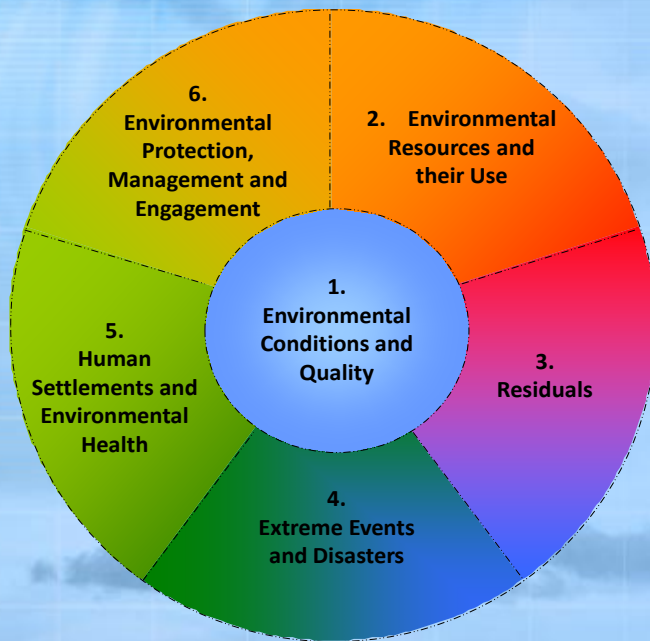


Ocean statistics and marine water quality



Regional Workshop on Environment Statistics and Climate Change Statistics for the Caribbean Community (CARICOM) Region

St. George's, Grenada

4-8 November 2019

Outline

1. (Draft) Marine water quality manual sheet
2. (Draft) UNEP manual on Ocean statistics
3. Ocean statistics as cross-cutting theme
 - Matrix of FDES statistics for ocean accounts and indicators



Component 1: Environmental Conditions and Quality

Subcomponent 1.3: Environmental Quality

Topic 1.3.3: Marine water quality



Manual

on the Basic Set of Environment Statistics of the FDES 2013



Marine Water Quality Statistics

*(Topics 1.3.3 Marine Water Quality
of the Basic Set of Environment Statistics of the FDES 2013)*

