** Includes ISIC 1020 (seafood processing and preserving), fish marketing and distribution (including in markets, on roadsides, and through intermediated trade), and shore-based and home-based components of the value chain such as gleaning, net-mending, drying, smoking, and informal marketing.
- ¶17 **Mandatory disaggregation.** Sex or gender, per Circular 1 (GESI) guidance and consistent with national data system conventions; and formal/informal employment status.
- ¶18 **Documented where available.** Age, indigeneity, disability, and migration status. Where the underlying survey does not collect these variables, the metadata records the gap rather than treating it as zero coverage.

¶19 Cross-references: **TG-3.13 Gender Equality and Social Inclusion** for the disaggregation framework; **TG-3.15** for the related value-chain treatment. Counts produced under this sub-step are preliminary and remain subject to revision under Section 4.1.1 / Step 1 sub-step 6 community sense-check.

3. ¶20

Sum employment across ocean industries to derive direct ocean employment total

4. ¶21

Compute ocean employment dependency ratio:

$$\text{Ocean employment ratio} = \text{Direct ocean employment} / \text{Total employment}$$

5. ¶22

Report both absolute employment count and percentage share

6. ¶23

**Community sense-check on employment count.** Before publishing the ratio, present the disaggregated employment counts (by ISIC category, by sex, by formal/informal status) to community sense-check sessions disaggregated by sex and age. Record findings on whether categories of work are systematically under- or over-counted, particularly informal and gendered work such as gleaning, shore-based processing, and net-mending. Apply the four-category treatment set out at the start of Section 4.2 and document the basis for any revision in metadata.

¶24 **Output:** Ocean employment dependency ratio (percent), with metadata documenting survey source, reference period, any adjustments for informal employment, sex/gender-disaggregated value-chain employment counts (sub-step 2a), and the four-category treatment applied following community sense-check.

## Step 2: Compile fish protein dependency ratio

¶1 **Objective:** Measure the contribution of marine-sourced protein to total animal protein supply.

¶2 **Data requirements:**

- ¶3 Food balance sheet or household consumption and expenditure survey
- ¶4 Fish catch statistics (commercial + subsistence)
- ¶5 Protein content conversion factors by species or species group

¶6 **Procedure:**

1. ¶7

Compile total fish supply from food balance sheet:

- ¶8 Domestic catch (commercial + estimated subsistence)
- ¶9 Plus imports, minus exports
- ¶10 Minus non-food uses (fishmeal, pet food, waste)
- ¶11 Equals fish available for human consumption (tonnes live-weight equivalent)

2. ¶12

Convert live-weight supply to edible weight using species-specific edible yield coefficients (FAO Food Composition Tables recommended; typical range 0.45–0.65). Where species-level yield data are unavailable, apply a default yield coefficient of 0.50 and flag the indicator as a low-confidence estimate in metadata.

$$\text{Fish available (edible weight, tonnes)} = \text{Fish available (live-weight, tonnes)} \times \text{Edible yield coefficient}$$

3. ¶13

Apply protein content factor to edible weight only:

$$\text{Fish protein supply (tonnes)} = \text{Fish available (edible weight, tonnes)} \times \text{Average protein content factor}$$

Use species-specific factors where possible; otherwise apply regional average (typically 0.16–0.20, with 0.18 as common benchmark for edible weight, wet-weight basis per FAO FCT conventions). Protein content factors must not be applied to live-weight or round-weight data.

4. ¶14

Compile total animal protein supply from food balance sheet:

- ¶15 Sum protein from meat, fish, dairy, eggs
- ¶16 Align reference period with fish data

5. ¶17

Compute fish protein dependency ratio:

$$\text{Fish protein dependency} = \text{Fish protein supply} / \text{Total animal protein supply}$$

6. ¶18

Compute per capita fish protein:

$$\text{Per capita fish protein (kg/year)} = \text{Fish protein supply} / \text{Population}$$

7. ¶19

**Community sense-check on dietary reliance.** Present the preliminary per capita fish protein supply and the protein dependency ratio to disaggregated community sense-check sessions. Pay particular attention to seasonality: where the household consumption survey reference period misses seasonal lows in fish availability, communities can identify this directly and the indicator should be flagged or supplemented with a seasonal range. Where subsistence harvesting is significant, sense-check sessions should verify whether the imputed subsistence component reflects actual household consumption. Apply the four-category treatment and document accordingly.

¶20 **Output:** Fish protein dependency ratio (percent) and per capita fish protein supply (kg/year), with metadata on protein conversion factors, data sources, and the four-category treatment applied following community sense-check.

### Step 3: Compile livelihood vulnerability index

¶1 **Objective:** Produce composite vulnerability index for ocean-dependent coastal community using exposure, sensitivity, and adaptive capacity components.

¶2 **Data requirements:**

- ¶3 Spatial data on coastal flood and cyclone risk zones
- ¶4 Household survey with income and asset modules
- ¶5 Coastal community education and employment data

- ¶6 Fish stock status assessments

#### ¶7 Procedure:

##### 1. ¶8

Define the spatial unit for vulnerability assessment:

- ¶9 Coastal administrative unit (district, municipality)
- ¶10 Or specific coastal community
- ¶11 Document spatial boundaries and population

##### 2. ¶12

Compile and normalise exposure indicators (scale 0–1, higher = greater exposure):

- ¶13 Flood risk: Share of settlement in 1-in-50-year flood zone
- ¶14 Cyclone frequency: Annual average cyclone landfalls (past 20 years), normalised by maximum observed
- ¶15 Stock risk: Share of local catch from stocks assessed as overfished or uncertain
- ¶16 Compute exposure score as simple average of normalised indicators

##### 3. ¶17

Compile and normalise sensitivity indicators (scale 0–1, higher = greater sensitivity):

- ¶18 Income dependence: Average share of household income from fishing/ocean sectors (from household survey)
- ¶19 Housing quality: Share of households in informal or non-code housing
- ¶20 Dietary dependence: Share of animal protein from fish (from household consumption survey)
- ¶21 Compute sensitivity score as simple average of normalised indicators

##### 4. ¶22

Compile and normalise adaptive capacity indicators (scale 0–1, higher = greater capacity):

- ¶23 Educational attainment: Average years of schooling, normalised by national average
- ¶24 Financial inclusion: Share of households with savings account or insurance coverage
- ¶25 Livelihood diversity: Shannon diversity index of employment across industries, normalised
- ¶26 Compute adaptive capacity score as simple average of normalised indicators

##### 5. ¶27

Compute composite vulnerability index:

$$\text{Vulnerability index} = (\text{Exposure} + \text{Sensitivity} + (1 - \text{Adaptive Capacity})) / 3$$

The formula inverts adaptive capacity (using 1 – AC) because higher capacity reduces net vulnerability. This produces a true 0–1 range where 0 indicates no vulnerability and 1 indicates maximum vulnerability.

