

Pollution and Other Flows to Environment

Provides operational guidance on compiling indicators of pollution and other flows from the economy to the marine and coastal environment.

Version 0.7.2 **Status** Draft **Stability** Applied

Last updated September 2026 **Responsible officer** Dr Jordan Gacutan

Drafting AI-assisted drafting from GOAP Secretariat source materials; source list to be published at the close of consultation.

OUTCOME

This Circular provides operational guidance on compiling indicators of pollution and other flows from the economy to the marine and coastal environment. These indicators support evidence-based decision-making for marine spatial planning, pollution control programmes, environmental impact assessment, and SDG 14.1 reporting. Upon completing this Circular, readers will understand how to derive pollution indicators from the residual flow accounts compiled using [TG-3.4 Flows from Economy to Environment](#), construct composite indices for marine pollution assessment, and calculate intensity and efficiency indicators that link economic activity to environmental pressures.

CONTENTS

1. Outcome	3
2. Requirements	3
3. Guidance Material	3
3.1 Pollution Indicator Framework	3
3.2 Compilation Procedure: From PSUT to Marine Indicators	5
3.3 Marine Pollution Indicators	8
3.4 Marine Litter Indicators	11
3.5 Atmospheric Deposition Indicators	13
3.6 Intensity and Efficiency Indicators	15
3.7 Worked Example: Coastal Zone Nutrient Loading Indicator	17
4. Data Sources and Compilation	18
5. Implementation Considerations	18
Prioritisation	19
Indicator presentation and communication	20
6. Acknowledgements	20
7. References	20

ABOUT THIS CIRCULAR

RECOMMENDED CITATION

Pollution and Other Flows to Environment (2026) (GOAP Technical Guidance on Ocean Accounting, TG-2.7, v0.7.2). GOAP Secretariat.
<https://guidance.oceanaccounts.org/circulars/section-2/2-7-pollution-flows/>

© 2026 Global Ocean Accounts Partnership. Licensed under CC BY-NC 4.0.

DRAFT

¶1 ⓘ Framework Position

¶2 TG-2.7 sits at the boundary between the residual flow accounts compiled in **TG-3.4 Flows from Economy to Environment** and the policy applications addressed in **TG-1.6 OA and Environmental Impact Assessment** and **TG-2.8 Climate Change Indicators**: the Circular converts accounting data on pollution flows into decision-relevant indicators. The indicators produced through this Circular feed directly into marine spatial planning, SDG 14.1 reporting, and environmental impact assessment processes.

1. Outcome

¶1 This Circular provides operational guidance on compiling indicators of pollution and other flows from the economy to the marine and coastal environment. These indicators support evidence-based decision-making for marine spatial planning, pollution control programmes, environmental impact assessment, and SDG 14.1 reporting¹. Upon completing this Circular, readers will understand how to derive pollution indicators from the residual flow accounts compiled using **TG-3.4 Flows from Economy to Environment**, construct composite indices for marine pollution assessment, and calculate intensity and efficiency indicators that link economic activity to environmental pressures.

2. Requirements

¶1 This Circular requires familiarity with:

- ¶2 **TG-0.1 General Introduction to Ocean Accounts** – for the conceptual framework and key components of Ocean Accounts
- ¶3 **TG-0.2 Overview of Relevant Statistical Standards** – for the methodological foundations provided by SNA 2025, SEEA CF, and SEEA EA that underpin both the residual flow accounts and the indicator derivation methods in this Circular
- ¶4 **TG-3.4 Flows from Economy to Environment** – for the accounting framework and compilation methods for residual flows to the marine environment

3. Guidance Material

3.1 Pollution Indicator Framework

¶1 The SEEA Central Framework supports indicator derivation through combined presentations that juxtapose physical flows with economic data². For marine pollution, this framework can be extended to address the specific characteristics of ocean-related residual flows, as in Figure 2.7.1³.

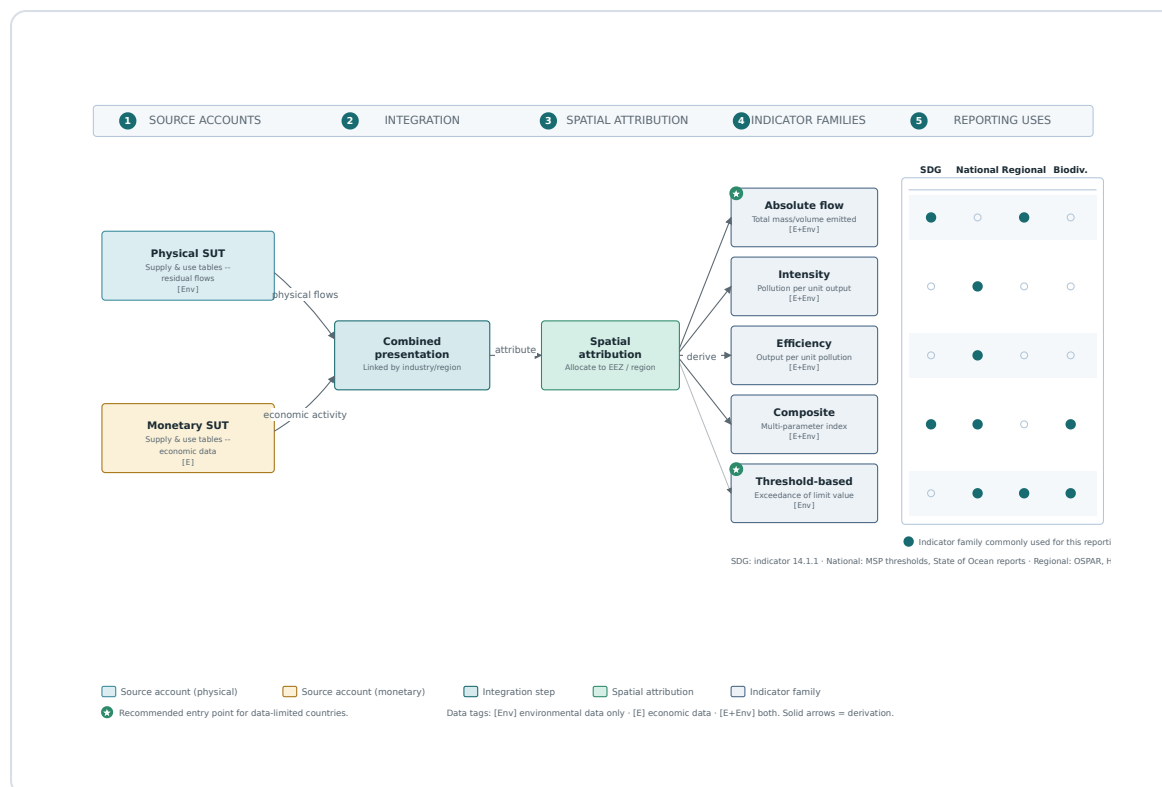


Figure 2.7.1 Physical and monetary accounts combine into five indicator families mapped to common reporting destinations. Tags: [Env], [E], [E+Env]. Stars mark recommended entry points under limited data.