Draft Version 1.0

16 April 2019

*Environment Statistics Section
United Nations Statistics Division*

*in collaboration with the
Expert Group on Environment Statistics*

Methodology sheets of the Basic Set of Environment Statistics

http://unstats.un.org/unsd/environment/FDES/Manual_BSES.htm

<http://unstats.un.org/unsd/environment/fdes.htm>

Topic 1.3.3: Marine Water Quality		Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
Statistics and Related Information (Bold text – Core Set/Tier 1; Regular text – Tier 2; <i>Italicized Text</i> – Tier 3)				
a.	Nutrients and chlorophyll		<ul style="list-style-type: none"> ▪ By coastal zone, delta, estuary or other local marine environment where relevant ▪ Sub-national ▪ National ▪ Supranational ▪ By point measurement ▪ By water resource 	<ul style="list-style-type: none"> ▪ UNECE Standard Statistical Classification of Marine Water Quality (1992) ▪ NOAA/NASA ▪ UNEP Regional Seas Programme (Chlorophyll-A based on remote sensing)
	1. Concentration level of nitrogen (Nitrate, Nitrite and Ammonia and/or Total Nitrogen)	Concentration		
	2. Concentration level of phosphorous (Phosphate and/or Total Phosphorous)	Concentration		
	3. Concentration level of chlorophyll A (trophic state) (as a proxy for nutrient loading)	Concentration		
b.	Organic matter			
	1. Biochemical oxygen demand (BOD)	Concentration		
	2. Chemical oxygen demand (COD)	Concentration		
c.	Pathogens			
	1. Concentration levels of faecal coliforms	Concentration		
d.	Metals (e.g., mercury, lead, nickel, arsenic, cadmium)			
	1. Concentration levels in sediment and marine water	Concentration		
	2. Concentration levels in marine organisms (Benthic & Fish)	Concentration		
e.	Organic contaminants (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols, radioactive waste)			
	1. <i>Concentration levels in sediment and marine water</i>	Concentration		
	2. <i>Concentration levels in marine organisms</i>	Concentration	<ul style="list-style-type: none"> ▪ UNECE Standard Statistical Classification of Marine Water Quality (1992) ▪ NOAA/NASA ▪ UNEP Regional Seas Programme 	
f.	Physical and chemical characteristics			
	1. <i>pH/Acidity/Alkalinity</i>	Level		
	2. Temperature	Degrees		
	3. <i>Total suspended solids (TSS)</i>	Concentration		
	4. <i>Salinity</i>	Concentration		
	5. Dissolved oxygen (DO)	Concentration		
	6. <i>Density</i>	Density		
g.	Coral bleaching		<ul style="list-style-type: none"> ▪ By coastal zone, delta, estuary or other local marine environment ▪ By location ▪ Sub-national ▪ National ▪ Supranational ▪ By point measurement 	<ul style="list-style-type: none"> ▪ UNECE Standard Statistical Classification of Marine Water Quality (1992) ▪ NOAA/NASA ▪ UNEP Regional Seas Programme
	1. Area affected by coral bleaching	Area/time		
h.	Plastic waste and other marine debris		<ul style="list-style-type: none"> ▪ By coastal zone, delta, estuary or other local marine environment ▪ By location ▪ Sub-national ▪ National ▪ Supranational ▪ By point measurement 	<ul style="list-style-type: none"> ▪ UNECE Standard Statistical Classification of Marine Water Quality (1992) ▪ NOAA/NASA ▪ UNEP Regional Seas Programme
	1. <i>Amount of plastic waste and other debris in marine waters</i>	Area, Mass		
i.	Red tide			
	1. <i>Occurrence</i>	Number		
	2. <i>Impacted area</i>	Area		
	3. <i>Duration</i>	Duration		
j.	Oil pollution		<ul style="list-style-type: none"> ▪ Sub-national ▪ National ▪ Supranational ▪ By point measurement 	<ul style="list-style-type: none"> ▪ UNECE Standard Statistical Classification of Marine Water Quality (1992) ▪ NOAA/NASA ▪ UNEP Regional Seas Programme
	1. <i>Area of oil slicks</i>	Area		
	2. <i>Amount of tar balls</i>	Area, Diameter, Number		

Statistics and Related Information		Category of Measurement	Potential Aggregations and Scales
(Bold text – Core Set/Tier 1; Regular text – Tier 2; <i>Italicized Text</i> – Tier 3)			
a.	Nutrients and chlorophyll		<ul style="list-style-type: none"> ▪ By coastal zone, delta, estuary or other local marine environment where relevant ▪ Sub-national ▪ National ▪ Supranational ▪ By point measurement ▪ By water resource
	1. Concentration level of nitrogen (Nitrate, Nitrite and Ammonia and/or Total Nitrogen)	Concentration	
	2. Concentration level of phosphorous (Phosphate and/or Total Phosphorous)	Concentration	
	3. Concentration level of chlorophyll A (Phytoplankton or trophic state) (as a proxy for nutrient loading)	Concentration	
b.	Organic matter		
	1. Biochemical oxygen demand (BOD)	Concentration	
	2. Chemical oxygen demand (COD)	Concentration	
c.	Pathogens		
	1. Concentration levels of faecal coliforms	Concentration	
d.	Metals (e.g., mercury, lead, nickel, arsenic, cadmium)		
	1. Concentration levels in sediment and marine water	Concentration	
	2. Concentration levels in marine organisms (Benthic & Fish)	Concentration	
e.	Organic contaminants (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols, radioactive waste)		
	<i>1. Concentration levels in sediment and marine water</i>	Concentration	
	<i>2. Concentration levels in marine organisms</i>	Concentration	
f.	Physical and chemical characteristics		
	<i>1. pH/Acidity/Alkalinity</i>	Level	
	<i>2. Temperature</i>	Degrees	

