EXPERT WORKSHOP ON MARINE POLLUTION INDICATORS UNDER SUSTAINABLE DEVELOPMENT GOAL TARGET 14.1

Meeting notes

Organization

UN Environment and IOC-UNESCO jointly convened an Experts Workshop in Paris at the UNESCO Headquarters from 12-13 September. The workshop brought together scientific experts, Regional Seas Programmes and earth observation specialists working on the science of marine pollution indicators, data capture and dissemination, to discuss potentials, advantages, challenges and stakeholders for the global methodology of SDG Target 14.1.

The workshop agenda covered aspects related to the methodological development of SDG indicator 14.1.1. Specifically, this SDG target and the respective indicator are elaborated below:

- *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*

In the context of the SDGs, SDG indicator 14.1.1 is considered as a single SDG indicator; however, in order to monitor this indicator there will need to be multiple sub-indicators related to coastal eutrophication and to marine litter. This workshop aimed to further elaborate these sub-indicators under 14.1.1. Additionally, UN Environment is developing a methodology which would be useful for measuring the SDG target 14.1 and thus the terminology of the indicator (i.e. "Index of coastal eutrophication and floating plastic debris density") may need to be revisited by the Inter-Agency and Expert Group on the SDG Indicators in order to better reflect the actual measurement methodology. As opposed to plastic debris, the term marine litter and microplastics will be used in the context of this document to match the terminology that is currently used by the UN Environment Ad Hoc Open Ended Expert Group on Marine litter and microplastic

The workshop sought to:

- Determine the state of science on the target indicators (index of coastal eutrophication, marine litter and other relevant metrics);
- Explore the application of 'big data' through earth observation systems and how these can be applied in linking landuse change with respect to freshwater and coastal pollution;
- Determine a systematic approach to facilitate country adoption of a 'harmonized approach';

- Determine the scale of reporting and how to apply across transboundary waters; coastal and open ocean;
- Determine roles among agencies in the development process; who can provide what and what is already being done and available;
- Examine the types of reporting that can be done globally versus nationally and how can these be integrated for seamless reporting;
- Determine how to bring it all together; outlining the methodology.

The final agenda of the meeting is shown in Annex I and the list of participants included in Annex II.

Background

The United Nations (UN) General Assembly in September 2015 agreed on 17 Sustainable Development Goals (SDGs) and 169 targets as framework for the 2030 Agenda for Sustainable Development. Additionally, the UN General Assembly committed to developing a monitoring framework for the SDG goals and targets. This monitoring framework includes 244 indicators; each indicator has been assigned to a custodian agency. The custodian is responsible for developing a methodology for the indicator, for working with Member States to reach agreement on the use of the methodology for official SDG monitoring at the global level and once a methodology has been agreed, for designing the reporting mechanism for the SDG indicator. Additionally, the custodians are responsible for developing approaches to support countries in building their capacity for national monitoring and for global reporting. (A full list of SDG indicators and tiers is available from: https://unstats.un.org/sdgs/iaeg-sdgs/ ; details on the indicators under UN Environment custodianship is available from: https://uneplive.unep.org/statistics.)

UN Environment is the custodian for SDG indicator 14.1.1 and currently working toward the development of a final methodology for coastal eutrophication and marine litter in coordination with IOC-UNESCO. Due to the complexity of this topic, UN Environment has determined that SDG indicator 14.1.1 will be divided into a number of sub-indicators which can be monitored globally. Additionally, UN Environment plans to provide advice on additional sub-indicators which will not be monitoring globally, but which would be important for national or regional level monitoring. In order to reduce the burden on countries, UN Environment has determined that existing data and experiences of Regional Seas Programmes and of countries will be taken into account.

Over the last few years, UN Environment has been collecting information on existing monitoring mechanisms and experiences in order to inform the SDG 14.1.1 monitoring. UN Environment plans to use this literature review, internal expertise and discussions with member States, together with the suggestions made by the Expert Workshop toward finalizing the methodology on SDG 14.1.1. This report aims to summarize the current state of play and decisions related to SDG indicator 14.1.1 as based on the Expert Workshop and its follow-up tele-meeting, and to propose a draft framework for further development of the indicators.

Summary of Discussions

Consensuses

The Expert Group participants provided feedback toward the methodological development for SDG indicator 14.1.1, mainly focusing indicators which could be available before 2020. The discussion are summarized in table and bullet forms for each of potential candidate of the indicators as attached in Annex III. This feedback will be used by UN Environment to refine and develop statistical methodologies for measuring these SDG indicators.

Consensus 1: The approach for monitoring SDG indicator 14.1.1 will be based on 2 levels of data: (1) global level datasets sources from earth observations using remote sensing, modeling and selected in-situ data; and (2) national and regional scale data, mostly in-situ data, collected by national and regional entities.

Consensus 2: SDG indictor 14.1.1 should include a dashboard of sub-indicators which cover the source of pollution, the state of pollution and the impacts of pollution for both coastal eutrophication and marine litter.

Consensus 3: For each sub-indicator (component of the dashboard), UN Environment will need to carefully map out the guidelines for the application of that sub-indicator and to elaborate if the sub-indicator should be monitored globally or only monitored nationally or regionally.