Source: TG-2.7, Section 3 (accounts-to-indicators derivation) and Section 4 (indicator-family mapping).

Typology of pollution indicators

¶1 Marine pollution indicators can be classified into the categories summarised in Table 3.1.1 below.

Category	Description
Absolute flow indicators	Total quantities of pollutants discharged or emitted to the marine environment, measured in physical units (tonnes, kilograms). These indicators directly derive from the physical supply tables in residual flow accounts and provide the foundation for assessing total environmental pressure.
Intensity indicators	Ratios that relate pollution flows to measures of economic activity, such as emissions per unit of gross value added or waste generated per unit of output. Intensity indicators enable assessment of whether pollution is increasing or decreasing relative to economic scale ⁴ .
Efficiency indicators	Measures of how effectively economic processes convert inputs to outputs while minimising waste generation. These include material productivity (GDP per unit of material consumed) and emission efficiency (output per unit of emissions).
Composite indices	Aggregated measures that combine multiple pollution parameters into single indices for communication and monitoring purposes. SDG indicator 14.1.1 (Index of coastal eutrophication and floating plastic debris density) exemplifies this approach ⁵ .
Threshold-based indicators	Measures that assess pollution levels against environmental quality standards or ecological thresholds, enabling assessment of exceedance frequency and magnitude.

Linking accounts to indicators

¶1 The derivation of indicators from accounts follows the structured process summarised in Table 3.1.2 below.

Step	Description
Select relevant account entries	Identify the physical flow data from residual flow accounts corresponding to the indicator scope (e.g., nutrient emissions to coastal waters).
Determine appropriate denominators	For intensity indicators, identify the economic or production variable (output, value added, employment) to use as denominator.
Establish spatial and temporal scope	Define the geographic boundary (coastal zone, EEZ, specific water bodies) and reference period.
Apply aggregation or weighting	For composite indices, determine the aggregation method and any weights reflecting relative importance or impact of different pollutants.
Document metadata and methods	Ensure indicator derivation is transparent and reproducible, supporting quality assessment per TG-0.7 Quality Assurance .

¶12 The FDES 2013 Basic Set of Environment Statistics identifies specific statistics related to emissions and waste that can inform indicator development, organised under Component 3: Residuals⁶. These include emissions of greenhouse gases by sector, generation and pollutant content of wastewater, discharge of wastewater to the environment, and generation and management of waste. The FDES 2013 Core Set of Environment Statistics provides a prioritised subset of the Basic Set, and compilers should note which indicators in this Circular align with Core Set statistics, as the Core Set carries the priority for international comparability⁷.

¶13 **Scope boundary – physical disturbance flows:** Physical disturbance flows (underwater noise, dredging, sediment disturbance, habitat modification) are outside the scope of this Circular. Indicator and compilation guidance for these flows is addressed in **TG-2.1 Aggregate Biophysical Indicators** and **TG-3.4 Flows from Economy to Environment**, Section 3.3.

3.2 Compilation Procedure: From PSUT to Marine Indicators

Step 1: Identify pollutant categories in residual flow accounts

¶1 The SEEA CF physical supply-use table for residuals records flows by substance or material type. For marine pollution indicators, compilers should extract the following categories from the PSUT:

¶12 **Water emissions:**

- ¶13 Nutrients: nitrogen compounds (nitrates, ammonia), phosphorus compounds
- ¶14 Organic pollutants: biological oxygen demand (BOD), chemical oxygen demand (COD)
- ¶15 Heavy metals: mercury, cadmium, lead, copper, zinc
- ¶16 Persistent organic pollutants (POPs): as listed under Stockholm Convention
- ¶17 Hydrocarbons: oil and petroleum products

¶18 **Air emissions with marine deposition:**

- ¶19 Nitrogen oxides (NO_x) and ammonia (NH₃) – contributing to marine eutrophication via atmospheric deposition
- ¶20 Sulphur oxides (SO_x) – affecting ocean chemistry
- ¶21 Carbon dioxide (CO₂) – driving ocean acidification
- ¶22 Mercury – depositing to marine waters and bioaccumulating in food webs

¶13 **Solid waste to marine environment:**

- ¶14 Plastics: by polymer type where data allow (PE, PP, PS, PET, PVC)
- ¶15 Marine litter: fishing gear (ALDFG), vessel waste, coastal litter
- ¶16 Microplastics: primary (industrial pellets, microbeads) and secondary (fragmented waste)

¶17 The SEEA CF Table 3.18 provides the general structure for recording solid waste flows by source and destination⁸. For marine litter accounting, the “waste to environment” category is disaggregated to distinguish waste reaching marine waters from other environmental destinations.

Step 2: Extract flows from PSUT by industry source

¶1 The physical supply table records residual generation by economic unit (industries classified by ISIC and households). For each pollutant category, compilers extract:

- ¶2 Total generation by industry (tonnes per year)
- ¶3 Industry classification (ISIC Rev.4 or national adaptation)
- ¶4 Distinction between point sources (identifiable discharge locations) and diffuse sources (distributed over area)

¶5 **Example extraction for nutrient emissions:**

ISIC	Industry	N discharge (tonnes)	P discharge (tonnes)	Source type
0111	Cultivation of cereals	15,240	2,850	Diffuse
0321	Marine aquaculture	1,850	420	Point & diffuse
1020	Fish processing	650	180	Point
3600	Water collection & treatment	8,200	1,100	Point
HH	Households	6,500	950	Point & diffuse

¶6 **Household residuals – boundary with municipal treatment systems:** Household generation should be recorded gross (before treatment) under the HH row as the total nutrient load generated at the household level. Treated discharge should be attributed to the wastewater treatment plant operator (ISIC 3600) to avoid double-counting household flows that have already been captured in the treatment system. Where PSUTs do not disaggregate household flows from mixed municipal or residential categories, compilers should estimate household nutrient generation using population and per-capita nutrient excretion coefficients. National coefficients should be used where available. In their absence, indicative values from SEEA CF Box 3.2 provide a starting point. The resulting estimates should be flagged with the appropriate TG-0.7 quality codes to document the estimation method⁹.

¶7 When extracting flows for maritime NOx indicators (used in the atmospheric deposition calculation in Step 3), compilers must exclude inland water transport (ISIC 5021–5022) from the maritime-destined atmospheric deposition sub-total. For the full scope definition of maritime NOx emissions, including the rationale for this exclusion, see the Maritime NOx indicator specification in Section 3.5.

¶8 The SEEA CF methodology for recording solid waste flows by source and destination is described in SEEA CF paras 3.268–3.277. For the general principles of attributing residual flows to source industries within the physical supply-use framework, see SEEA CF paras 3.99–3.109. Attribution should record flows to the industry that generates the residual rather than the industry that manages or treats it, and this attribution should be applied consistently across pollutant categories (unless treatment is incomplete and residuals are released).