##### 6. ¶28

Interpret result using threshold classification (all thresholds are illustrative – see note at start of Section 4.2):

- ¶29 0.00–0.33: Low vulnerability
- ¶30 0.33–0.55: Moderate vulnerability
- ¶31 0.55–1.00: High vulnerability

##### 7. ¶32

**Community sense-check on component scores and composite index.** Present preliminary component scores (exposure, sensitivity, adaptive capacity) and the composite index to disaggregated community sense-check sessions. Three questions structure the engagement:

- ¶33 Does the composite score reflect lived experience of vulnerability in this place?
- ¶34 Which component is most over- or under-stated, and why?
- ¶35 What is missing from the indicator set that the community would include?

The threshold classification (low / moderate / high) is the most consequential element to sense-check, because it drives policy targeting. A community whose composite score falls near a threshold boundary may experience itself as more or less vulnerable than the classification suggests, for reasons the index does not capture; this finding must appear in metadata even where the score itself is unchanged. Apply the four-category treatment to each component and to the composite. Where supplementation occurs – that is, where a community identifies an indicator the index should include – record the supplementary indicator in the national table and flag it for consideration in the next revision of this Circular and in the forthcoming Accounting for People Circular<sup>49</sup>.

¶36 **Output:** Composite livelihood vulnerability index (0–1 scale) with component scores, spatial unit definition, interpretation guide, and the four-category treatment applied following community sense-check.

## Step 5: Document methodology and metadata

¶1 For all compiled indicators, document:

- ¶2 Data sources (survey instrument, administrative system, reference period)
- ¶3 Estimation methods (calculation formulas, adjustment factors, normalisation procedures)
- ¶4 Limitations and uncertainties (sampling error, coverage gaps, imputation methods)
- ¶5 **Community sense-check engagements:** date, spatial unit, groups consulted (with disaggregation), questions asked, findings recorded, and the four-category treatment (set out at the start of Section 4.2) applied to each indicator
- ¶6 **Supplementary indicators** added through sense-check supplementation, with the rationale for inclusion and a flag for consideration in the next revision of this Circular and in the forthcoming Accounting for People Circular<sup>49</sup>
- ¶7 Quality assessment per **TG-0.7 Quality Assurance**

¶8 **Reference-year metadata block.** A single reference-year field is insufficient for indicators whose underlying sources update at different frequencies. For each compiled indicator, the metadata block must record the following eight fields rather than a single year stamp:

1. ¶9 **Indicator's published reference year** – the year to which the published indicator value is attributed.
2. ¶10 **Anchor source and observation year** – the binding source for the indicator and the year of its underlying observation. The anchor source per indicator is: **HIES** for the livelihood vulnerability index (because the index is sensitivity-led and sensitivity depends on household income and asset variables only the HIES provides); **LFS** for the ocean employment dependency ratio (because it is the only source providing the industry-by-employment cross-tabulation on a comparable basis); **Food balance sheet** for the fish protein dependency ratio. The **Population and Housing Census is not an anchor source** for any TG-2.3 indicator because the inter-censal interval is too long to keep an anchor current; the census is used only to provide small-area population denominators.
3. ¶11 **Every contributing source** – listed with its reference year and update frequency.
4. ¶12 **Temporal gap in years** – the largest difference, in years, between the published reference year and the observation year of any contributing source.
5. ¶13 **Bridging method** – the method used to bring older contributing sources up to the published reference year. The standard method is **proportional Denton temporal disaggregation** (IMF Quarterly National Accounts Manual, Chapter 6), which preserves both the lower-frequency benchmark and the higher-frequency indicator's shape. **Pro rata extrapolation is rejected** as a bridging method because it does not preserve the benchmark's covariance with auxiliary information. On methodology changes in the contributing source, the indicator series is **back-cast** rather than spliced, so that pre- and post-change values remain comparable.

6. ¶14 **Indicator series used for extrapolation** – the higher-frequency series (typically LFS, climate, or stock-status data) used to bring older HIES or FBS observations forward.
7. ¶15 **Update type** – routine update, benchmark update, or comprehensive revision, in the SNA 2025 sense (paras 20.92, 20.95–20.98, 20.36, 20.101; satellite-account treatment in paras 21.59–21.62, 21.67).
8. ¶16 **Confidence flag** – where the temporal gap exceeds five years between the anchor source’s observation year and the published reference year, the indicator is flagged as **low confidence** in the publication. Gaps of three to five years are flagged as **medium confidence**, and gaps under three years as **high confidence**.

¶17 A worked example of a vintage label, where the HIES observation is from 2024 but the indicator is published with respect to reference year 2024 in publication year 2026, is: “reference year 2024, vintage 2026, routine update, high confidence”. The reference-year metadata block is a publication-side artefact attached to each compiled indicator and is the principal mechanism by which the analytical layer described in Section 4.1.2 stays consistent with the revision conventions of the official statistics on which it is built (see also SNA 2025 paras 21.28 and 21.59–21.62).

¶18 This documentation supports transparency, enables indicator updates in subsequent periods, and provides the evidence base for indicator reform when the Accounting for People Circular is finalised.

**Table 2 – Recommended compilation frequency and maximum data vintage**

¶1 The dependency indicators in this Circular share survey-side update cycles with the official statistics from which they are derived. Table 2 sets out the recommended compilation frequency and maximum acceptable data vintage for each indicator, together with the primary data source and natural update cycle of that source.

| Indicator                         | Primary data source                           | Natural update cycle                    | Recommended compilation frequency                                                                                | Maximum data vintage                         | Notes                                                                                     |
|-----------------------------------|-----------------------------------------------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------------------------------|
| Ocean employment dependency ratio | Labour Force Survey (LFS)                     | Annual or biennial                      | Annual where LFS is annual; otherwise biennial                                                                   | 2 years (annual LFS); 4 years (biennial LFS) | Industry-by-employment cross-tabulation routinely available                               |
| Fish protein dependency ratio     | Food Balance Sheet (annual) + HIES (3–5 year) | FBS annual; HIES 3–5 year               | Annual ratio; HIES-based household-level disaggregation refreshed on HIES cycle                                  | 2 years (FBS); 5 years (HIES)                | Use FBS as the routine series; refresh household-level component on HIES cycle            |
| Livelihood vulnerability index    | HIES (anchor) + annual climate and stock data | HIES 3–5 year; climate and stock annual | Composite re-run annually using updated climate and stock data with most recent HIES; full refresh on HIES cycle | 5 years (HIES anchor)                        | Sensitivity components carry the longest vintage and dominate the index’s currency status |

¶2 *Table 2: Recommended compilation frequency and maximum data vintage by indicator*

¶3 Two principles govern the practical use of Table 2:

1. ¶4 **Sub-indicators update independently; the composite is re-run on the most recent vintage of each.** A compiler is not required to wait for the slowest-moving input before re-running the composite. The composite is re-run each year using the most recent vintage of each con-

tributing source, with the reference-year metadata block (Step 5) recording the vintage of each contributing input.