Consensus 4: UN Environment will need to work with partners and existing mechanisms, including the Joint Group of Experts on Environmental Scientific Aspects of Marine Pollution (GESAMP), expert groups under the Regional Seas Programmes, the Global Ocean Observing System (GOOS), leading research institutes and others, to not only map out the guidelines, but also to develop a framework to gathering and compiling data, as well as approaches for capacity building around monitoring marine litter and coastal eutrophication.

Overarching recommendations

Harmonization, comparability and reporting

- There are many experiences in monitoring coastal eutrophication and marine litter, but these are not harmonized across countries and regions which makes global monitoring challenging. Additional effort will be required to identify ways to bring existing experiences together. In particular, NOAA agreed to use their role in the Group on Earth Observations to support work toward bringing together a global map of Chlorophyll A anomalies as an indicator of coastal eutrophication which would use the best practices from different regions.
- UN Environment should continue to work with existing partners to provide guidance on standard /harmonized data collection procedures. Additionally, UN Environment should work with the Regional Seas Programmes to promote the use of standard /harmonized methodologies.
- UN Environment will need to conduct an inventory of what can be shared by Regional Seas Programmes for formal SDG reporting. This can serve as a basis for developing a data collection mechanism which could be used to collect data from countries and from Regional Seas Programmes. It also need to identify research/monitoring activities emerging in recent years and seek collaboration to develop the inventory, particularly in marine plastics.

Attribution and source of pollution

- The purpose of the SDGs is to support countries in developing national actions toward achieving sustainable development. In order for countries to be in a position to develop national actions and identify key sectors, information on the source of marine pollution is essential. The Expert Group recommended that for both coastal eutrophication and marine litter it would be important to compile some information on source.

Global modelling and remote sensing (eg. Satellite) based data products

- Due to a lack of data on both coastal eutrophication and marine litter from in situ and national sources, the participants agreed that remote sensing data such as satellite data or data captured by drones global modelling should be utilized where possible.
- In particular, UN Environment should work with partners to develop satellite-based data products on both eutrophication and marine litter which could be used for both global monitoring and to provide countries with an additional source of information.
- Global modelling should be validated with some key in-situ monitoring results and can be improved by the use of national data and citizen science (validated) data over time.
- Efforts for developing a framework and promoting development and improvement of monitoring technologies as well as relevant capacity development.

Capacity building and national inventories

- There is a lack of experience in many national statistical systems in collecting data related to coastal eutrophication and marine litter. The operationalization of SDG indicator 14.1.1 will require support in terms of putting systems in place to collect national data on the source of pollution, the state of pollution and the impact of pollution. Additionally, support on how to structure this information into a national inventory which could be used to inform policy and to continuously monitor policy interventions would be needed. In order to provide this type of capacity support would require collaboration with a variety of partners.

Conclusions from the meeting

Draft monitoring framework

The Expert Group elaborated the sub-indicators that could be used for SDG 14.1.1 and potential data sources for each sub-indicator (tabulated below). This section attempts to capture a dashboard of sub-indicators which were discussed by the participants, including the level of monitoring (i.e. monitoring via a global data product or a national data product) and potential partners for the sub-indicator. NOTE: this section does not represent a final version, but a starting point for further elaboration.

Coastal Eutrophication monitoring draft framework

Type of Sub-Indicator	***Core 14.1.1****	***Data source for SDG monitoring+***	***Other data sources+***	**Level of reporting**	**Partners**
Sub-Indicators related to the source (or attribution) of nutrients					
Index of Coastal Eutrophication Potential (ICEP)	G	M	N	River basin	IOC/N-CIRP and ICEP partners
River Total Nitrogen (in situ is collected through SDG 6.3.2)	C	M, I		River basin	GEMS, ICEP partners
River Total Phosphate (in situ is collected through SDG 6.3.2)	C	M, I		River basin	GEMS, ICEP partners
River Silica (in situ is collected through SDG 6.3.2)	C	M, I		River basin	GEMS, ICEP partners
Atmospheric Nitrogen deposition	C	M		River basin	ICEP partners, GESAMP Working Group 38
Other river water quality parameters (as per SDG 6.3.2)	N		I		GEMS
Sub-Indicators related to the state of nutrient loading or a proxy for potential eutrophication status					
Chlorophyll A (annual average, anomalies and annual max)	G	S	I	30m resolution	ESA, NOAA, NASA and other space agencies; Regional Seas Programmes, GOOS
Total Nitrogen (TN), Dissolved inorganic nitrogen (DIN), Total Phosphorous (TP), Dissolved inorganic phosphorous (DIN), Dissolved oxygen	G	I		Regional	Regional Seas Programmes, GOOS
Coloured dissolved organic matter	C	S	I	30m resolution	ESA, NOAA, NASA and other space agencies
Turbidity	C	S	I	30m resolution	ESA, NOAA, NASA and other space agencies
Other water parameters (O_2% Saturation, Secchi depth, River discharge, Salinity, Temperature, pH, alkalinity, organic carbon, toxic metals, persistent organic pollutants)	N		I		GOOS
Sub-Indicators related to the impacts of eutrophication					
Microalgal growth, harmful algal blooms, submerged aquatic vegetation coverage, biodiversity and hypoxia	N		I, S		

** G = Global monitoring core parameter, C = Collected globally, but will not be reported as part of the official SDG reporting framework, N = National monitoring parameter*

+ S = Satellite based global data product, M= globally modelled data, I = In situ data collected from countries, N = Nationally derived data which is based on national modelling, citizen science or other national data products.