Step 3: Apply spatial attribution to identify marine-destined flows

¶1 Not all residuals recorded in the PSUT reach the marine environment. Spatial attribution requires:

¶2 **Hydrological connectivity analysis** – identify catchments that drain to coastal waters, and estimate nutrient transport coefficients accounting for in-stream retention:

$$\text{Marine load} = \text{Catchment generation} \times \text{Delivery ratio}$$

¶3 Delivery ratios typically range from 0.05 to 0.40 depending on distance to coast, soil type, vegetation cover, and retention in waterways. Higher delivery ratios apply to short, steep catchments with limited riparian buffers. Lower ratios apply to flat, heavily vegetated catchments where significant in-stream retention occurs. Compilers should select the delivery ratio method from the following four-level tiered protocol, applied in order of preference:

1. ¶4

Tier 1 – Modelled national or OECD ratios: Use ratios derived from national hydrological models or OECD Gross Nitrogen Balance guidance where these are available and applicable to the catchment hydrology. The OECD Gross Nitrogen Balance methodology provides guidance on estimating nutrient delivery from agricultural catchments to receiving waters¹⁰. This tier applies primarily to temperate agricultural systems in OECD member states.

2. ¶5

Tier 2 – Regional sea or river-basin studies: Where OECD or national modelled ratios are unavailable or not applicable (e.g., small island states, tropical coastlines, monsoon-dominated basins), use delivery ratios from regional sea assessments or peer-reviewed river-basin studies covering comparable hydrological and geomorphological conditions.

3. ¶6

Tier 3 – Simplified export-coefficient approaches: Where neither Tier 1 nor Tier 2 sources are available, apply simplified export-coefficient methods – for example, USGS SPARROW model coefficients adapted for tropical catchments, or FAO Land and Water Division guidance on nutrient export coefficients for tropical agriculture¹¹. These methods are less precise but documented and reproducible.

4. ¶7

Tier 4 – Low-confidence documented fallback: Where no validated source is available, assume a delivery ratio consistent with the general range (0.05–0.40), document the assumed value and its justification, and flag the resulting indicator as low-confidence using the appropriate TG-0.7 quality codes. Do not use undocumented or arbitrary coefficients.

¶8 **Direct discharge identification** – for point sources (wastewater treatment plants, industrial outfalls), use administrative records to identify facilities discharging to coastal waters versus inland waters.

¶9 **Atmospheric transport modelling** – for air emissions, use atmospheric deposition models (e.g., EMEP, GEOS-Chem) to estimate the fraction depositing to marine waters within the EEZ. Where atmospheric models are unavailable, compilers may use deposition budget outputs published by regional sea conventions – for example, HELCOM Pollution Load Compilation or OSPAR deposition budget assessments – as documented simplified sources applicable to their regional context¹². If no validated method is available for the compiler's region, atmospheric deposition should be reported as "not compiled" rather than estimated with undocumented coefficients. Omitting this component is preferable to introducing unverifiable estimates, and the absence should be noted in the indicator metadata.

¶10 **Marine litter leakage rates** – estimate the fraction of mismanaged waste reaching marine waters using methodologies such as Jambeck et al. (2015)¹³, which incorporates coastal population, waste management infrastructure, and proximity to shore.

Step 4: Compute indicator values

¶1 With marine-attributed flows identified, compute indicator values:

¶2 **Absolute indicators:**

$$\text{Total marine nutrient loading} = \text{Sum of N flows to marine waters (tonnes N/yr)}$$
¶3 **Intensity indicators:**

$$\text{Nutrient intensity} = \text{Marine nutrient loading} / \text{Ocean economy GVA (kg N per million currency)}$$

¶4 The ocean economy GVA denominator is compiled as described in **TG-3.3 Economic Activity Relevant to the Ocean**, ensuring consistency between the numerator (pollution) and denominator (economic activity driving pollution).

¶5 **Spatial indicators:**

$$\text{Nutrient loading density} = \text{Marine nutrient loading} / \text{Coastal zone area (kg N per km}^2\text{)}$$
¶6 **Temporal indicators:**

$$\text{Loading change rate} = (\text{Current year loading} - \text{Base year loading}) / \text{Base year loading}$$
Step 5: Quality assessment and uncertainty quantification

¶1 Pollution indicators inherit uncertainty from multiple sources: measurement error in residual flow accounts, uncertainty in spatial attribution (delivery ratios, atmospheric deposition fractions), and sampling variability in monitoring data. Indicators compiled via spatial attribution carry multiplicative uncertainty that compounds across the delivery ratio, deposition fraction, and leakage rate assumptions. Compilers should:

- ¶2 Document methods and assumptions for each step
- ¶3 For each key spatial attribution assumption (delivery ratio, atmospheric deposition fraction, marine leakage rate), document the uncertainty range or plausible bounds
- ¶4 Compute the indicator under low and high assumption scenarios to derive an uncertainty range
- ¶5 Present the central estimate alongside its uncertainty range, and do not publish a single-point estimate without indicating the plausible range
- ¶6 Apply a standard multiplicative uncertainty propagation formula – for example, the approach described in JCGM 100:2008 (GUM) for combined uncertainty in indirect measurements¹⁴
- ¶7 Validate indicator trends against independent monitoring data (e.g., compare estimated nutrient loads with measured concentrations in coastal waters)
- ¶8 Apply quality flags following **TG-0.7 Quality Assurance**

¶9 The SEEA CF principle of recording flows at the point of generation (rather than point of ultimate environmental impact) means that accounts-based indicators measure pressure rather than state. Compilers should clearly communicate that nutrient loading indicators, for example, represent inputs to marine waters, not resulting water quality. The link between loading (pressure) and concentration (state) depends on hydrodynamic dilution, biological uptake, and other factors addressed in ecosystem condition accounts.

3.3 Marine Pollution Indicators**Nutrient pollution indicators**

¶1 Nutrient pollution (nitrogen and phosphorus compounds) contributes to coastal eutrophication and is addressed by SDG Target 14.1, with indicator 14.1.1 including a coastal eutrophication index^{15, 16}.

¶2 **Recommended nutrient indicators:**

Indicator	Definition	Unit	Source Data	Compilation Note
Total nitrogen discharge to coastal waters	Sum of nitrogen compounds discharged to coastal and marine waters from point and non-point sources	tonnes N/year	Water emissions account	Apply delivery ratios to catchment sources
Total phosphorus discharge to coastal waters	Sum of phosphorus compounds discharged to coastal and marine waters from point and non-point sources	tonnes P/year	Water emissions account	Apply delivery ratios to catchment sources
Agricultural nutrient surplus to coastal zones	Excess of nutrient inputs over crop uptake in coastal catchments	kg N/ha, kg P/ha	Agricultural statistics, land cover data	Use OECD Gross Nutrient Balance method
Nutrient loading intensity	Nutrient discharge per unit coastal zone area	kg N/km ² , kg P/km ²	Water emissions account, spatial data	Compare to ecological thresholds
Wastewater nutrient discharge	Nutrient load in treated and untreated wastewater discharged to marine waters	tonnes N/year, tonnes P/year	Wastewater discharge records	Distinguish by treatment level

¶3 The OECD/Eurostat Gross Nitrogen Balances and Gross Phosphorus Balances methodologies provide standardised approaches for calculating agricultural nutrient balances that can be applied to coastal catchments¹⁰. The SEEA Agriculture, Forestry and Fisheries (SEEA AFF) guidance extends these methodologies within an accounting framework¹⁷.