d.	Metals (e.g., mercury, lead, nickel, arsenic, cadmium)	
	1. Concentration levels in sediment and marine water	Concentration
	2. Concentration levels in marine organisms (Benthic & Fish)	Concentration
e.	Organic contaminants (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols, radioactive waste)	
	1. <i>Concentration levels in sediment and marine water</i>	Concentration
	2. <i>Concentration levels in marine organisms</i>	Concentration
f.	Physical and chemical characteristics	
	1. <i>pH/Acidity/Alkalinity</i>	Level
	2. Temperature	Degrees
	3. <i>Total suspended solids (TSS) (turbidity and water clarity)</i>	Concentration
	4. <i>Salinity</i>	Concentration
	5. Dissolved oxygen (DO)	Concentration
	6. <i>Density</i>	Density
g.	Coral bleaching	
	1. Area affected by coral bleaching	Area/time
h.	Plastic waste and other marine debris	
	1. <i>Amount of plastic waste and other debris in marine waters</i>	Area, Mass
i.	Red tide	
	1. <i>Occurrence</i>	Number
	2. <i>Impacted area</i>	Area
	3. <i>Duration</i>	Duration
j.	Oil pollution	
	1. <i>Area of oil slicks</i>	Area

Introduction/ Relevance



GESAMP
Joint Group of Experts on the
Scientific Aspects of Marine
Environmental Protection



**Regional
Seas**

GESAMP is a group of independent scientific experts that provides advice to the UN system on scientific aspects of marine environmental protection.

<http://www.gesamp.org/>

- Marine water quality statistics the ocean environment
- Current resources to develop
 - *The Global Manual on Ocean SDG indicators 14.1.1a, 14.1.1b* of existing resources and
 - *The GESAMP Guidelines for the monitoring and assessment of plastic litter and microplastics in the ocean*, including data requirements and study design
 - *The Regional Seas Management Plan*
- Marine water quality
 - Forming marine water quality
 - Increasing marine water quality
 - Establishing marine water quality modelled

Home / Explore Topics / Oceans & seas / What we do / Working with regional seas / Regional seas programmes

Wider Caribbean

Caribbean Environment Programme

The Wider Caribbean Region (WCR) comprises the insular and coastal States and Territories with coasts on the Caribbean Sea and Gulf of Mexico as well as waters of the Atlantic Ocean adjacent to these States and Territories and includes 28 island and continental countries.

In Oceans & seas

Why do oceans and seas matter?

What we do

Addressing land-based pollution

3. Definitions and description of the statistics

- **Marine water quality** – status of ocean water in a certain area (e.g., water column, on shorelines, etc.).
- **Marine pollution** – harmful substances negatively impacting marine water quality
- **Marine litter** – any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment (GPA 1995)
 - categorized by size including: mega-litter, macro-litter, meso-litter, mirco-litter (specifically known as microplastics) and nano-litter.
- **Coastal eutrophication** – occurs following an imbalance in nutrient concentration in a certain area.
- **Ocean acidification/warming** – results of increased carbon emissions from human activities



3A. Definition of statistics

Area affected by coral bleaching (FDES 1.3.3.g.1)

A measure of the square kilometres of bleached coral.

Remarks:

- Rising temperatures caused by global warming are the biggest caused of coral bleaching

Amount of plastic waste and other debris in marine waters (FDES 1.3.3.h.1)

The amount of plastic waste and other debris in marine waters is measured specific to locations including: shorelines, sea surface and water column, seafloor, marine biota and particular considerations for microplastics. The statistics to match the monitoring location include: plastic debris washed on beaches, plastic debris in the water column, plastic debris on the seafloor and plastic ingested by biota.