Marine litter draft monitoring framework

Type of **Sub-*Indicator***	***Core 14.1.1****	***Data source for SDG monitoring+***	***Other data sources+***	**Level of reporting**	**Partners**
Sub-Indicators related to the source (or attribution) of marine litter					
Plastic pollution potential (based on the use and landfilling of plastics)	G	M	N	River basin	Waste statistics partners for SDG 12
River litter	C	I		River basin	GEMS
Modelling of litter movement through oceans	C	M		Global	NASA and ESA, GESAMP Working Group 40
Other parameters related to plastic consumption and recycling	N		I		
Sub-Indicators related to the state of marine litter or a proxy for the state					
Beach litter	G	I, N		National	Regional Seas, GESAMP WG 40, Citizen Science organisations
Floating plastics (concentration and large items over 10m)	G	S		TBD	NASA and ESA
Water column plastics	C	I		National	GESAMP WG 40
Microplastics (floating, water column and sea floor)	C	I		National	GESAMP WG 40
Plastic ingestion	N		I	National	GESAMP WG 40, Citizen Science organisations
Sea floor plastic litter	N		I	National	GESAMP WG 40
Sub-Indicators related to the impacts of marine litter					
Entanglement	N		I, N		Citizen Science organisations
Health indicators (human health and ecosystem health)	N		I, S, N		

** G = Global monitoring core parameter, C = Collected globally, but will not be reported as part of the official SDG reporting framework, N = National monitoring parameter*
+ S = Satellite based global data product, M= globally modelled data, I = In situ data collected from countries, N = Nationally derived data which is based on national modelling, citizen science or other national data products.

Annex 1 Agenda: Experts Workshop on Marine Pollution Indicators under SDG Target 14.1.1

12-13 September 2018, Paris

Time	Session description	Lead(s) /presenter(s)
DAY 1		
09:00-09:10	**SESSION 1:** Welcome, overview and introductions	Vladimir Ryabinin, IOC-UNESCO Lisa Svensson, UN Environment
09:10-09:15	The SDG indicator process and progress toward adoption; • Status of marine pollution indicator and outlook	Jillian Campbell, UN Environment
09:15-10:00	**SESSION 2: State of the art in estimating marine pollution.** Moderated by Henrik Enevoldesen, IOC-UNESCO *Session format: panel discussion style; no individual PowerPoint presentations, although may be aided as needed by slides for illustration. Individual interventions should be no longer than 10 minutes*	
	Conventional In-situ to monitoring nutrient loading, plastic deposition in riverine and coastal environments; SDG6 water quality monitoring linked to coastal water quality	GEMS Water TBC Emma Heslop, GOOS, IOC-UNESCO
	Remote sensing marine pollution assessment applications and validation (eg chlorophyll-a concentrations; marine litter) • What is the state of art • What are the gaps?	Emily Smail; GEO Blue Planet Ved Chirayath, NASA Paolo Corradi, ESA; Nikolai Maximenko, U of Hawaii
	Modelling approaches including the ICEP modelling; plastic circulation. • What is the state of art • What are the gaps?	John Harrsion, Washington State U Lex Bouwman, PBL Netherlands Alexander Turra; GESAMP
	Question and answer	
10:00-10:15	BREAK	
10:15-11:45	**SESSION 3: National and regional experiences in marine pollution assessments; Focus on key highlight(s), challenges and gaps** Moderated by Christopher Cox, UN Environment *Session format: panel discussion style; no individual PowerPoint presentations, although may be aided as needed by slides for illustration. Individual interventions should be no longer than 5 minutes*	
	Mediterranean Sea region	Jelena Knezevic, MAP Secretariat
	Caribbean Sea region	Luisa Espinosa, INVEMAR Daryl Banjoo, IMA
	Baltic Sea region	Owen Rowe, HELCOM Secretariat
	North Pacific region	Genki Terauchi, NOWPAP Secretariat
	Pacific region	Marta Ferreira, U of South Pacific
	India	Ramesh Ramachandran, Ministry of Environment, Forest & Climate Change, India
	Germany	Simon Felgendreher, Federal Statistical Office

Time	Session description		Lead(s) /presenter(s)
	Brazil		Alexander Turra, U of São Paulo
	Japan		Takashi Ohmura, Ministry of the Environment, Japan
	Question and answer		
11:45-12:00	**SESSION 4: Approach for integration – SDG 6 and 14 country support pathway**. Progress, challenges and gaps ***Session format: PowerPoint presentation***		Jillian Campbell, UN Environment
12:00-13:00	Summary discussion on challenges, gaps and the integration of national and global data sources. What are realistic ambitions? ***Session format: Open discussion***		Moderated by Heidi Savelli, UN Environment
13:00-14:00	LUNCH		
14:00-14:10	**SESSION 5: Toward an updated workplan.** Closing the gaps, identifying the work needed, commitments by partners; who can do what and by when. Discussion on existing resources and areas where resource mobilization is required. ***Session format: break groups on the 2 thematic areas; open discussion around the guiding questions (see below)***		
14:10-17:30	**Parallel workgroup 1 –** nutrient pollution monitoring and assessment	**Parallel workgroup 2 –** plastics pollution monitoring and assessment	Workgroup 1: Facilitated by John Harrsion Workgroup 2: Facilitated by Alexander Turra
DAY 2			
	SESSION 5: Parallel work group discussion continue		
09:00-12:00	**Parallel workgroup 1 –** nutrient pollution monitoring and assessment	**Parallel workgroup 2 –** plastics pollution monitoring and assessment	Workgroup 1: Facilitated by John Harrsion Workgroup 2: Facilitated by Alexander Turra
12:00-13:00	**SESSION 6: Work group report-back; action plan**		Working group rapporteurs
13:00-14:00	**LUNCH**		
14:00-15:30	Mapping out the key elements of the methodology (bring it all together)		Jillian Campbell, UN Environment
15:30-16:00	Wrap-up and closing remarks		Christopher Cox, UN Environment Henrik Enevoldsen, IOC-UNESCO