¶4 Compilation of nutrient indicators should:

- ¶5 Distinguish between point sources (industrial and municipal discharges with identifiable locations) and diffuse sources (agricultural runoff, urban stormwater)
- ¶6 Apply appropriate models or coefficients to estimate nutrient transport from catchments to coastal waters, accounting for in-stream retention and transformation
- ¶7 Attribute emissions to industries using ISIC classification, enabling analysis of sectoral contributions

¶8 The relationship between nutrient loading indicators (pressure) and marine ecosystem condition indicators such as dissolved oxygen levels, chlorophyll-a concentrations, and habitat quality scores is addressed in **TG-2.1 Aggregate Biophysical Indicators**. Understanding this pressure-state linkage is central to interpreting nutrient indicators in a policy context.

Chemical pollution indicators

¶1 **Recommended chemical pollution indicators**, following the FDES basic set for releases of chemical substances¹⁸:

Indicator	Definition	Unit	Source Data	Compilation Note
Heavy metal discharges	Discharge of specified heavy metals (Hg, Cd, Pb, Cu, Zn) to coastal and marine waters	kg/year by metal	Pollution inventories, industrial discharge records	Priority: Hg, Cd, Pb per Stockholm/Minamata Conventions. Each substance must be recorded individually; do not aggregate with equivalence weights unless specifically required for a reporting framework. Monitoring registry data (e.g., E-PRTR equivalents) may substitute for PSUT-sourced values where PSUT disaggregation to substance level is not available; document the substitution and flag with TG-0.7 quality codes. For unmeasured substances, report as “not compiled” rather than zero. See SEEA CF Table 3.18 for the row/column structure required for substance-level disaggregation ⁸ .
POPs discharges	Discharge of persistent organic pollutants to marine waters	kg/year by substance	Chemical release inventories	Stockholm Convention substances. Record each substance individually per SEEA CF Table 3.18. Monitoring registry data may substitute for PSUT-sourced values; document substitution and apply TG-0.7 quality flags.
Antifouling compound release	Estimated release of antifouling biocides from vessel hulls	kg/year	Vessel registry, coating data	Tributyltin (TBT) and copper-based

¶12 For indicators of oil and petroleum product discharges to marine waters, see the Hydrocarbon pollution indicators sub-section below.

¶13 The measurement of chemical pollutants presents challenges due to the large number of substances, varying analytical methods, and difficulty in estimating diffuse sources. The European Pollutant Release and Transfer Register (E-PRTR) and similar national registries provide models for point source reporting¹⁹. For ocean accounting, priority should be given to chemicals:

- ¶14 Subject to international regulation (Stockholm Convention POPs, Minamata Convention mercury)
- ¶15 Of particular concern for marine ecosystems (tributyltin, microplastics)
- ¶16 With established monitoring and reporting systems

¶17 **Data-scarce context – countries without a Pollutant Release and Transfer Register (PRTR):** Many national statistical offices, particularly in developing countries and small island states, have no PRTR or equivalent national registry. In these contexts, a minimum compilation approach comprises: (1) use UNEP GEMS/Water global water quality monitoring data as a proxy for point-source chemical concentrations where available; (2) estimate emissions using sectoral activity data (mining output volumes, industrial production indices) combined with substance-specific emission factors from IPCC/EMEP emission factor compilations; (3) flag all estimates compiled without PRTR data using the appropriate TG-0.7 quality codes to communicate data source limitations. The UNEP Guidance on Developing National Pollutant Release and Transfer Registers (2006)²⁰ sets out a capacity-building pathway toward establishing national systems. Even partial indicators compiled under this approach contribute to international comparability and SDG reporting coverage, and data scarcity alone is not grounds for omitting them.

Hydrocarbon pollution indicators

¶11 Recommended hydrocarbon indicators:

Indicator	Definition	Unit	Source Data	Compilation Note
Operational oil discharge from vessels	Oil discharged through normal vessel operations	tonnes/year	Port reception facility records (IMO GISIS database ²¹); vessel surveys for compliant at-sea discharges	MARPOL Annex I scope: Machinery space (bilge water) discharges are governed by MARPOL Annex I Regulation 15 (effluent must not exceed 15 ppm; vessels ≥400 GT must have approved oily water separators). Cargo tank washing discharges from oil tankers are governed by MARPOL Annex I Regulation 34 (effluent must not exceed 15 ppm; discharge only outside special areas and >50 nm from land). Port reception facility records capture discharges that are off-loaded; legally compliant at-sea discharges (≤15 ppm) are not required to be offloaded and represent a systematic data gap that should be acknowledged in the indicator metadata.
Accidental oil spills	Volume of oil released through accidental spills	tonnes/year; number of spills	Maritime incident records (EMSA datasets, IMO GISIS)	Distinguish by spill size class. MARPOL Annex I reporting.
Offshore operational discharge	Oil in produced water and other discharges from offshore installations	tonnes/year	Operator reporting	Link to offshore energy accounts
Land-based hydrocarbon runoff	Oil entering marine waters from urban and industrial runoff	tonnes/year	Estimated from land use and runoff models	High uncertainty; validate with monitoring

¶2 The ratio of accidental spills to total oil transport provides an indicator of maritime safety performance, whilst the trend in operational discharges indicates progress in compliance with MARPOL regulations²².

¶3 For offshore petroleum activities, additional guidance on accounting for operational discharges is provided in **TG-3.10 Offshore Energy**. The broader context of marine litter (including oil-contaminated debris) is addressed in **TG-6.12 Marine Litter and Plastics Accounting**.

3.4 Marine Litter Indicators

¶1 SDG Target 14.1 addresses marine debris, with indicator 14.1.1 including floating plastic debris density²³. The Intergovernmental Negotiating Committee (INC) process under UNEA Resolution 5/14 has been working toward a global plastics treaty²⁴. Compilers should monitor the outcomes of INC sessions for potential new mandatory reporting requirements on plastic waste that may affect indicator specifications in future revisions of this Circular.