2. ¶5 **Over-vintage indicators carry a metadata flag rather than being suppressed.** Where a contributing source has not been refreshed within the maximum vintage in Table 2, the indicator is published with a confidence flag rather than withdrawn. Suppression of an indicator deprives users of the most recent defensible estimate. Flagging preserves the estimate while making its vintage status transparent. This is consistent with SNA 2025 Chapter 21 guidance on satellite-account publication where source vintages differ from the core-account release.

### 4.3 Worked Example

¶1 Synthetic data for a hypothetical Small Island Developing State (SIDS) illustrate the three core compilation procedures. Compilers should substitute national data sources as described in Section 4.1.

#### Employment dependency indicators

¶1 **Step 1 – Sum direct ocean employment by sector:**

| Sector                               | Employment (persons) |
|--------------------------------------|----------------------|
| Fishing (commercial and artisanal)   | 12,000               |
| Aquaculture                          | 3,500                |
| Coastal tourism                      | 25,000               |
| <b>Total direct ocean employment</b> | <b>40,500</b>        |

¶2 Maritime transport (8,000 persons) is secondary-tier employment (Section 3.2.1) and seafood processing (6,000 persons) is value-chain employment (Section 4.2 Step 1 sub-step 2a). Both are reported separately and are not part of the direct total.

¶3 **Step 2 – Compute the ocean employment ratio:**

$$\text{Ocean employment ratio} = \text{Ocean employment} / \text{Total employment}$$

$$= 40,500 / 420,000 = 9.6\%$$

¶4 **Step 3 – Estimate total ocean-dependent employment using an indirect multiplier:**

¶5 Input-output analysis for the national economy yields an ocean sector employment multiplier of 1.8, meaning that each direct ocean job supports an additional 0.8 jobs in supply chains and induced spending.

$$\text{Total ocean-dependent jobs} = 40,500 \times 1.8 = 72,900$$

$$\text{Total ocean-dependent employment share} = 72,900 / 420,000 = 17.4\%$$

¶6 Compilers should report both the direct ratio (9.6%) and the multiplier-adjusted ratio (17.4%), noting the multiplier source and methodology. Multiplier estimates are sensitive to the scope of industries included and should be validated against input-output tables as described in **TG-3.3**

#### Economic Activity.

## Nutritional dependency indicators

### ¶1 Step 1 – Estimate fish available for human consumption:

¶2 The food balance sheet reports annual fish supply of 45,000 tonnes (live-weight equivalent) after accounting for imports, exports, and non-food uses.

### ¶3 Step 2 – Convert live-weight supply to edible weight:

¶4 Apply an edible yield coefficient to convert from live-weight to the edible portion. Using a yield coefficient of 0.50 (appropriate as a default where species-level data are unavailable; compilers should use species-specific FAO FCT coefficients where possible):

$$\text{Fish available (edible weight)} = 45,000 \text{ tonnes} \times 0.50 = 22,500 \text{ tonnes edible weight}$$

### ¶5 Step 3 – Apply protein content factor to edible weight:

$$\text{Fish protein supply} = \text{Fish available (edible weight)} \times \text{Average protein content factor}$$

$$= 22,500 \text{ tonnes} \times 0.18 = 4,050 \text{ tonnes fish protein}$$

¶6 The protein content factor of 0.18 (18% of edible weight, wet-weight basis per FAO FCT conventions) is a standard conversion factor for mixed fish species; compilers should adjust based on national catch composition (edible-weight-only application: Section 4.2 Step 2).

### ¶7 Step 4 – Compute the fish protein dependency ratio:

$$\text{Fish protein dependency ratio} = \text{Fish protein supply} / \text{Total animal protein supply}$$

$$= 4,050 / 32,000 = 12.7\%$$

### ¶8 Step 5 – Compute per capita fish protein supply:

$$\text{Per capita fish protein} = \text{Fish protein supply} / \text{Population}$$

$$= 4,050 \text{ tonnes} / 2.1 \text{ million persons} = 1.93 \text{ kg per capita per year}$$

¶9 A fish protein dependency ratio of 12.7% indicates meaningful nutritional reliance on marine resources. Values above 20% are commonly used as thresholds for identifying fish-dependent populations. Per capita fish protein supply can be compared against FAO global averages (approximately 3.3 kg per capita per year) to contextualize national dependency levels. Note that the two-stage conversion (live-weight to edible weight, then edible weight to protein) is essential for comparability: omitting the edible weight step would overstate fish protein supply by approximately 100% in this example.

## Livelihood vulnerability index

¶1 A composite livelihood vulnerability index aggregates exposure, sensitivity, and adaptive capacity indicators into a single summary measure, following the IPCC vulnerability framework referenced in Section 3.6 in its earlier (AR4) form, which places exposure inside vulnerability; the IPCC Sixth Assessment Report treats exposure as a separate determinant of risk alongside hazard and vulnerability. Each component is normalised to a 0–1 scale where higher values indicate greater exposure, greater sensitivity, or greater adaptive capacity respectively.

#### ¶2 **Step 1 – Compile component scores for a coastal fishing community:**

¶3 Note: This example uses a reduced indicator set for brevity. Compilers should include all indicators listed in the compilation procedure (Section 4.2), including stock risk for exposure and dietary dependence for sensitivity.

| Component         | Sub-indicator                                               | Score       |
|-------------------|-------------------------------------------------------------|-------------|
| Exposure          | Flood risk (share of settlement in 1-in-50-year flood zone) | 0.68        |
|                   | Cyclone frequency (events per decade, normalised)           | 0.76        |
|                   | <b>Exposure average</b>                                     | <b>0.72</b> |
| Sensitivity       | Income dependence on fishing (% of household income)        | 0.70        |
|                   | Housing quality (% informal or non-code construction)       | 0.60        |
|                   | <b>Sensitivity average</b>                                  | <b>0.65</b> |
| Adaptive capacity | Educational attainment (years, normalised)                  | 0.50        |
|                   | Savings and insurance coverage (% of households)            | 0.35        |
|                   | Alternative livelihood options (diversity index)            | 0.50        |
|                   | <b>Adaptive capacity average</b>                            | <b>0.45</b> |

¶4 **Step 2 – Compute the composite vulnerability index** (apply the formula from Section 4.2 Step 5):

$$= (0.72 + 0.65 + (1 - 0.45)) / 3 = (0.72 + 0.65 + 0.55) / 3 = 1.92 / 3 = 0.64$$

#### ¶5 **Step 3 – Interpret the result:**

¶6 A vulnerability index of 0.64 indicates high vulnerability (formula inversion: Section 4.2 Step 5). Applying the illustrative threshold classification from Section 4.2 Step 6:

- ¶7 Values below 0.33 suggest low vulnerability
- ¶8 Values between 0.33 and 0.55 suggest moderate vulnerability
- ¶9 Values above 0.55 suggest high vulnerability warranting priority policy attention

¶10 The example community scores high on exposure (0.72) and sensitivity (0.65) but has limited adaptive capacity (0.45), driven primarily by low savings and insurance coverage (0.35). Policy interventions targeting financial inclusion and livelihood diversification would improve adaptive capacity and reduce the composite vulnerability score.