Annex 2 Guiding questions for parallel working groups - Session 5:

Day 1 (12 September): National monitoring outlook

Parallel Group 1: National monitoring of nutrient pollution

- What should be included in a core set of indicators for global monitoring?
- Do you agree with the idea to have some indicators based on global data products – satellite data and/or modelling? What might be limitations or constraints?
- How should national data be collected at the global level (from Regional Seas Programmes with data supplemented by countries)?
- Should we aim to only collect indicators which would be available in most regions or should we already aim to collect a non-core set of indicators which we are hoping should available in the future?
- How frequently should UN Environment aim to collect data which could be used for global reporting?
- Should we also aim to provide guidance on what a country or Regional Sea Programme may wish to measure at the regional/national level?

Parallel Group 2: National monitoring of marine plastics

- What should be included in a core set of indicators for global monitoring?
- Do you agree with the idea to have some indicators based on global data products – satellite data and/or modelling?
- How should national data be collected at the global level (from Regional Seas Programmes with data supplemented by countries)?
- Should we aim to only collect indicators which would be available in most regions or should we already aim to collect a non-core set of indicators which we are hoping should available in the future?
- How frequently should UN Environment aim to collect data which could be used for global reporting?
- Should we also aim to provide guidance on what a country or Regional Sea Programme may wish to measure at the regional/national level?

Day 2 (13 September): Global monitoring outlook

Parallel Group 1: Nutrient pollution

- What is the best way to support the development of a global product which UN Environment could use for Chlorophyll-A and TSS?
- How frequently can it be updated?
- What are the constraints/costs?
- Do we need partnerships with private companies to get the resolution/frequency needed?
- For global modelling of coastal eutrophication potential (ICEP), what are the data sources which need to be improved? Who is in the best position to conduct the modelling exercise?
- What are functionalities of current coastal eutrophication platforms that may be relevant to consider for a global platform on SDG 14.1.1 – is a global platform needed?
- What are relevant entities with expertise in this area for potential involvement in future discussions and review process.

- How can information be better shared and disseminated in order to improve the use of data?

Parallel Group 2: Marine plastics

- What aspects of marine litter can be modelled using satellites/earth observation systems?
- What are the opportunities to model marine plastics using citizen science data?
- What are the constraints/costs?
- Do we need partnerships with private companies to get the resolution/frequency needed?
- What are existing relevant platforms relevant to marine litter monitoring?
- What are functionalities of other platforms that may be relevant to consider for a global platform on SDG 14.1.1 – is a global platform needed?
- What are relevant entities with expertise in this area for potential involvement in future discussions and review process.
- How can information be better shared and disseminated in order to improve the use of data?

Annex 3 Group work from parallel session

This section includes the raw material that the parallel groups created during the workshop.

Marine Litter – Floating plastic debris density...

Priority to inform the SDG goal: L / M / H

Feasibility: L / M/ H

Mega: >1m

Macro: 2.5 cm to 1m

Meso: 0.5 cm to 2.5cm

Micro: <0.5 cm

What should be monitored? Indicator	**Global scale**		**1. Why? 2. Assessment methods? 3. Who? 4. Where?**	**Relevant for some countries?**	**Recommendations for developments / to improve comparability / best practices**	**Who can help?**
	Prio rity	Feasib ility				
Mega floating debris items or patches (sea) (area occupied by the litter/km²) derived from satellite images	H	H (> 10 m) M (< 10 m)	1. Global sink / Source of microplastics / Proxy of microplastics / Initial guidance for removal actions / 2. Satellite images processing 3. UNEP/Any country/organization that has access to satellite imaging system 4. Global	Yes. Resolution (size of particles) can be improved depending on countries capacities and data availability	Develop algorithms for image detection and spectrum classification; Develop algorithms to separate plastics from other debris; Develop standardized satellite products; Availability of commercial data for everywhere (i.e., higher resolution than public databases); Commercial images may be guided by modeling or knowledge on hotspots; If error is standardized, it can be comparable spatially and temporally; Global data from satellites can be used for trend analysis at the global level; Need to understand sources of error/variation (temporal and spatial).	NASA ESA JAXA INPE Planet Lab DIGIGLOBE Etc...
What should be monitored? Indicator	Global scale		1. Why? 2. Assessment methods? 3. Who? 4. Where?	Relevant for some countries?	Recommendations for developments / to improve comparability / best practices	Who can help?
	Prio rity	Feasib ility				
Mega stranded debris items or patches (beaches) (area occupied by the litter/beach length or m²) derived from satellite images	H	M (> 10 m) M (< 10 m)	1. Local sink / Source of microplastics / Proxy of microplastics / Initial guidance for removal actions 2. Satellite/High Altitude Platform Systems (Plan, Drones...) images processing 3. UNEP/Any	Yes. Resolution (size of particles) can be improved depending on countries capacities and data availability (or using other remote sensing devices as planes, balloons, drones etc.)	Develop algorithms for image detection and spectrum classification; Develop algorithms to separate plastics from other debris; Develop standardized satellite products; Availability of commercial data for everywhere (i.e.,	NASA ESA JAXA INPE Planet Lab DIGIGLOBE NGOs Fishermen Universities/Research