Plastic pollution indicators

¶1 **Recommended plastic pollution indicators:**

Indicator	Definition	Unit	Source Data	Compilation Note
Plastic waste generation	Total plastic waste generated by all sources	tonnes/year	Waste statistics	Disaggregate by polymer type where possible
Mismanaged plastic waste	Plastic waste not properly disposed or recycled	tonnes/year	Waste management statistics	Share of total generation
Plastic leakage to ocean	Estimated plastic waste entering marine environment	tonnes/year	Modelling (Jambeck methodology) ¹³	Apply coastal leakage coefficients; see uncertainty note below
Coastal plastic waste intensity	Plastic waste generated per km of coastline	tonnes/km/year	Waste statistics, coastal length	Identify hot-spots
Beach litter density	Count or mass of litter per beach survey area	items/m ² , kg/m ²	Beach survey programmes	OSPAR/HELCOM protocols
Floating debris density	Density of floating debris in surface waters	items/km ²	At-sea visual surveys	SDG 14.1.1 component
Microplastic concentration	Concentration of microplastic particles in marine waters	particles/m ³	Water sampling	Document size detection limits; state monitoring variable only – see microplastics boundary note below

¶2 The Taskforce on Nature-related Financial Disclosures (TNFD) framework identifies plastic footprint as a specific disclosure metric, defined as total weight of plastics used or sold, disaggregated by reusable, compostable, and technically recyclable categories²⁵.

¶3 For practical compilation, the approach developed by Jambeck et al. (2015) provides a methodology for estimating plastic leakage from waste generation, mismanagement rates, and proximity to coastlines¹³. This methodology can be adapted to national contexts using locally-sourced waste statistics. **Uncertainty in Jambeck-derived estimates:** The Jambeck methodology carries substantial uncertainty – published estimates span approximately one order of magnitude across scenarios, reflecting uncertainty in waste generation rates, mismanagement rates, and coastal proximity assumptions. Compilers must accompany any plastic leakage indicator derived from this methodology with a stated confidence range reflecting the low and high scenarios. Presenting a single central estimate without bounds is not appropriate for official statistics. Assign TG-0.7 quality flags for modelled estimates to communicate the estimation basis. Where beach survey data, at-sea debris observations, or national waste audit data are available, these should be used to validate or constrain the modelled estimate. More recent global waste model updates (Borrelle et al. 2020²⁶; Lau et al. 2020²⁷) may provide updated coefficient ranges for sensitivity testing.

¶4 **Microplastics boundary – accounting classification:** The boundary between microplastics as a water emission and as a solid waste entry requires explicit treatment to prevent double-counting across TG-2.7 and **TG-3.4 Flows from Economy to Environment**. This Circular adopts the following classification. **Primary microplastics** (industrial pellets, microbeads, and other microplastic particles released directly to water from industrial or consumer processes) are classified as water emissions and recorded as a flow entry in the residual flow accounts. **Secondary microplastics** (particles that fragment from macroplastic solid waste already present in the marine environment) represent stock changes within the marine litter account rather than new economy-to-environment

flows, and should not be recorded as a new emission flow. **Water column microplastic concentration** is an environmental monitoring variable, a state indicator rather than an accounting flow, and should not be entered as a residual flow in the PSUT. Compilers implementing both TG-2.7 and TG-3.4 should apply this classification consistently. For the full treatment of marine litter stock-flow accounts, including the marine litter asset account within which secondary microplastic stock changes are recorded, see **TG-6.12 Marine Litter and Plastics Accounting**.²⁸

Other marine debris indicators

¶1 Beyond plastics, marine litter includes fishing gear, packaging, and other materials.

¶2 Recommended debris indicators:

Indicator	Definition	Unit	Source Data	Compilation Note
Abandoned, lost or discarded fishing gear (ALDFG)	Quantity of fishing gear entering marine environment	tonnes/year; items/year	Fisheries surveys, gear loss reporting	See ALDFG compilation note below
Derelict vessel count	Number of abandoned vessels in coastal waters	count	Maritime registries, surveys	
Litter composition	Proportion of litter by material category	percentage	Beach and seabed surveys	
Litter removal	Quantity of litter removed from marine environment	tonnes/year	Clean-up programme records	

¶3 **ALDFG compilation method:** Abandoned, lost or discarded fishing gear (ALDFG) is rarely collected systematically in national fisheries statistics. Compilers should apply the following tiered approach: (1) as the primary data source, use gear loss rate surveys conducted following the FAO Voluntary Guidelines on the Marking of Fishing Gear (2019)²⁹ and associated FAO Technical Guidelines for Responsible Fisheries on ALDFG; (2) as a secondary method where surveys are unavailable, apply gear-specific loss rate coefficients to fleet activity data (vessel-days by gear type) – loss rate coefficients by gear type are available from the Global Ghost Gear Initiative data framework; (3) document minimum metadata requirements distinguishing survey-based from modelled estimates, including the survey coverage (percentage of fleet observed), gear types covered, and the coefficient source. Estimates derived from loss rate coefficients rather than direct surveys should be flagged with TG-0.7 quality codes indicating the modelled basis.

¶4 The SF-MST (Statistical Framework for Measuring the Sustainability of Tourism) provides guidance on tourism solid waste accounting relevant to coastal tourism waste generation³⁰.

3.5 Atmospheric Deposition Indicators

¶1 Key substances include nitrogen compounds (contributing to marine eutrophication), sulphur compounds (affecting ocean chemistry), carbon dioxide (driving ocean acidification), and mercury (entering marine food webs via atmospheric deposition)³¹.

¶2 This pathway is addressed in **TG-3.4 Flows from Economy to Environment**, Section 3.1, which notes that “the accounting challenge is to link atmospheric emissions to their marine deposition, which requires integration with atmospheric modelling or use of deposition coefficients.” This Circular addresses the indicator derivation aspect of this challenge.

Atmospheric nitrogen deposition

¶1 The SEEA Technical Note on Air Emissions Accounting provides guidance on air emissions accounts that form the basis for deposition estimates³².

¶2 Recommended atmospheric deposition indicators:

Indicator	Definition	Unit	Source Data	Compilation Note
Atmospheric nitrogen emissions (relevant sectors)	NO _x and NH ₃ emissions from sectors contributing to marine deposition	tonnes N/year	Air emissions account	Focus on coastal zone sources
Estimated nitrogen deposition to marine waters	Nitrogen deposited to EEZ waters from atmospheric emissions	tonnes N/year	Atmospheric deposition models	High uncertainty; document assumptions. Report as “not compiled” if no validated method is available; do not estimate with undocumented coefficients.
Maritime NO _x emissions	NO _x emissions from sea and coastal water transport only (ISIC 5011–5012). Excludes inland water transport (ISIC 5021–5022): inland ship-ping NO _x deposits principally over rivers and estuaries rather than open marine waters and must not be included in this indicator.	tonnes NO _x /year	Air emissions account, maritime data	Authoritative scope definition; compilers extracting flows in Step 2 should apply this exclusion to the maritime-destined atmospheric deposition sub-total.

¶3 The estimation of actual deposition requires atmospheric transport and deposition modelling, which may be beyond the capacity of many national statistical systems. A pragmatic approach is to report emissions from relevant sectors (agriculture, transport, energy) that contribute to deposition, whilst noting that the relationship between emissions and marine deposition depends on atmospheric conditions and distance to coast. Where deposition modelling capacity is unavailable, compilers should consult HELCOM Pollution Load Compilation or OSPAR deposition budget outputs as documented regional sources before concluding that atmospheric deposition cannot be estimated¹².