4. International sources and recommendations

4A. Classifications and groupings

- GESAMP Classification for Marine Litter
 - Provide a collective overview of marine plastic litter including details on how to develop measurements over time and analyse what the

Eutrophication

Major criteria: trophic state of marine surface water and the best available expert judgement regarding the impact of trophic state on aquatic life

- UNEP

- An

Class interpretation:

Class I: Oligotrophic

Class II: Mesotrophic

Class III: Slightly eutrophic

- UNEP

- The

Class IV: Strongly eutrophic

Class V; Hypertrophic

Pollution by harmful substances (metals, organochlorines, and other)

Major criteria: toxicological impact on aquatic life as established by US-EPA

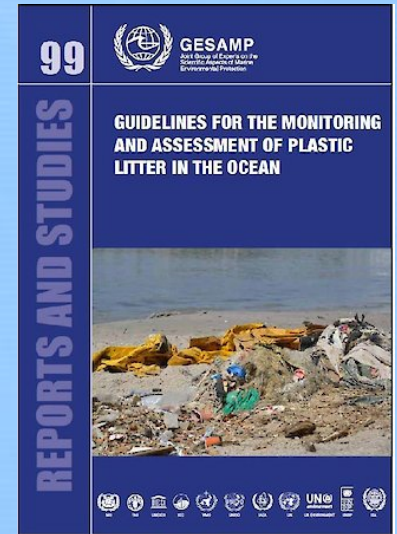
Class interpretation:

- Ecosystem based management under CBD indicator 14.2.1



4B. Reference to international statistical recommendations, frameworks and standards

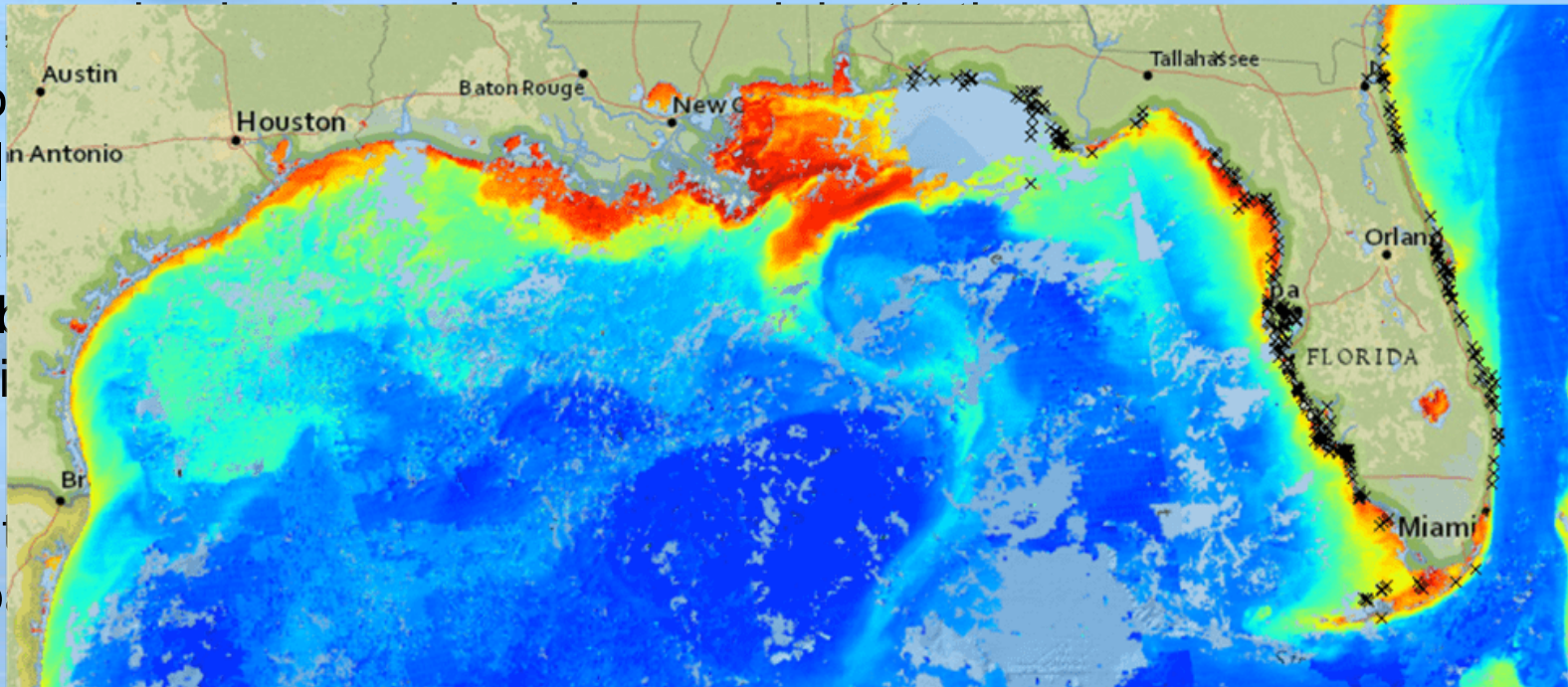
- GESAMP (2019). Guidelines on the monitoring and assessment of plastic litter and microplastics in the ocean (Kershaw P.J., Turra A. and Galgani F. editors), (IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP/ISA Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). Rep. Stud. GESAMP No. 99, 130p
https://environmentlive.unep.org/media/docs/marine_plastics/unep_science_division_gesamp_reports.pdf
- UN Environment (2018). Global Manual on Ocean Statistics. Towards a definition of indicator methodologies. Nairobi (Kenya): UN Environment. 46 pp. plus four appendices.
https://uneplive.unep.org/media/docs/statistics/egm/global_manual_on_ocean_statistics_towards_a_definition_of_indicator_methodologies.pdf
- UN Economic Commission for Europe (1993). Readings in International Environment Statistics. New York, NY.
https://unstats.un.org/unsd/envaccounting/ceea/archive/Framework/classification_in_environment.pdf