			country/organization that has access to satellite imaging system (can help validate by in situ sampling) 4. Global		higher resolution than public databases); Commercial images may be guided by modeling or knowledge on hotspots; If error is standardized, it can be comparable spatially and temporally Global data from satellites can be used for trend analysis at the global level; Need to understand sources of error/variation (temporal and spatial).	Institutes Citizen science Etc...
What should be monitored? Indicator	Global scale		1. Why? 2. Assessment methods? 3. Who? 4. Where?	Relevant for some countries?	Recommendations for developments / to improve comparability / best practices	Who can help?
Mega floating debris items or patches (interior waters; big rivers and lakes) (area occupied by the litter/beach length or m²) derived from satellite images	H	H (> 10 m) M (< 10 m) H (Lakes ; large rivers) S (Small rivers)	1. Local source/ Engaging countries that are land-locked / Source of microplastics / Initial guidance for removal actions 2. Satellite/High Altitude Platform Systems (Plan, Drones...) images processing 3. UNEP/Any country/organization that has access to satellite imaging system (can help validate by in situ sampling) 4. Global	Yes. Resolution (size of particles) can be improved depending on countries capacities and data availability (or using other remote sensing devices as planes, balloons, drones etc.)	Develop algorithms for image detection and spectrum classification; Develop algorithms to separate plastics from other debris; Develop standardized satellite products; Availability of commercial data for everywhere (i.e., higher resolution than public databases); Commercial images may be guided by modeling or knowledge on hotspots; If error is standardized, it can be comparable spatially and temporally Global data from satellites can be used for trend analysis at the global level; Need to understand sources of error/variation (temporal and spatial); Engage river basin organizations.	NASA ESA JAXA INPE Planet Lab DIGIGLOBE NGOs Fishermen Universities/Research Institutes Citizen science River Basin Organizations Etc...
What should be monitored? Indicator	Global scale		1. Why? 2. Assessment methods? 3. Who? 4. Where?	Relevant for some countries?	Recommendations for developments / to improve comparability / best practices	Who can help?
Potential generation of plastic litter from land based sources and identification of fluxes and sinks	EH	H	1. Need to understand sources / Address responsibilities / monitor the effectiveness of policy making or management strategies / estimate what is	Yes. Potential to produce in situ data as scanning from bridges or to improve models with better reported data and satellite resolution.	Work is ongoing. Link to Plastic Pollution Emissions Working Group or others. May be difficult to agree globally on methods (sensitive to countries). Difficult to estimate leakage	Countries, municipalities, companies, regional and international organizations for

to predict future plastic input into the ocean			generated in country vs. received from the sea / target where priority measures should be focused; 2. High resolution satellite images (river output), secondary data on plastic generation, consumption, waste generation; waste management, precipitation; modeling; in situ sampling or scanning from bridges. 3. Academia partnerships, international research networks (e.g., Air Centre), countries. 4. Global		data. Difficult to standardize data across countries. Consider information per capita. Consider to focus on specific types of items (e.g., bottles...)	sustainable waste management, national statistics database,
What should be monitored? Indicator	Global scale		1. Why? 2. Assessment methods? 3. Who? 4. Where?	Relevant for some countries?	Recommendations for developments / to improve comparability / best practices	Who can help?
Beach litter (mega, 1.0m; macro, >2.5 cm) – number of items, weight, volume and categories (*in situ*); Record metadata to allow data interpretation	H	H	1. Simple and cost efficient; Highest public impact; economic tourism/fisheries value; raises awareness; Something that can be easily improved to show results of a policy; Decrease impacts on marine organisms at the beach 2. Refer to GESAMP and UNEP Guidelines 3. UNEP (coordinate); Everyone 4. Global	Yes, depending on the capacity to improve/widen monitoring coverage	Useful to estimate floating litter in coastal waters because there differences in the type of polymers from coasts to open ocean. Look at brands/barcodes/potential sources. Beaches near sources (river mouths) may return important information of what is entering the ocean. Such data can improve/validate modeling. Need to improve citizen science approaches and correlate them to monitoring approaches. Improve the use of APPs. Need to take into account methodological limitations and the influence of natural phenomena as tides, storms...	Municipalities, Citizens, Universities, NGOs, private sector, Regional seas
What should be monitored? Indicator	Global scale		1. Why? 2. Assessment methods? 3. Who? 4. Where?	Relevant for some countries?	Recommendations for developments / to improve comparability / best practices	Who can help?