Ocean acidification indicators

¶1 Ocean acidification is addressed by SDG Target 14.3, with indicator 14.3.1 tracking average marine acidity measured at representative sampling stations³³. Indicators linking economic activity to acidification drivers are relevant for ocean accounting.

¶2 Recommended acidification-related indicators:

Indicator	Definition	Unit	Source Data	Compilation Note
Total CO ₂ emissions	National total carbon dioxide emissions	tonnes CO ₂ /year	Air emissions account	Link to UNFCCC inventory
Maritime CO ₂ emissions	CO ₂ emissions from domestic and international shipping	tonnes CO ₂ /year	Air emissions account	ISIC 5011–5012
CO ₂ emission intensity	CO ₂ emissions per unit GDP	kg CO ₂ /currency unit	Air emissions account, national accounts	Track decoupling
Cumulative CO ₂ emissions	Historical total emissions contributing to atmospheric CO ₂ stock	tonnes CO ₂	Aggregated air emissions time series	Carbon budget context

¶3 The relationship between national emissions and ocean acidification is mediated by global atmospheric mixing, meaning that national emissions contribute to global rather than specifically national marine acidification. The full treatment of climate-ocean indicators is provided in **TG-2.8 Climate Change Indicators**, which addresses ocean acidification indicators in detail in Section 3.3.

Mercury deposition indicators

¶1 Mercury enters marine food webs through atmospheric deposition and bioaccumulates in fish, posing human health risks. The Minamata Convention on Mercury establishes international reporting requirements³⁴.

¶2 Recommended mercury indicators:

Indicator	Definition	Unit	Source Data
Mercury emissions to air	Total atmospheric mercury emissions	kg Hg/year	Air emissions account
Mercury emissions by sector	Mercury emissions from major source categories	kg Hg/year by sector	Air emissions account
Artisanal gold mining mercury use	Mercury used in artisanal and small-scale gold mining	kg Hg/year	Minamata Convention reporting

3.6 Intensity and Efficiency Indicators

¶1 Intensity and efficiency indicators relate pollution flows to measures of economic activity, enabling assessment of decoupling^{35, 36}. They link the economic activity data compiled under **TG-3.3 Economic Activity Relevant to the Ocean** to the residual flow data compiled under **TG-3.4 Flows from Economy to Environment**.

Pollution intensity indicators

¶1 Recommended intensity indicators:

Indicator	Definition	Unit	Interpretation
Nutrient discharge intensity	Nutrient discharge per unit GVA	kg N/million currency; kg P/million currency	Lower values indicate cleaner production
Waste generation intensity	Solid waste generated per unit GVA	tonnes/million currency	Declining trend indicates relative decoupling
Emission intensity by industry	Industry emissions per unit industry GVA	varies by pollutant	Enables inter-industry comparison
Coastal tourism waste intensity	Waste generated per tourist-night	kg/tourist-night	Links tourism pressure to activity level
Aquaculture emission intensity	Nutrient discharge per tonne production	kg N/tonne fish; kg P/tonne fish	Indicates aquaculture environmental efficiency

¶2 Intensity indicators should be calculated separately for key ocean-related industries as identified in **TG-3.3 Economic Activity Relevant to the Ocean**:

- ¶3 Fishing (ISIC 031)
- ¶4 Aquaculture (ISIC 032)
- ¶5 Fish processing (ISIC 1020)
- ¶6 Water transport (ISIC 50)
- ¶7 Coastal tourism (ISIC 55, 79, 93)
- ¶8 Offshore extraction (ISIC 06, 09)

Decoupling indicators

¶1 Decoupling indicators assess whether environmental pressure is growing slower than (relative decoupling) or declining absolutely whilst the economy grows (absolute decoupling)³⁷.

¶2 **Recommended decoupling indicators:**

Indicator	Definition	Formula	Interpretation
Pollution-GDP decoupling factor	Rate of change in pollution relative to GDP growth	$(\% \text{ change pollution}) / (\% \text{ change GDP})$	<1 indicates relative decoupling; <0 indicates absolute decoupling. This ratio assumes positive GDP growth. Recession-period interpretation: in years of economic contraction, a fall in pollution may reflect reduced economic activity rather than genuine efficiency improvement, and the ratio can produce a spuriously positive decoupling signal. During periods of economic contraction, compilers should: (i) use potential GDP (a measure of trend output that removes cyclical fluctuations) as an alternative denominator, following OECD (2002) guidance on decoupling indicators for non-stable growth periods ³⁸ ; (ii) present absolute pollution levels and emission intensity trends separately alongside the ratio, rather than relying on the ratio alone; and (iii) contextualise results with a note explaining the economic cycle.
Material productivity	GDP per unit domestic material consumption	GDP / DMC	Rising trend indicates improved material efficiency
Water productivity	GVA per unit water abstraction	$\text{GVA} / \text{water use (m}^3\text{)}$	Rising trend indicates improved water efficiency

¶3 The interpretation of decoupling requires time series data. Single-period ratios provide intensity measures, but decoupling assessment requires comparison of percentage changes over multiple periods.

¶4 Additional guidance on resource efficiency indicators is provided in **TG-2.11**

Resource Efficiency.

Combined presentation for indicators

¶1 Following the SEEA Central Framework approach, a combined presentation for marine pollution indicators would include³⁹:

Data Element	Physical Units	Monetary Units	Indicator Derived
Output by ocean industry	–	Currency	Denominator for intensity
Gross value added by ocean industry	–	Currency	Denominator for intensity
Employment by ocean industry	Persons	–	Employment intensity
Nutrient discharge to marine waters	tonnes N, tonnes P	–	Absolute pressure indicator
Solid waste to marine environment	tonnes	–	Marine litter indicator
CO2 emissions from ocean industries	tonnes CO2	–	Carbon intensity
Environmental protection expenditure	–	Currency	Response indicator
Environmental taxes paid	–	Currency	Policy instrument indicator

¶2 The indicator categories derived from this combined presentation follow the five-category typology defined in Section 3.1. The structure aligns with that recommended in **TG-3.4 Flows from Economy to Environment**, Section 3.4, ensuring consistency between accounting and indicator frameworks.

3.7 Worked Example: Coastal Zone Nutrient Loading Indicator

Context

¶1 Coastal Zone Alpha is a 50 km stretch of coastline with intensive aquaculture (5 farms producing 8,000 tonnes/year of finfish), one urban wastewater treatment plant serving a population of 120,000, and agricultural catchments draining 15,000 hectares of cropland to coastal waters. The zone experiences periodic algal blooms, and planners require a nutrient loading indicator to support marine spatial planning decisions.