5. Data collection and sources of data

- Statistical unit – **concentration or area**
- Data collection processes are currently specific to individual studies
- Efforts exist to harmonize data collection for improved methodologies to allow for coordinated global databases
 - Also seek to improve collaboration between nations, regions, institutions and the levels of data collection

- Currently marine water quality data originates from **national monitoring** programs



- Metho
model
- Three ma
 - Land-b
statisti
 - In situ
 - Remo
litter b

6. Uses and dissemination

6A: Potential presentation/dissemination formats

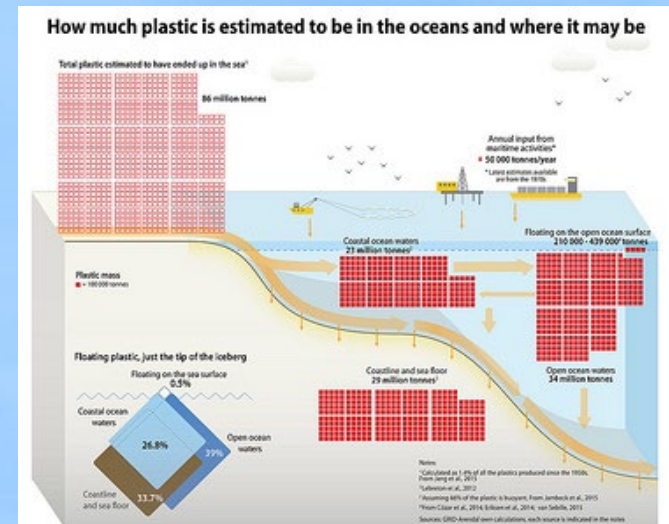
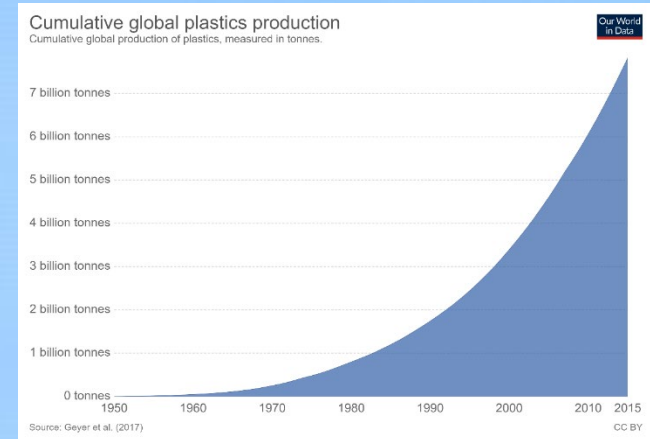
- Maps - Examples include maps showing:
 - beach clean-ups
 - movement of marine plastic litter
 - coastal eutrophication
 - pollution hotspots
- Graphs - Representation of marine water quality over time is best done using graphs.
- Diagrams - To visually explain the relationship between sources and sinks of marine pollution
 - Used to bring together data and images