Floating plastic debris density, including microplastics, (per area; volume) (in situ)	EH	L	1. Largest impact on biota and food chain (food safety); inform models (ground-truth); inform directly the SDG 14.1.1.; 2. Refer to GESAMP report 3. Governments, academics, NGOs 4. Global	Yes, depending on their capacity to produce and share in situ data	Data for some areas may be used to feed models to produce global estimates (see next indicator) Need more and regular expeditions to provide data. Develop microplastics sensors to install in vessels to increase coverage. For developed countries it is important to look at input fluxes of microplastics in sewage treatment.	Municipalities, Universities, NGOs, Fisheries organizations /industry,, shipping sector, Regional seas
What should be monitored? Indicator	Global scale		1. Why? 2. Assessment methods? 3. Who? 4. Where?	Relevant for some countries?	Recommendations for developments / to improve comparability / best practices	Who can help?
Estimated distribution of Floating plastic debris density, including microplastics, (per area) based on modeling, validated/feed by *in situ* (microplastic) data and remote sensing	EH	H	1. We need to have a global time series/coverage/estimate/prediction of floating plastic density/mass budget; Indicative of exposure to the biota; food safety; invasive species; identification of hotspots; estimate social-economic loss; Input/output flux budget for every country (global dynamics/track); establish profiles to identify sources (barcoding, brands..); to develop better planning for in situ observation; to foster plastic recycling. 2. Large scale computing; Refer to GESAMP guidelines; 3. Governments, academics/research, NGOs plus UNEP (coordination) 4. Global	Yes, depending on their capacity to produce and share in situ data	Some agreement on standardized models is required.	Universities, Research institutions, NASA ESA JAXA INPE Planet Lab DIGIGLOBE, GODAE Oceanview modelers
What should be monitored? Indicator	Global scale		1. Why? 2. Assessment methods? 3. Who?	Relevant for some countries?	Recommendations for developments / to improve comparability / best	Who can help?

			4. Where?		practices	
Biota – Ingestion (all sizes of plastics) (number of items/g)	H	M	1. Potential high impact on food safety; potential large ecosystem impact; help to understand plastic mass budget. 2. Refer to GESAMP guideline 3. Governments, academics/research, fishing industry, National monitoring initiatives plus UNEP (coordination) 4. Fishing hotspots, areas of biological significance, marine debris hotspots.	Yes, depending on their capacity to produce and share data	Needs further development in monitoring program or scheme/opportunistic programs. Stomach content is easier than analysis in tissues Need to harmonize data from different parts of the world based on different species. Need to select sentinel species (e.g., filter feeders or commercial species; pan-global species/genera) Need studies to correlate ingestion with effects on humans	Governments, academics/research, NGOs, fishing industry, National monitoring initiatives, NOAA muscle watch
Biota – Potential of entanglement (number of species/individuals) in a given area	H	L	1. Potential large ecosystem impacts 2. 3. 4.		Fisheries reporting lost fishing gear Opportunistic Based on cases that can be upscaled.	Fisheries
What should be monitored? Indicator	Global scale		1. Why? 2. Assessment methods? 3. Who? 4. Where?	Relevant for some countries?	Recommendations for developments / to improve comparability / best practices	Who can help?
Sea floor (benthic habitats)						
Number of item per area (km2)	H	L	1. Most of the litter is in the bottom; importance for the mass budget; 2. Refer to GESAMP report 3. 4.		Opportunistic Based on cases that can be upscaled.	
Water column						

What needs to be collected on the ground

Country level initiatives

Citizen science info

How to make people more aware of what is going

Eutrophication group discussion from Day 1 (September 12th) of Marine Indicators Expert Workshop

Summary

- OK to use a mix of globally available and locally measured indicators.

- Locally measured indicators could be either provided directly to UNEP by countries or through regional seas, when such programs are available.
- Thought it was useful to divide indicators into "core indicators" and "desirable or aspirational" indicators
- Core parameters: ICEP, chlorophyll a, nutrients (total nitrogen, total phosphorous, silica, and dissolved inorganic N, P, and Si), , dissolved oxygen, pH, salinity, secchi depth, turbidity, HAB occurrence, SST, confidence index for products, river flow nutrient concentrations and discharge
- Aspirational: HAB extent in time and space, microalgal growth, submerged aquatic coverage, alkalinity, biodiversity, dissolved organic carbon, toxic metals, persistent organic pollutants, regional contaminants of concern
- Reporting at most annually (for satellite-derived products), less frequently for measurements.
- Appropriate for UN Environment and IOC to provide recommendations on methodology and parameters/indicators
- Also thought it would be important for UNEP/IOC to consider cost of core indicators

More detailed discussion notes

Question 1 – what parameters

Indicators

-chlorophyll-a

-discharge flux from rivers into coastal areas various N/P and silica in the rivers/discharge sources (for ICEP)

-monthly concentration values in coastal areas for N/P/silica and chlorophyll for validation (for ICEP)

- Sensitive areas, what is an acceptable baseline? What should be the maximum threshold?
- How many points along a coastline should be measured per country?
    - HELCOM requires 15 stations to be measured in a country from June to September (shifts as you go further north)
- Chlorophyll-a anamoly ratio?
- Maximum value along a coastline, anomaly relative to a long-term average
- 10-year average?
- Incremental approach for what is possible now, what is useful for
- Coastal categories – based on the watershed source of nutrients and water flowing into the coastal zone and the characteristics of the ecosystems receiving those segments (ex. Do not mix coastal lagoons and fjords). Currently about 160 areas.
- Could organize the coastaline globally and use them as way to organize land/sea
- Sediments topology in India, US, UK (primary cells, secondary cells), typology for coastal waters, could be used to make a grid to determine where to make measurements.
- For in situ measurements – ideally monthly. How many measurements?
- Sampling will depend on what is representative taking into account natural variability and seasonality, what is characteristic of each season

Question 2 – include global parameters?