Step 1: Extract nutrient flows from residual accounts

¶1 From the national physical supply-use table for water emissions (compiled per **TG-3.4**), extract nitrogen discharge for Zone Alpha:

Source	ISIC	N discharge (kg/yr)	Data source
Marine aquaculture	0321	184,000	Farm environmental reports
Urban wastewater	3600	96,000	WWTP discharge permits
Agricultural runoff	0111	225,000	Modelled using OECD N-balance
Total generation		505,000	

Step 2: Apply spatial attribution

¶1 Not all generated nitrogen reaches marine waters. Apply delivery ratios:

Source	Generation (kg N/yr)	Delivery ratio	Marine load (kg N/yr)	Justification
Aquaculture	184,000	1.00	184,000	Direct to coastal waters
WWTP	96,000	0.95	91,200	Outfall 2 km offshore; minimal in-situ processing
Agriculture	225,000	0.18	40,500	15 km average distance to coast; riparian retention
Total marine load			315,700	

¶2 The agricultural delivery ratio of 0.18 is applied as a Tier 1 estimate based on OECD guidance for mixed cropland catchments with moderate riparian buffers. A sensitivity analysis under Tier 1 uncertainty bounds gives delivery ratios ranging 0.12–0.25 depending on rainfall intensity and vegetative cover, and the resulting total marine load range is approximately 302,000–331,000 kg N/yr. This uncertainty range should be reported alongside the central estimate.

Step 3: Compute indicator values

¶1 **Absolute loading indicator:**

Total nitrogen load to Zone Alpha = 315,700 kg N/yr = 316 tonnes N/yr

¶2 **Spatial intensity indicator:**

Loading per coastline length = 316 tonnes / 50 km = 6.3 tonnes N per km per year

¶3 **Loading per unit coastal zone area:**

Coastal zone area = 50 km × 5 km (avg width) = 250 km²
Loading density = 316 tonnes / 250 km² = 1.26 tonnes N per km² per year

¶4 Source attribution:

- ¶5 Aquaculture: 58% of marine load
- ¶6 Wastewater: 29% of marine load
- ¶7 Agriculture: 13% of marine load (though 45% of gross generation)

Step 4: Compare to thresholds

¶1 The OSPAR eutrophication strategy suggests coastal zones with loading exceeding 1.0 tonne N/km²/yr may be at elevated eutrophication risk. Zone Alpha exceeds this threshold, indicating policy intervention may be warranted (the OSPAR value is a regional threshold: compare against the ecological threshold that applies locally, as the nutrient loading intensity row in Section 3.3 requires).

Step 5: Link to economic activity

¶1 From ocean economy accounts (**TG-3.3**), Zone Alpha aquaculture GVA is 12.5 million currency units per year:

Aquaculture N intensity = 184 tonnes N / 12.5 million currency = 14.7 kg N per thousand currency GVA

¶2 This intensity can be compared across zones or tracked over time to assess whether nutrient loading is decoupling from aquaculture production.

Policy interpretation

¶1 The indicator compilation reveals that whilst aquaculture contributes the majority (58%) of nitrogen reaching coastal waters, agricultural sources represent 45% of gross generation but only 13% of marine load due to retention in the catchment-to-coast pathway. Policy interventions focused solely on aquaculture may achieve 58% reduction potential, whilst interventions targeting agricultural practices have lower marine impact due to natural attenuation. The indicator supports prioritisation of aquaculture best management practices (reduced feed conversion ratios, improved waste collection) and WWTP upgrades, whilst agricultural interventions may be warranted for broader environmental benefits beyond marine loading.

4. Data Sources and Compilation

¶1 ⓘ Section schema

¶2 This circular uses an extended six-section schema (Sections 1-3 standard, Section 4 Data Sources and Compilation, Section 5 Implementation Considerations, Section 6 Acknowledgements, Section 7 References). The extension accommodates the multi-source compilation procedure and tiered implementation guidance required for pollution indicators. Cross-references from other circulars to “Acknowledgements” or “References” in TG-2.7 should target Sections 6 and 7 respectively. All other circulars follow the canonical four-section schema (Sections 1-3 substantive, Section 4 Acknowledgements, Section 5 References) defined in the GOAP Circular Style Guide.

¶3 Compilation of pollution indicators draws on the residual flow accounts established under **TG-3.4 Flows from Economy to Environment**, supplemented by additional data sources for indicator derivation. **TG-4.2 Statistical Sources and Data Gaps** provides a full inventory of monitoring data sources and quality assessment procedures for pollution indicators, including national accounts denominators, spatial data, and international reporting framework alignment. ⁴⁰

5. Implementation Considerations

Prioritisation

¶1 Given resource constraints, compilers should prioritise indicators based on:

1. ¶2 **Policy relevance** – indicators that address national marine policy priorities and international commitments (particularly SDG 14)
2. ¶3 **Data availability** – indicators for which underlying data can be compiled from existing sources
3. ¶4 **Trend monitoring** – indicators that can be compiled consistently over time for trend analysis
4. ¶5 **Sectoral attribution** – indicators that enable identification of industries responsible for environmental pressure

¶6 To translate these criteria into an actionable indicator shortlist, the following three-tier implementation framework maps all indicators in this Circular to implementation capacity levels. Tier 1 is the minimum set recommended for all countries. Tier 2 is an intermediate set for countries with established environmental monitoring infrastructure, and Tier 3 is the full set for countries with full PSUT and modelling capacity. All Tier 1 indicators align with SDG 14.1.1 components or the FDES 2013 Core Set of Environment Statistics⁷.

¶7 **Table 5.1: Tiered implementation framework for TG-2.7 pollution indicators**

Indicator	Category	Section	Tier	FDES Core Set
Total nitrogen discharge to coastal waters	Nutrient	3.3	1	Yes
Total phosphorus discharge to coastal waters	Nutrient	3.3	1	Yes
Wastewater nutrient discharge	Nutrient	3.3	1	Yes
Plastic waste generation	Marine Litter	3.4	1	Yes
Mismanaged plastic waste	Marine Litter	3.4	1	Yes
Floating debris density (SDG 14.1.1)	Marine Litter	3.4	1	Yes
Total CO ₂ emissions	Atmospheric/Acidification	3.5	1	Yes
Heavy metal discharges (Hg, Cd, Pb priority)	Chemical	3.3	2	No
POPs discharges	Chemical	3.3	2	No
Plastic leakage to ocean (Jambeck-derived)	Marine Litter	3.4	2	No
Beach litter density	Marine Litter	3.4	2	No
ALDFG	Marine Litter	3.4	2	No
Atmospheric nitrogen emissions (relevant sectors)	Atmospheric/Acidification	3.5	2	No
Maritime CO ₂ emissions	Atmospheric/Acidification	3.5	2	No
Agricultural nutrient surplus to coastal zones	Nutrient	3.3	2	No
Nutrient loading intensity	Nutrient	3.3	2	No
Nutrient discharge intensity	Intensity/Decoupling	3.6	2	No
Pollution-GDP decoupling factor	Intensity/Decoupling	3.6	2	No
Operational oil discharge from vessels	Hydrocarbon	3.3	2	No
Accidental oil spills	Hydrocarbon	3.3	2	No
Offshore operational discharge	Hydrocarbon	3.3	3	No
Antifouling compound release	Chemical	3.3	3	No
Estimated nitrogen deposition to marine waters	Atmospheric/Acidification	3.5	3	No
Maritime NO _x emissions	Atmospheric/Acidification	3.5	3	No
Microplastic concentration	Marine Litter	3.4	3	No
Mercury emissions by sector	Atmospheric/Acidification	3.5	3	No