¶11 For guidance on weighting, normalisation methods, and quality assurance of composite indices, see **TG-2.1 Indicator Design Principles** and **TG-0.7 Quality Assurance**.

## 4.4 Decision Use Cases

¶1 This section describes the policy decision contexts where livelihood dependency indicators compiled following this Circular directly inform management choices.

### Use Case 1: Coastal poverty targeting

¶1 **Decision context:** A national poverty reduction programme seeks to identify coastal communities requiring targeted support. Standard poverty headcount data exist but do not reveal which poor households also face high exposure to ocean ecosystem degradation.

¶2 **Dependency indicators used:**

- ¶3 Ocean employment dependency ratio by coastal administrative unit
- ¶4 Fish protein dependency ratio by household consumption survey cluster
- ¶5 Livelihood vulnerability index combining exposure, sensitivity, and adaptive capacity

¶6 **Application:** Combine poverty mapping with dependency indicators to identify communities that are both poor and highly dependent on ocean ecosystems. Prioritize these “high-dependency, high-poverty” communities for interventions addressing both poverty and ecosystem resilience. Communities with high dependency but low poverty may require different policy responses focused on sustaining livelihoods rather than poverty alleviation.

¶7 **Policy outcome:** Improved targeting of social protection, livelihood diversification programmes, and ecosystem restoration investments to communities where both poverty and ecosystem dependency are high.

### Use Case 2: Just transition planning for fisheries reform

¶1 **Decision context:** A country is implementing new fisheries regulations to reduce overfishing, which will reduce total allowable catch and eliminate some fishing licenses. Policy-makers need to identify which communities and workers will be most affected and design compensation and transition support.

¶2 **Dependency indicators used:**

- ¶3 Employment dependency indicators by fishing community (direct, indirect, induced employment)
- ¶4 Share of household income from fishing activities
- ¶5 Employment characteristics (age, sex, educational attainment, alternative skill sets)
- ¶6 Adaptive capacity indicators (access to credit, social protection coverage)

¶7 **Application:** Map the spatial distribution of fishing-dependent employment and household income shares against the proposed license reductions. Identify communities where a high proportion of employment depends on fishing (for example, >30%, though compilers should establish context-specific thresholds based on national circumstances) and where adaptive capacity (education, alternative skills) is low. Design differentiated transition packages: early retirement for older fishers near retirement age; retraining and job placement for younger workers with transferable skills; direct income support for households with high fishing income dependency and limited alternatives.

¶8 **Policy outcome:** Socially equitable fisheries reform that protects livelihoods while achieving sustainability objectives, with compensation and support tailored to community-specific dependency profiles.

### Use Case 3: Food security monitoring in coastal zones

¶1 **Decision context:** A Ministry of Health monitors national nutrition indicators and seeks to understand whether coastal populations face distinct food security risks related to marine ecosystem change or fishing access restrictions.

¶2 **Dependency indicators used:**

- ¶3 Fish protein dependency ratio by region
- ¶4 Share of households relying on subsistence fishing
- ¶5 Nutritional quality indicators (contribution to micronutrient intake)

- ¶6 Price volatility of marine food products

¶7 **Application:** Identify coastal regions where a high share of animal protein comes from fish (for example, >40%, though compilers should establish context-specific thresholds based on national circumstances) and where subsistence fishing provides a substantial share of household consumption (for example, >20%). Establish nutrition surveillance in these high-dependency zones to track changes in dietary adequacy alongside monitoring of fish stock status and coastal access. If fish protein dependency is high and fish stocks are declining, trigger contingency food security responses (school feeding programmes with alternative protein sources, nutrition supplementation, support for alternative protein production).

¶8 **Policy outcome:** Proactive food security interventions in fish-dependent populations, preventing malnutrition before it occurs by linking nutrition surveillance to ecosystem condition monitoring.

#### Use Case 4: Marine protected area design with livelihood safeguards

¶1 **Decision context:** A conservation agency plans to expand marine protected areas (MPAs) to meet biodiversity targets, but must ensure that MPA boundaries and management rules do not disproportionately harm fishing-dependent communities.

¶2 **Dependency indicators used:**

- ¶3 Spatial distribution of fishing effort and subsistence harvesting
- ¶4 Cultural dependency indicators (traditional marine tenure systems, culturally significant sites)
- ¶5 Income and employment dependency by coastal community
- ¶6 Alternative livelihood options available in affected areas

¶7 **Application:** Overlay proposed MPA boundaries with maps of fishing dependency and cultural significance. Identify coastal communities that currently derive >50% of income from areas proposed for strict protection. Adjust MPA boundaries to avoid complete exclusion of high-dependency communities, or design co-management zones where sustainable fishing and cultural practices continue under community governance. Where displacement is unavoidable, quantify affected livelihoods and design compensation mechanisms including alternative livelihood support and benefit-sharing from MPA tourism revenues.

¶8 **Policy outcome:** Conservation gains achieved without imposing uncompensated livelihood losses, with MPA governance structures that recognise and support the dependencies of coastal communities on marine ecosystems.

#### Use Case 5: Indigenous customary sea rights (deferred – placeholder)

¶1 A customary sea rights use case (Indigenous tenure, FPIC, UNDRIP) is in development. Drafting is deferred until Indigenous co-authors and reviewers are confirmed as part of the writing team with authority over the text, consistent with the principle stated in **TG-3.6 Traditional Knowledge Accounts** that guidance on Indigenous knowledge and tenure should be written with, not about, the communities concerned. Practitioners from the jurisdictions named in the original proposal (Fiji, Vanuatu, and ideally others such as Aotearoa and the Torres Strait) would be the appropriate people to lead or co-lead this use case. The omission is recorded here as a finding rather than a gap: writing a use case on customary sea rights without Indigenous co-authors would contradict the framing this Circular already adopts elsewhere on Indigenous data sovereignty and community-led methods.

#### Use Case 6: Post-disaster needs assessment (PDNA)

¶1 **Decision context:** Following a major cyclone, storm surge, or coastal flooding event, a government convenes a Post-Disaster Needs Assessment to quantify damage and loss across affected sectors and to plan recovery. The PDNA Fisheries and Coastal Livelihoods sector requires evidence on the dependent population, the magnitude of livelihood loss, and the recovery cost. The Sendai

Framework for Disaster Risk Reduction 2015-2030<sup>3</sup> frames this work as the operational expression of disaster resilience commitments. TG-2.3 supplies the dependency baseline against which damage and loss are measured.