Diagram: How Much Plastics are in the Ocean and Where?

<http://www.grida.no/resources/6907>

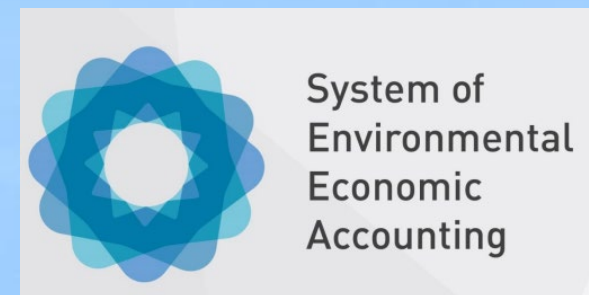
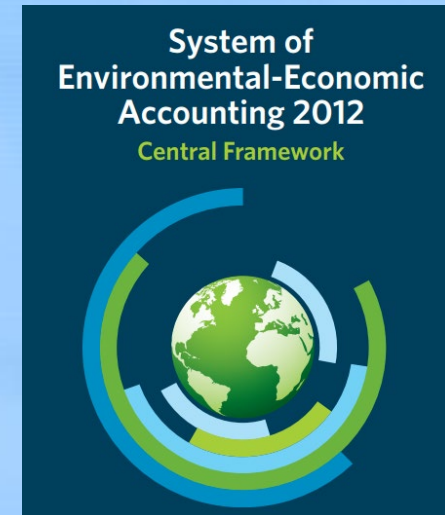
Graph: Cumulative Global Plastic Production

<https://ourworldindata.org/plastic-pollution>



6B. SEEA accounts/ tables that use these statistics

- SEEA Central Framework includes 'Water emissions account' in which several statistics are traced through economic sectors to the ocean, including:
 - BOD/COD
 - Suspended solids
 - Nitrogen and Phosphorus
- SEEA Experimental Ecosystem Accounting includes a water quality aspect in the condition account
 - Coastal and marine ecosystems are introduced as specific types



6C. Commonly used indicators that incorporate these statistics

- **National reporting agencies** often have requirements to test bathing water quality
- **Marine Information System for Europe** host indicators on heavy metals, chlorophyll-a, total nitrogen and phosphorus etc.
- **Regional Seas Indicators** include the statistics in various ways



6D. SDG indicators that incorporate these statistics



14.1.1 “Index of Coastal Eutrophication (ICEP) and marine litter”

ICEP and chlorophyll a A (FDES 1.3.3.a.3), plastic waste and other marine debris (FDES 1.3.3.h)

14.2.1 “Proportion of national exclusive economic zones managed using ecosystem-based approaches”

Exclusive economic zones (EEZ) using ecosystem-based approaches can be informed from these environmental statistics as a way to determine the success of the management.

14.3.1 “Average marine acidity (pH) measured at agreed suite of representative sampling stations”

pH/alkalinity/acidity (FDES 1.3.3.f.1), other physical statistics (FDES 1.3.3.f) and coral bleaching (FDES 1.3.3.g)

14.4.1 “Proportion of fish stocks within biologically sustainable levels”

Physical statistics (FDES 1.3.3.f), nutrients (FDES 1.3.3.a), red tides (FDES 1.3.3.i) and oil pollution (FDES 1.3.3.j)

14.5.1 “Coverage of protected areas in relation to marine areas.”

The environmental statistics can serve to identify hotspots or problem areas that need to be prioritized as a protected area.