Indicator	Category	Section	Tier	FDES Core Set
Artisanal gold mining mercury use	Atmospheric/Acidification	3.5	3	No
Aquaculture emission intensity	Intensity/Decoupling	3.6	3	No
Coastal tourism waste intensity	Intensity/Decoupling	3.6	3	No
Land-based hydrocarbon runoff	Hydrocarbon	3.3	3	No

¶8 Countries at first implementation are recommended to compile all Tier 1 indicators before expanding to Tier 2 and Tier 3. Countries with partial monitoring infrastructure may selectively advance specific Tier 2 indicators where data are available without completing all Tier 1 indicators first, provided they document coverage gaps.

Indicator presentation and communication

¶1 The combined presentation table in Section 3.6 provides a template that can be adapted for dashboard and report card formats. Guidance on integrating pollution indicators with other ocean accounting outputs for combined presentation and communication is provided in **TG-3.8 Combined Presentations**.

6. Acknowledgements

¶1 **Authors:** Gerald Singh, Kirsten Oleson

¶2 **Reviewers:** [To be confirmed]

7. References

- ¶1 United Nations, *Transforming Our World: The 2030 Agenda for Sustainable Development*, A/RES/70/1 (2015), Target 14.1.
- ¶2 SEEA CF (2014), para. 6.116.
- ¶3 Figure adapted from SEEA CF (2014), Chapter VI combined presentation approach, applied to marine pollution indicators.
- ¶4 SEEA CF (2014), para. 6.145.
- ¶5 United Nations, *Global indicator framework for the Sustainable Development Goals*, A/RES/71/313, Indicator 14.1.1.
- ¶6 FDES 2013, Component 3: Residuals, paras. 3.162 onwards.
- ¶7 FDES 2013, Chapter 1, paras. 1.39–1.44, on the Core Set of Environment Statistics.
- ¶8 SEEA CF (2014), Table 3.18 on the structure of solid waste accounts by source and destination.
- ¶9 SEEA CF (2014), Box 3.2 on household residuals; SEEA CF paras. 3.99–3.109 on attribution principles.
- ¶10 OECD/Eurostat, *Gross Nitrogen Balances Handbook* (2007); OECD/Eurostat, *Gross Phosphorus Balances Handbook* (2007).
- ¶11 FAO Land and Water Division, guidance on nutrient export coefficients for tropical agriculture (various editions).
- ¶12 HELCOM, *Pollution Load Compilation* (most recent edition); OSPAR Commission, *Atmospheric deposition assessment* (most recent edition); EMEP Status Report 1/2024.
- ¶13 Jambeck, J.R. et al., "Plastic waste inputs from land into the ocean," *Science* 347(6223) (2015): 768–771.
- ¶14 Joint Committee for Guides in Metrology, *Evaluation of Measurement Data – Guide to the Expression of Uncertainty in Measurement* (GUM), JCGM 100:2008.
- ¶15 FDES 2013, Topic 1.3.3: Marine water quality, paras. 3.58–3.66.
- ¶16 SDG indicator 14.1.1: Index of coastal eutrophication and floating plastic debris density.
- ¶17 FAO/UNSD, *System of Environmental-Economic Accounting for Agriculture, Forestry and Fisheries (SEEA AFF)* (2018).
- ¶18 FDES 2013, Subcomponent 3.4: Release of Chemical Substances, paras. 3.211–3.218.
- ¶19 Regulation (EC) No 166/2006 concerning the establishment of a European Pollutant Release and Transfer Register.
- ¶20 United Nations Environment Programme, *Guidance on Developing National Pollutant Release and Transfer Registers* (2006); UNEP Global PRTR (prtr.net).
- ¶21 International Maritime Organization, Global Integrated Shipping Information System (GISIS), port reception facility module.

2. ¶22 International Maritime Organization, *International Convention for the Prevention of Pollution from Ships* (MARPOL), as amended.
3. ¶23 SDG indicator 14.1.1, floating plastic debris density component.
4. ¶24 UNEA Resolution 5/14, *End plastic pollution: towards an international legally binding instrument* (2022).
5. ¶25 Taskforce on Nature-related Financial Disclosures, *Recommendations of the Taskforce on Nature-related Financial Disclosures* (2023).
6. ¶26 Borrelle, S.B. et al., "Predicted growth in plastic waste exceeds efforts to mitigate plastic pollution," *Science* 369(6510) (2020): 1515-1518.
7. ¶27 Lau, W.W.Y. et al., "Evaluating scenarios toward zero plastic pollution," *Science* 369(6510) (2020): 1455-1461.
8. ¶28 GESAMP, *Sources, Fate and Effects of Microplastics in the Marine Environment*, Reports and Studies No. 90 (2015); SEEA CF (2014), para. 3.155 on dissolved/suspended substances.
9. ¶29 FAO, *Voluntary Guidelines on the Marking of Fishing Gear* (2019); FAO, *Technical Guidelines for Responsible Fisheries No. 13* on abandoned, lost or discarded fishing gear.
0. ¶30 UNWTO/UNSD, *Measuring the Sustainability of Tourism: A Statistical Framework (SF-MST)* (2024).
1. ¶31 SEEA Technical Note: Air Emissions Accounting (2016), Section 2.2.
2. ¶32 SEEA Technical Note: Air Emissions Accounting (2016), Core Account 1.
3. ¶33 SDG indicator 14.3.1: Average marine acidity (pH) measured at agreed suite of representative sampling stations.
4. ¶34 Minamata Convention on Mercury (2013), Article 8 (Emissions), Article 21 (Reporting).
5. ¶35 OECD, *Indicators to Measure Decoupling of Environmental Pressure from Economic Growth* (2002).
6. ¶36 SEEA CF (2014), para. 6.117.
7. ¶37 UNEP, *Decoupling Natural Resource Use and Environmental Impacts from Economic Growth* (2011).
8. ¶38 OECD, *Indicators to Measure Decoupling of Environmental Pressure from Economic Growth* (2002), Section 3; UNEP, *Decoupling Natural Resource Use* (2011), Chapter 4; EEA, *Decoupling of resource use and environmental impacts from economic growth*, EEA Report 2/2016.
9. ¶39 Adapted from SEEA CF (2014), Table 6.11: Combined presentation for air emissions.
0. ¶40 UN Environment Programme, *Measuring Progress: Environment and the SDGs* (2021).

DRAFT