¶2 **Dependency indicators used (PDNA phase mapping):**

| PDNA phase                 | Indicators required                                                                              | TG-2.3 source                                 |
|----------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Baseline (pre-event)       | Ocean employment dependency ratio; fish protein dependency ratio; livelihood vulnerability index | Compiled per Section 4.2                      |
| Rapid assessment (72-hour) | Pre-event indicator values, affected-population overlay                                          | Pre-existing values + spatial extent of event |
| Damage and loss            | Loss of employment, loss of subsistence harvest, dependency-weighted loss valuation              | Pre-event dependency × event extent           |
| Recovery planning          | Vulnerability index components; integration with the social protection register (SDG 1.3.1)      | Section 3.6 / 4.2                             |

¶3 **Application:** TG-2.3 indicators supply the pre-event baseline against which the PDNA Fisheries and Coastal Livelihoods sector module quantifies damage and loss. The dependency indicators are inputs to the PDNA methodology – they do not replace the World Bank / UN / EU PDNA Fisheries and Coastal Livelihoods sector guidance note (the sector-specific damage and loss costing methodology). The illustrative magnitudes documented in the Inhambane Bay case (small-scale fisheries providing 60–70% of household income and 70–80% of dietary protein in coastal villages; Burnside, 2026)<sup>2</sup> indicate the order of magnitude that dependency baselines can take in SSF-reliant coastal economies and the corresponding scale of livelihood loss that an event in such a setting can impose.

¶4 **Policy outcome:** PDNA recovery costings that reflect the dependency baseline of affected populations, supporting Loss & Damage Fund applications and recovery resourcing decisions that are calibrated to the magnitude of pre-event reliance on ocean ecosystems.

***Note on scope.** The PDNA-sector worked-table crosswalk in this use case, including its precise alignment with the most recent World Bank / UN / EU PDNA Fisheries and Coastal Livelihoods sector guidance note, is to be confirmed in consultation with the GOAP Secretariat. The use case is therefore presented as the operational frame for the indicator set rather than as a substitute for the PDNA sector methodology.*

## Use Case 7: Marine spatial planning and ESIA

¶1 **Decision context:** A marine spatial planning (MSP) authority and a project developer have a concurrent need for dependency evidence over the same spatial area: the MSP authority requires the human-uses analysis to underpin allocation of the marine area between competing uses (Step 4 of the IOC-UNESCO MSP guidance<sup>50, 51</sup>), whilst the developer requires an Environmental and Social Impact Assessment (ESIA) under IFC Performance Standard 5<sup>52</sup> and the Equator Principles IV<sup>53</sup> to identify economically displaced persons and design livelihood restoration. The use case is framed throughout from the government / MSP-authority perspective, with the ESIA application as a downstream use of the same indicator stack.

¶2 **Dependency indicators used:**

- ¶3 Spatial distribution of fishing-effort-based employment, by fishing ground
- ¶4 Subsistence-harvesting areas at sub-administrative spatial resolution
- ¶5 Fish protein dependency by coastal administrative unit
- ¶6 Livelihood vulnerability index by coastal community

¶7 **Application (MSP):** Under Step 4 of the IOC-UNESCO MSP guidance, the dependency indicators populate the human-uses analysis that the spatial allocation depends on. The MSP authority overlays the dependency layers against proposed allocations – offshore wind concessions, MPA zoning, shipping lanes, aquaculture sites – to identify spatial conflicts and the populations whose livelihoods the allocation will displace, sustain, or transform.

¶8 **Application (ESIA / IFC PS5):** The same indicator stack supplies the ESIA's baseline. Specifically, it identifies the economically displaced persons whose livelihood restoration the developer is obliged to plan; it provides the pre-project baseline against which livelihood restoration is measured (PS5 paragraph 28); and the livelihood vulnerability index, in conjunction with the dependency indicators, supports identification of “particularly vulnerable” status (PS5 paragraph 27).

¶9 **Worked illustration – offshore-wind concession.** A 200 km<sup>2</sup> concession overlaps a fishing ground that supplies 18% of the affected coastal community's fishing effort, in a community whose livelihood vulnerability index is greater than 0.55. The MSP authority's response is either a fisheries-compatible turbine array (with spacing, foundations, and access arrangements that retain fishing access) or an offset package tied to the dependency magnitude (livelihood restoration funded at a level scaled to the 18% effort displaced and the vulnerability classification of the affected community). Cross-reference: this use case is the developer-and-MSP-authority counterpart to Use Case 4 (MPA design with livelihood safeguards), and shares the underlying spatial dependency methodology.

¶10 **Policy outcome:** MSP allocations and ESIA mitigation plans that are calibrated to the dependency magnitude they affect, reducing the incidence of post-allocation livelihood disputes and supporting the IFC PS5 / Equator Principles IV obligations on economically displaced persons.

#### Use Case 8: Fishing access agreements (DWFN / SIDS)

¶1 **Decision context:** A Small Island Developing State government is renewing an access agreement with a distant-water fishing nation (DWFN) under, for example, the Pacific Islands Forum Fisheries Agency Vessel Day Scheme<sup>54</sup>, with PNA Office minimum benchmark prices<sup>55</sup> as a floor. The negotiating government requires evidence on the social and nutritional floor (the level of access below which domestic livelihoods and food security are compromised) and on the fiscal floor (the level of access fees below which the agreement does not deliver an adequate share of resource rent to the coastal state).

#### ¶2 **Dependency indicators used:**

- ¶3 Fish protein dependency ratio (social floor) – minimum domestic catch needed to maintain dietary protein supply
- ¶4 Government revenue dependency on fisheries (fiscal floor) – access-fee share of government revenue, which in some Pacific SIDS exceeds 30–40% of total government revenue
- ¶5 Ocean employment dependency, specifically in domestic processing, transshipment, and crewing
- ¶6 Livelihood vulnerability index for SSF-dependent coastal communities

¶7 **Application:** The dependency indicators inform the negotiation in three ways. First, the fish protein dependency ratio establishes the social floor below which domestic catch retained for local consumption must not fall. Second, the government revenue dependency indicator establishes the fiscal floor against which access-fee levels are evaluated, with the PNA Vessel Day Scheme benchmark prices as a defensible minimum. Third, the employment dependency in domestic processing and transshipment indicates whether the agreement should require minimum domestic landings, crewing, or transshipment to sustain shore-based employment, consistent with FAO Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries (the SSF Guidelines), Chapters 5 and 7<sup>56</sup>.

¶8 **Note on SNA 2025 asymmetry.** Under SNA 2025, output from a DWFN vessel is allocated to the residency of the vessel operator (the DWFN), whilst access fees received by the coastal state are recorded as resource rent. Conventional GDP accounting therefore systematically understates the economic significance of the resource to the coastal state. This is precisely the asymmetry that TG-2.3 dependency indicators are designed to surface: by quantifying domestic livelihood, protein, and revenue dependency on the resource, the indicators provide the evidence base that GDP accounts cannot. Distributional consequences for domestic SSF (gear conflict, stock pressure, displacement of local fleets) cross-reference Use Case 2 on just transition and, where relevant, the deferred Use Case 5.

¶9 **Policy outcome:** Access-agreement renewals in which the negotiating government has explicit, defensible floors for domestic catch retention, access-fee levels, and shore-based employment, replacing the present asymmetric position in which DWFNs are typically the better-resourced negotiating party.

### Use Case 9: Climate adaptation planning and NAP

¶1 **Decision context:** A government compiles a National Adaptation Plan (NAP) and prepares finance submissions to the Green Climate Fund, the Adaptation Fund, and the Loss and Damage Fund. The NAP needs ocean-dependent evidence over a 10–20 year planning horizon, aligned with the Nationally Determined Contribution (NDC) cycle.