(Final draft of) Global Manual on Ocean
Statistics for Measuring SDG 14.1.1,
14.2.1 and 14.5.1



SDG 14 'Life below water' and country-level perspectives

Sustainable Development Goal SDG 14 '*Life below water*' sets the aim to *conserve and sustainably use the oceans, seas and marine resources for sustainable development*. UN Environment is the custodian agency for the following indicators related to SDG 14:

- *14.1.1a* *Index of Coastal Eutrophication*
- *14.1.1b* *Plastic debris density*
- *14.2.1* *Number of countries using ecosystem-based approaches to manage marine areas*
- *14.5.1* *Coverage of protected areas in relation to marine areas*



Target code	Target name	Ind. code	Indicator name	Custodian agency (and partners)	Tier class.
14.1	By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	14.1.1a	Index of Coastal Eutrophication (ICEP)	UN Environment (IOC-UNESCO, FAO)	3
		14.1.1b	Plastic debris density	UN Environment (IOC-UNESCO, FAO)	3
14.2	By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	14.2.1	Number of countries using ecosystem-based approaches to manage marine areas	UN Environment (IOC-UNESCO, FAO)	3
14.5	By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information	14.5.1	Coverage of protected areas in relation to marine areas	UN Environment (UNEP-WCMC)	1



Step-by-step guide for each indicator

Level 1: Proposed global indicators

Level 2: Proposed national indicators

Level 3: Supplementary indicator

Monitoring parameters	Level 2	Level 3
Coverage of marine and coastal areas by protected areas	X	
Coverage, by protected areas, of areas of importance for biodiversity and derived ecosystem services		X
Management effectiveness of protected areas		X
Connectivity of protected areas		X
Equity in protected area benefits and costs		X



FDES Matrix on ocean accounts and statistics

- Need to develop a cross-cutting ocean statistics incl. also fisheries and other resources, uses of oceans and coasts, impacts etc.
- Correspondences mapped between:
 - Accounting categories and FDES statistics
 - SDGs and FDES statistics
 - Regional Seas indicators and FDES statistics

Mapping of the FDES (2013) to Annex 2 Ocean-related SDG indicators and links to ocean accounts (concept note of the Asia and the Pacific Regional Expert Workshop on

SDG Target	SDG Indicator	Custodian	Link to ocean accounts	FDES Component, Sub-component and Topic	FDES Statistics (Tier I, Tier II, Tier III)	FDES Spatial Area
Concept Note Asia and the Pacific Regional Expert Workshop on Ocean Accounts 1-3 August				Developed by UNSD based on the FDES (2013)		
13.2 Integrate climate change measures into national policies, strategies and planning	13.2.1 Number of countries that have communicated the establishment or operationalization of an	UNFCCC	SEEA Air Emissions, Ecosystem Carbon,	Not applicable to FDES		
14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	14.1.1 Index of coastal eutrophication and floating plastic debris density	UNEP (with FAO, UNESCO-IOC, IMO)	SEEA Ecosystem Condition Accounts, Water Emissions, Solid Wastes	Component 1: Environmental Conditions and Quality, Sub-component 1.3: Environmental Quality, Topic 1.3.3: Marine water quality	1.3.3.a: Nutrients and chlorophyll: 1.3.3.a.1: Concentration level of nitrogen 1.3.3.a.2: Concentration level of phosphorous 1.3.3.h: Plastic waste and other marine debris <i>1.3.3.h.1: Amount of plastic</i>	- By coastal zone, delta, estuary or other local marine environment - Sub-national - National - Supranational - By point measurement

Discussion points

- What is the role of NSOs in monitoring and reporting on coasts and oceans?
- What is better monitored at the Regional level by regional bodies (due to the nature of oceans) and what on national?
- Can additional indicators be added – especially to align with the SDGs which will include additional parameters on marine plastic (such as on seafloor and ingested) and on nutrients?
- Would you recommend amending the tiers in this sheet?





Questions and comments?





Thank you for your attention!

For more information please contact the Environment Statistics Section
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