- Common procedure for boundary of what is "coastal eutrophication"
- Satellite data: baseline should start from 1998 when NASA began collecting data on a regular basis, need to combine data sets to make something
- what should the baseline be for a chlorophyll anomaly?

Question 3 – how should data be collected at the global level?

- HELCOM: they having mandatory reporting that are then quality checked before being incorporated into the indicators, if there was something similar to this we should be able to have data collected by countries and reported to the UN? Data collection is done by the contracting parties
- Is it feasible to do this globally? There are large resources needed to do this.
- Elisabetta – envisioned Regional Seas collecting data, data given to UN Environment then passed to the UN in New York for processing
- UN Environment has "UNEP live", IRIS tool which is in the pilot testing phase, easy way to input data, can be done automatically for different reporting oblgations to help reduce reporting burden for countries; UN Environment has interface for extracting data
- Ideally, tool down the line, GEO database with coastal units (coscats), then map in chlorophyll anamoly, etc.
- In HELCOM, after they have agreed on data and guidelines, the database has specific requirements for the formats, need to have an agreed format
- IRIS tool depends on focal point on the country to make sure the data is valid
- Another SDG indicator (12), regional parties have focal points, challenge to mandate the regional seas secretariats to do this, needs to be approved by the contracting parties
- Needs to be an upfront effort to make sure data is reported in a comparable way, SDG annual report is the end reporting goal

Question 4 – how widespread should this be?

- Have two sets – a "must have dataset" and the other one is optional…what is the thing every country can do?
- Chlorophyll, dissolved oxygen, turbidity/water clarity, pH
- For reporting – as long as the methodology is agreed upon such as just measuring in situ data in "hot spots"
- Core set of indicators, add in non-core parameters and indicators that countries can report on in the future, for non-core indicators
- HELCOM: they do this by having some monitoring proxies and assign a confidence on that based on the number of components that enter the assessment and availability of the coverage, could show the confidence based on how many parameters are included in the index
- Cost should be considered for core indicators
- Also link with goal 6
- Water temperature
- Biodiveristy not specifically included in indicators, just MPA distribution, IUCN asked for biodiversity to be overlayed on areas with high biodiversity

Question 5 – how often?

- Is annual basis enough? How often could we get those from countries?
- With HELCOM they get the data to the database every year, an assessment is done every year
- SDG database not analyzed by UN Environment
- How often UN Environment is expected to analyze it, there is a cycle, every three years a goal comes up, need to say “something” every three years
- Is expectation to see changes? In HELCOM they have seen extensive recovery times, new report almost identical
- Do not want to see an increase in eutrophication in terms of reporting, reporting would look for
- Countries can only pass data through the custodian, must go through UN Environment to go in the global report, countries can submit a voluntary report
- Paper sent to regional seas or countries member states that data share should be going through UN Environment
- Time scale – could have some delay, will be a mismatch of years for data reporting
- Data can be taken directly from space agencies, countries can be overlayed on global products, or they can be submitted as separate sub-indicators

Question 6 – **how prescriptive should IOC and UN Environment in terms of what should be measured ?**

- Can provide recommendations on methodology and parameters
- Methodologies for the 22 indicators in the regional seas programs are being developed by Takahiro Nakamura
- Could have multiple methods for collecting data for various parameters, Helcom could put that forward to the contracting parties
- Resources will also have to be mobilized to do this, some regional seas projects have active GEF projects
    - CLME+ initative (nutrient loading effort)
    - South China sea has initative
    - Western Indian Ocean
    - Mediterranean sea
- How to determine the “coastal zone”, watersheds of interest, etc.
- Source to sea approach, framework should link with the waters that are delivering pollutants
- Drainage basins and coastal receiving basin
- Costcats could be used as a breakdown
- HELCOM has different levels, regions broken down into water body types
- How to deal with sensitivities of coastal countries?

List of indicators with comments

Core Indicator?	Type of information	Indicator/ Products	Global Scale?	Who can help?	Timeline?

Y	Satellite-derived	Absolute Chl a estimate (composite of different, regionally appropriate algorithms) (Need long-term compatability/consistency for all products if the time-series data is to be correctly interpreted)	Y	NOAA/NASA/ESA/JAXA-space agencies coordinated by CEOS and GEO/Paul DiGiacamo/Steve Greb	reported annually, but would need some time to figure out what actually to report
Y		Chl a anomaly (Need to use region-specific, calibrated algorithms when/where available for all products)	Y	NOAA/NASA/ESA/JAXA-space agencies coordinated by CEOS and GEO/Paul DiGiacamo/Steve Greb	
Y		Chl a max in space and time (annual) (Monthly, seasonal, and annual median, max for all, with coastal cells unmasked (but without cells likely to be influenced by bottom reflection, land, etc.))	Y	NOAA/NASA/ESA/JAXA-space agencies coordinated by CEOS and GEO/Paul DiGiacamo/Steve Greb	
Y		Colored Dissolved Organic Matter	Y	NOAA/NASA/ESA/JAXA-space agencies coordinated by CEOS and GEO/Paul DiGiacamo/Steve Greb	
Y		Turbidity	Y	NOAA/NASA/ESA/JAXA-space agencies coordinated by CEOS and GEO/Paul DiGiacamo/Steve Greb	
Y	Modeled	River TN load	Y	UU, WSU	Reported every 5 years(?), contingent upon funding
Y		River TP load	Y	UU, WSU	
Y		River DSi load	Y	UU, WSU	
Y		Index of Coastal Eutrophication Potential (ICEP)	Y	UU, WSU	
Y		Atmospheric N Dep.	Y		
				Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	