#### ¶2 **Dependency indicators used:**

- ¶3 Livelihood vulnerability index components (exposure, sensitivity, adaptive capacity)
- ¶4 Ocean employment dependency ratio
- ¶5 Fish protein dependency ratio
- ¶6 Coastal protection dependency (Section 3.4 storm-mitigation service flow)
- ¶7 TG-2.1 ecosystem extent and condition indicators (biophysical input)

¶8 **Application:** A trajectory analysis overlays current dependency indicators against projected ecosystem condition. Projections are drawn from IPCC AR6 regional climate projections, down-scaled where available, and from national stock-status assessments under climate scenarios. The product of “today’s dependency” and “projected ecosystem trajectory” identifies populations and sectors with the greatest projected livelihood loss over the planning horizon, which in turn drives the NAP’s adaptation-investment prioritisation and the loss-and-damage component of climate-finance submissions.

#### ¶9 **Indicator → climate-finance criterion mapping:**

| TG-2.3 indicator                                            | NAP / climate-finance criterion                 |
|-------------------------------------------------------------|-------------------------------------------------|
| Livelihood vulnerability index                              | Particularly Vulnerable Group identification    |
| Ocean employment dependency × projected ecosystem condition | Just transition investment case                 |
| Fish protein dependency × projected stock trajectory        | Food-security adaptation investment case        |
| Coastal protection dependency × SLR projection              | Nature-based coastal protection investment case |

¶10 **Distinction from Use Case 2.** Use Case 2 (just transition for fisheries reform) addresses policy-triggered transition (a regulator-imposed reduction in total allowable catch). Use Case 9 addresses ecosystem-driven transition (climate-driven change in ecosystem condition), and is loss-and-damage oriented rather than reform-compensation oriented. Both use the same dependency indicators, whilst the trigger and the policy instrument differ.

¶11 **Data limitations.** Climate-projection-based use of dependency indicators must be presented as scenario ranges, not point estimates. The community sense-check protocol established in

Section 4.1.1 applies to the projected-change scenarios: communities have direct evidence on whether the trajectory implied by a climate scenario is consistent with their observation of stock, season, and storm patterns over the recent past, and this evidence must be capable of revising the scenario set used in the NAP.

¶12 **Policy outcome:** NAP investment portfolios and climate-finance submissions that are calibrated to projected dependency loss rather than to current-condition dependency alone, with explicit scenario uncertainty surfaced rather than collapsed into point estimates.

#### Use Case 10: TNFD nature-related disclosure

¶1 **Decision context:** A government statistical agency, regulator, or financial system supervisor uses national or sub-national dependency indicators to support the Taskforce on Nature-related Financial Disclosures (TNFD) LEAP framework<sup>57</sup> – Locate, Evaluate, Assess, Prepare – particularly the Locate and Evaluate phases at national and sub-national scale.

¶2 **Dependency indicators used:**

- ¶3 Spatial distribution of ocean employment and subsistence harvesting (Locate)
- ¶4 Fish protein dependency ratio by region (Evaluate)
- ¶5 Livelihood vulnerability index by coastal community (Evaluate)
- ¶6 Coastal protection dependency from Section 3.4 (Locate / Evaluate)

¶7 **Application:** National and sub-national TG-2.3 indicators serve as **screening inputs and contextual baselines** for TNFD-aligned disclosure at the entity level. They locate the high-dependency, high-vulnerability geographies that financial institutions and corporates should examine in greater detail under the Locate and Evaluate phases, and they provide the contextual baseline against which entity-level data are interpreted.

¶8 **Constraints on use.** Three constraints govern this use case and must be made explicit in any application:

1. ¶9 **Scale mismatch.** TG-2.3 indicators are compiled at national or sub-national scale. They do not, by themselves, satisfy project-level due diligence requirements. Where a district-level indicator flags a population as high-dependency or high-vulnerability, the appropriate response is finer-scale data collection at the affected community, not treatment of the national or district indicator as sufficient.
2. ¶10 **IFC PS7 is a safeguard standard, not a measurement framework.** TG-2.3 indicators inform the screening process by which Indigenous Peoples-related risk is identified. They do not meet PS7 obligations. PS7 obligations – including Free, Prior and Informed Consent – attach at the project level and to the entity undertaking the activity, and they require entity-level due diligence consistent with IFC PS7<sup>58</sup>.
3. ¶11 **Deferred-use-case boundary.** This use case must not pre-empt deferred Use Case 5 on Indigenous customary sea rights, particularly given the PS7 FPIC provisions. Any TNFD-disclosure application that engages Indigenous tenure, knowledge, or rights is bound by the principle stated under Use Case 5: drafting and use must be led by the communities concerned, with their authority over the text.

***Note on scope.** The scope of this use case – the extent to which TG-2.3 indicators can be used to support TNFD disclosure beyond screening, and the boundary between disclosure use and the deferred Indigenous use case – is to be confirmed in consultation with the GOAP Secretariat.*

¶12 **Policy outcome:** A defensible boundary for the use of national and sub-national ocean dependency indicators in TNFD-aligned disclosure: as screening inputs that direct entity-level due diligence rather than as substitutes for it.

## Use Case 11: Scenario analysis (cross-cutting)

¶1 **Decision context:** A government, regulator, or research institute requires a defensible mechanism for asking “what if” questions of the dependency indicator set – for example, “what would the ocean employment dependency ratio equal if the total allowable catch fell by 30%?” – without overstating the analytical confidence of the answer. The use case is cross-cutting: it sits alongside the policy-specific use cases above and supports them with a common scenario-analysis frame.

¶2 **Methodological frame.** This use case is framed as a sensitivity table, not a predictive model. The Circular’s stance against causal inference from cross-sectional dependency indicators (Section 3.6.5; Section 4.2) is preserved: a scenario analysis built on these indicators reports the magnitude of indicator change implied by a given input change, under stated and explicit assumptions, and does not represent itself as a forecast of the policy outcome.

¶3 **Indicator linkages.** A scenario passes through three Circulars in sequence: biophysical inputs from **TG-2.1 Biophysical Indicators** (stock, extent, condition); ecosystem service flows from **TG-3.2 Flows from Environment to Economy** (the service-flow transformation); and the social outcomes that TG-2.3 measures (employment, protein, vulnerability). All three core TG-2.3 indicators are addressed – the scenario frame is not restricted to a single indicator. The synthetic SIDS figures in Section 4.3 (40,500 direct ocean employment; 4,050 tonnes fish protein supply; vulnerability index 0.64) provide the parameter base for the worked scenarios below.