Y	In situ data	Chl a concentrations	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
Y		TN	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
Y		DIN (ammonium, nitrate, and nitrite)	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
Y		TP	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
Y		DIP	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
Y		O2% Sat.	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
Y		DO (mg/L)	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting

Y	Secchi depth	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
Y	Turbidity	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
Y	ICEP	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
Y	River nutrient concentrations (N, P, Si)	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
Y	River discharge	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
Y	N, P, and Si loads (rivers plus "hotspots")	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
Y	Salinity	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting

Y	Temperature	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
Y	pH	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
	HAB occurrence	N	HAEDAT(note this is a HAB event data base not a data base on harmful algal bloom aoccurrences)	~1-year delay between collection and reporting
N (aspirational)	HAB extent in time	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
N (aspirational)	HAB extent in space	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
N (aspirational)	atmospheric N deposition	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
N (aspirational)	microalgal growth	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting

N (aspirational)	submerged aquatic vegetation coverage	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
N (aspirational)	alkalinity	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
N (aspirational)	biodiversity	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
N (aspirational)	dissolved organic carbon	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
N (aspirational)	total organic carbon		Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
N (aspirational)	toxic metals	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
N (aspirational)	persistent organic pollutants	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting

N (aspirational)	regional contaminants of concern	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
N (aspirational)	hypoxia extent in time	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting
N (aspirational)	hypoxia extent in space	N	Data sources In order of priority, from greatest to least: regional seas programs (with GOOS as support), nations, research consortia, published datasets	~1-year delay between collection and reporting

Annex 4 Participants

Experts Workshop on Marine Pollution Indicators under SDG Target 14.1.1
12-13 September 2018, Paris

	Name	Organization	E-mail
1	Luisa Espinosa	INVEMAR, Colombia	luisa.espinosa@invemar.org.co
2	Ramesh Ramachandran	National Centre for Sustainable Coastal Management Ministry of Environment, Forest & Climate Change, Government of India	rramesh_au@yahoo.com
3	Alexander Turra	University of São Paulo, Brazil	turra@usp.br
4	Darryl Banjoo	Institute of Marine Affairs Hilltop Lane, Chaguaramas Republic of Trinidad and Tobago	dbanjoo@ima.gov.tt
5	Marta Ferreira	Faculty of Science, Technology and Environment, The University of the South Pacific, Fiji	marta.ferreira@usp.ac.fj
6	Simon Felgendreher	Federal Statistical Office of Germany	simon.felgendreher@destatis.de
7	Jelena Knezevic	Monitoring and Assessment Officer, Mediterranean Action Plan	jelena.knezevic@un.org
8	Genki Terauchi	Northwest Pacific Action Plan (NOWPAP), Regional Activity Centre (CEARAC), Japan	terauchi@npec.or.jp
9	Owen Rowe	Helcom Secretariat Baltic Marine Environment Protection Commission - Helsinki Commission	Owen.Rowe@helcom.fi

	Name	Organization	E-mail
		Finland	
10	Lex Bouwman	PBL Netherlands Environmental Assessment Agency, The Netherlands	Lex.Bouwman@pbl.nl
11	Arthur Buesen	PBL Netherlands Environmental Assessment Agency, The Netherlands	Arthur.Beusen@pbl.nl
12	John Harrison	Washington State University, Pullman, Washington, United States	john_harrison@wsu.edu
13	Takashi Ohmura	Office of Marine Environment, Ministry of the Environment, Japan	TAKASHI_OMURA@env.go.jp
14			
15			
16	Isabelle Ansorge	Department of Oceanography, RW James Building University Avenue University of Cape Town	Isabelle.Ansorge@uct.ac.za
17	Emily Smail	GEO Blue Planet Secretariat, NOAA Center for Weather and Climate Prediction	Emily.Smail@noaa.gov
18	Rose Osinde Alabaster	Science Action in Schools for Sustainable Development, ETH, Zurich	rose.alabaster@gmail.com
20	Ved Chirayath,	NASA Ames Research Center	ved.chirayath@nasa.gov
21			
22	Paolo Corradi	Space Applications Services for ESA - European Space Agency, The Netherlands	Paolo.Corradi@esa.int
23	Henrik Enevoldsen	IOC-UNESCO	h.enevoldsen@unesco.org
24			
25	Christopher Cox	Global Programme of Action, UN Environment	christopher.cox@un.org
26	Heidi Savelli	Global Programme of Action, UN Environment	heidi.savelli@un.org
27	Jillian Campbell	Science Division, UN Environment	campbell7@un.org
28	Emma Heslop	Programme Specialist for GOOS & JCOMM OCG IOC/UNESCO	e.heslop@unesco.org

Meeting photos at https://www.flickr.com/photos/140082532@N06/albums/72157701045820634