¶4 **Worked example – TAC reduction.** Using the Section 4.3 SIDS parameters, a 30% reduction in TAC propagates through the indicator set as follows. Direct ocean employment in fishing falls by approximately 3,600 jobs (30% of 12,000), reducing the ocean employment dependency ratio from 9.6% to approximately 8.8% before multiplier effects. The fish protein dependency ratio is re-computed against a reduced domestic catch input to the food balance sheet. Sensitivity to the trade response is large, and the scenario must report a range bounded by full import substitution at one end and unsubstituted domestic shortfall at the other. The livelihood vulnerability index increases through both the sensitivity channel (income dependence on a contracting sector) and, indirectly, through the adaptive-capacity channel as livelihood diversity is forced to adjust on a shortened time frame.

¶5 **Explicit limitations.**

- ¶6 The composite vulnerability index has no internationally agreed statistical endorsement. Scenario analysis using the index is therefore exploratory in character and must report the input weights, the normalisation choice, and the threshold classification used.
- ¶7 The multiplier estimates underlying induced and indirect employment in the Section 4.3 worked example must be validated against national input-output tables before being used in scenario analysis, consistent with **TG-3.3 Economic Activity**.
- ¶8 Scenario analysis on dependency indicators does not substitute for behavioural modelling of the response of fishers, processors, and households to the input change. It quantifies the indicator-level consequence of an assumed input change, not the dynamic response.

¶9 **Policy outcome:** A defensible cross-cutting tool for scenario interrogation of the dependency indicator set, preserving the Circular’s anti-causal stance while allowing decision-makers to bound the magnitude of indicator change implied by alternative input assumptions.

## 4.5 Spatial considerations

¶1 Livelihood dependencies are spatially concentrated in coastal communities, requiring attention to geographic disaggregation:

- ¶2 Compile indicators for coastal administrative units separately from national totals
- ¶3 Align social data boundaries with marine spatial units used in environmental accounts
- ¶4 Identify hotspots where high dependency coincides with ecosystem stress

## 4.6 Temporal considerations

¶1 Dependencies may vary seasonally (monsoon fishing patterns, tourism seasons) and change over time (shifts in employment structure, declining fish stocks). Time series data enable:

- ¶2 Identification of seasonal vulnerability periods
- ¶3 Tracking of long-term dependency trends
- ¶4 Assessment of livelihood transitions

## 5. Acknowledgements

¶1 **Authors:** [To be confirmed]

¶2 **Reviewers:** [To be confirmed]

## 6. References

¶1 **Section 3.4 (illustrative composite) references:**

- ¶2 Arkema, K. K. et al. (2013). "Coastal habitats shield people and property from sea-level rise and storms." *Nature Climate Change* 3: 913–918.
- ¶3 McGranahan, G., Balk, D., & Anderson, B. (2007). "The rising tide: assessing the risks of climate change and human settlements in low elevation coastal zones." *Environment and Urbanization* 19(1): 17–37.
- ¶4 Adger, W. N. et al. (2005). "Successful adaptation to climate change across scales." *Global Environmental Change* 15(2): 77–86.
- ¶5 Brooks, N., Adger, W. N., & Kelly, P. M. (2005). "The determinants of vulnerability and adaptive capacity at the national level and the implications for adaptation." *Global Environmental Change* 15(2): 151–163.
- ¶6 Tol, R. S. J. & Yohe, G. W. (2004). "The weakest link hypothesis for adaptive capacity: an empirical test." Working paper.
- ¶7 Beck, M. W. & Lange, G.-M. (eds) (2016). *Managing Coasts with Natural Solutions: Guidelines for Measuring and Valuing the Coastal Protection Services of Mangroves and Coral Reefs*. World Bank WAVES Technical Paper. <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/995341472708337982> (<https://documents.worldbank.org/en/publication/documents-reports/documentdetail/995341472708337982>).
- ¶8 Menéndez, P., Losada, I. J., Beck, M. W., et al. (2018). "Valuing the protection services of mangroves at national scale: The Philippines." *Ecosystem Services* 34: 24–36. <https://doi.org/10.1016/j.ecoser.2018.09.005> (<https://doi.org/10.1016/j.ecoser.2018.09.005>).
- ¶9 Australian Bureau of Statistics (2022). *National Ecosystem Accounts: Experimental Estimates, Methodology – coastal protection account*. <https://www.abs.gov.au/methodologies/national-ecosystem-accounts-experimental-estimates-methodology/2020-21> (<https://www.abs.gov.au/methodologies/national-ecosystem-accounts-experimental-estimates-methodology/2020-21>).
- ¶10 Guannel, G. et al. InVEST Coastal Vulnerability Model documentation (Natural Capital Project, Stanford University).
- ¶11 Climate Central. CoastalDEM high-resolution coastal digital elevation product.

### FOOTNOTES

1. ¶1 FAO, The State of World Fisheries and Aquaculture 2024. Globally, fisheries and aquaculture employ over 60 million people, with hundreds of millions more dependent on the sector for nutrition and livelihoods.
2. ¶2 Burnside, D. (2026). *Integrated Ocean-Poverty Account Framework*. Working paper; cited illustrative cases (Inhambane Bay; Lake Illawarra; Nippon Causeway / Tarawa) provide the empirical motivation for the poverty-allevi-

ation framing and integration-with-existing-survey-systems approach adopted in Section 1, Section 4.1.2, and Use Case 6.

3. ¶3 UNDRR (2015). *Sendai Framework for Disaster Risk Reduction 2015-2030*. Adopted by the UN General Assembly in resolution A/RES/69/283. The Framework provides the policy reference under which TG-2.3 dependency indicators feed disaster risk reduction, resilience planning, and Loss & Damage processes (see Use Case 6).
4. ¶4 United Nations, Transforming our world: the 2030 Agenda for Sustainable Development, SDG Target 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."
5. ¶5 United Nations, Transforming our world: the 2030 Agenda for Sustainable Development, SDG Target 14.7.
6. ¶6 United Nations et al. (2025). *System of National Accounts 2025*, Chapter 16 on Labour. Provides comprehensive guidance on employment status, remuneration of employees, and the distinction between formal and informal employment.
7. ¶7 SEEA Ecosystem Accounting, para. 2.15. "Benefits are the goods and services that are ultimately used and enjoyed by people and society. The benefits to which ecosystem services contribute may be captured in current measures of production (e.g. food, water, energy, recreation) or may be outside such measures."
8. ¶8 SEEA Ecosystem Accounting, para. 2.14. "Ecosystem services are the contributions of ecosystems to the benefits that are used in economic and other human activity."
9. ¶9 SF-MST, para. 1.1. "Given the range of direct and indirect effects and the wide spectrum of stakeholders involved, there is a need for an integrated approach to tourism development, management and monitoring."
0. ¶10 *System of National Accounts 2025*, Preface. The 2025 SNA broadens the national accounts framework "to better account for elements affecting wellbeing and sustainability."
1. ¶11 SF-MST, para. 2.57. The framework distinguishes "direct effects" from "indirect and induced effects" for measuring sustainability.
2. ¶12 SEEA Ecosystem Accounting, para. 2.31.
3. ¶13 SF-MST, Chapter 3. "Linkages between measures of employment in tourism" provides detailed guidance adaptable to ocean sector employment.
4. ¶14 United Nations, Global indicator framework for SDGs, Indicator 14.7.1.
5. ¶15 United Nations, 2030 Agenda for Sustainable Development, SDG Target 2.3.
6. ¶16 SEEA for Agriculture, Forestry and Fisheries, para. 2.
7. ¶17 United Nations, 2030 Agenda for Sustainable Development, SDG Target 8.9.
8. ¶18 SF-MST, para. 5.80.
9. ¶19 SF-MST, para. 2.57.
0. ¶20 SF-MST, para. 2.58.
1. ¶21 SF-MST, para. 2.58.
2. ¶22 *System of National Accounts 2025*, Chapter 16 on Labour. Provides comprehensive guidance on employment status, remuneration of employees, and the treatment of self-employed and informal workers in national accounts.
3. ¶23 SF-MST, Table 5.3.
4. ¶24 FAO, *The State of World Fisheries and Aquaculture 2024*. Fish provides over 3.3 billion people with at least 20% of their average animal protein intake.
5. ¶25 Hicks et al. (2019), "Harnessing global fisheries to tackle micronutrient deficiencies." *Nature* 574: 95-98.
6. ¶26 United Nations, 2030 Agenda for Sustainable Development, SDG Target 2.1.
7. ¶27 SEEA Ecosystem Accounting, Table 6.3.
8. ¶28 SEEA Ecosystem Accounting, para. 2.15. "The benefits to which ecosystem services contribute may be captured in current measures of production (e.g. food, water, energy, recreation) or may be outside such measures (e.g. clean water, clean air, flood protection)."
9. ¶29 United Nations, 2030 Agenda for Sustainable Development, SDG Target 14.b.
0. ¶30 *System of National Accounts 2025*, guidance on own-account production.
1. ¶31 FAO, *Food Security Framework*.
2. ¶32 SEEA Ecosystem Accounting (UN et al., 2021; consolidated edition December 2024), Table 6.3. The previously combined "water flow regulation for mitigating river and coastal flooding" service is split into three reference services: Water flow regulation, Flood control, and Storm mitigation. Coastal protection services sit under Flood control services; Storm mitigation services are explicitly confined to storms "other than water-related events". See [https://seea.un.org/sites/seea.un.org/files/documents/EA/seea\\_ea\\_f124\\_web\\_12dec24.pdf](https://seea.un.org/sites/seea.un.org/files/documents/EA/seea_ea_f124_web_12dec24.pdf) ([https://seea.un.org/sites/seea.un.org/files/documents/EA/seea\\_ea\\_f124\\_web\\_12dec24.pdf](https://seea.un.org/sites/seea.un.org/files/documents/EA/seea_ea_f124_web_12dec24.pdf)).
3. ¶33 SEEA Ecosystem Accounting, Chapter 7 (physical supply-and-use tables, SPA/SBA structure) and Chapter 9 §9.3.6 (expected-expenditure / avoided-damage methods) and §9.4 (service-specific valuation). The forward-references in this section to a future Accounting for People Circular (post-September 2026) and the GOAP Social Accounts methodology supplement, rather than replace, SEEA-EA guidance.
4. ¶34 SEEA Ecosystem Accounting, para. 6.51.
5. ¶35 SEEA Ecosystem Accounting, Table 6.3, row 18.
6. ¶36 SEEA Ecosystem Accounting, Table 6.3, entry for "Recreation-related services."
7. ¶37 SEEA Ecosystem Accounting, Table 6.3, row 19.
8. ¶38 SEEA Ecosystem Accounting, Table 6.3, rows 21-22.

9. ¶39 SEEA Ecosystem Accounting, Table 6.3, rows 20, 23.
0. ¶40 TNFD Recommendations, Box 1.
1. ¶41 United Nations, 2030 Agenda for Sustainable Development, SDG Target 14.7.
2. ¶42 SEEA Ecosystem Accounting, para. 1.66. “Measuring the Sustainability of Tourism website...provides guidance on linking ecosystem accounting to measures of tourism activity.”
3. ¶43 IPCC, 2022, Annex II: Glossary.
4. ¶44 United Nations, 2030 Agenda for Sustainable Development, SDG Target 14.2.
5. ¶45 United Nations, 2030 Agenda for Sustainable Development, SDG Target 1.5.
6. ¶46 United Nations, Global indicator framework for SDGs, Indicator 1.3.1 measures “Proportion of population covered by social protection floors/systems.” SDG 1.3.1 is distinct from the poverty headcount ratio (SDG 1.1.1 / 1.2.1), which measures the prevalence of poverty rather than the institutional coverage of social protection.
7. ¶47 SF-MST, para. 2.6.
8. ¶48 GOAP Social Accounts methodology. The community sense-checking protocol in Section 4.1.1 and Section 4.2 is consistent with the disaggregated-consultation quality assurance approach established in that methodology, which treats disaggregated consultation as a quality assurance requirement rather than a procedural courtesy.
9. ¶49 A future GOAP **Accounting for People Circular** (planned post-September 2026) will provide the consolidated standard for socially-disaggregated indicators of ocean dependency, including community sense-checking protocols. Until then, this Circular records community-identified indicators added through Section 4.2 Step 3 supplementation as candidates for inclusion in that future Circular.
0. ¶50 Ehler, C. and Douvère, F. (2009). *Marine Spatial Planning: a step-by-step approach toward ecosystem-based management*. Intergovernmental Oceanographic Commission and Man and the Biosphere Programme. IOC Manual and Guides No. 53, ICAM Dossier No. 6. UNESCO.
1. ¶51 UNESCO-IOC / European Commission (2021). *MSPglobal International Guide on Marine/Maritime Spatial Planning*. IOC Manuals and Guides No. 89.
2. ¶52 International Finance Corporation (2012). *Performance Standard 5: Land Acquisition and Involuntary Resettlement*. PS5 paragraphs 27 and 28 are referenced in Use Case 7 for particularly-vulnerable identification and livelihood-restoration baselines respectively.
3. ¶53 Equator Principles Association (2020). *The Equator Principles IV*.
4. ¶54 Pacific Islands Forum Fisheries Agency. *Vessel Day Scheme*. See <https://www.ffa.int/> (<https://www.ffa.int/>).
5. ¶55 Parties to the Nauru Agreement (PNA) Office. PNA Office minimum benchmark price for vessel days under the Vessel Day Scheme.
6. ¶56 FAO (2015). *Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication* (the SSF Guidelines), particularly Chapters 5 (Governance of tenure in small-scale fisheries and resource management) and 7 (Value chains, post-harvest and trade).
7. ¶57 Taskforce on Nature-related Financial Disclosures (2023). *Recommendations of the Taskforce on Nature-related Financial Disclosures*, including the LEAP approach (Locate, Evaluate, Assess, Prepare) and the Metrics and Targets pillar.
8. ¶58 International Finance Corporation (2012). *Performance Standard 7: Indigenous Peoples*. Including the Free, Prior and Informed Consent provisions referenced in Use Case 10 and the boundary condition vis-à-vis deferred Use Case 5.