Nutrients Desk Study

Presented 3 March 2021

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Objectives

- Identify the sources, sinks, fate and transport, and impacts of pollution, focusing mainly on nitrogen and phosphorus.
- Provide information on national and regional nutrient reduction commitments, targets, measures, gaps in management and governance
- Identify existing monitoring and assessment programmes in COBSEA countries.

Proposed Regional Responses

COBSEA can move forward and implement the Pollution Component of its Strategy

Methodology

· Team of 2 consultants

Research – literature review, focused on N and P in coastal and marine environments

- Online research
- Questionnaire sent to experts in the countries – Status of N and P in the country, management of N and P
- Drew upon personal knowledge
- Dialogues with individuals
- UN-led initiatives

· Working schedule from Jan. 2021 to Mid-March 2021

Sources of N and P

Mainly from land-based sources

- Agriculture – chemical fertilizers, pesticides, herbicides
- Domestic waste
- Industry
- Some aquaculture
- Other non-point sources: rivers, reservoirs

Transport pathways to the coastal and marine environment

Mainly via rivers

Some atmospheric, but lower loads compared to rivers

Sinks

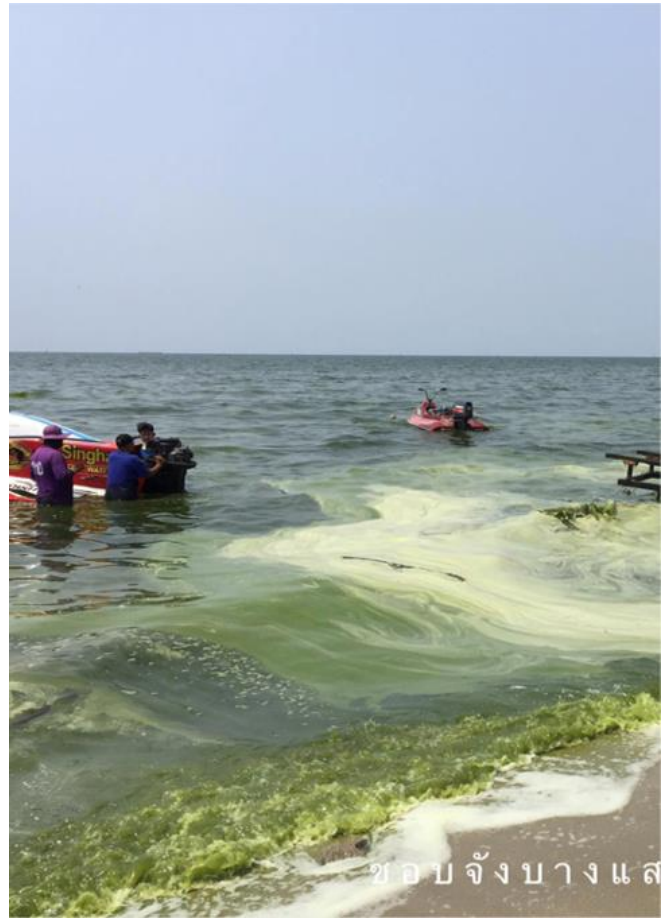
- Floating in sea water
- Deposited into coastal terrestrial areas, sediments & offshore seabeds
- Taken up by algae, aquatic plants

Impacts

- Coastal water quality: eutrophication > HABs
- Marine Environment & Biodiversity: fish, shellfish killed
- Fisheries > livelihood
- Tourism > economic

Some Hotspots (or highly eutrophicated areas)

- Yangtze and Pearl River deltas; Liaodong and Bohai Bays, China
- HABs observed in:
  - 1x in Kep - Cambodia coastal area (2016)
  - Jakarta Bay, Indonesia
  - Masan Bay, Shiwha Lake, ROK
  - Upper and Inner Gulf of Thailand
  - Khanh Hoa, Ninh Thuan, and Binh Thuan coasts, Vietnam
- High eutrophication – Manila Bay, Philippines



GOVERNANCE

Targets for Nutrients and Pollution Reduction

China

- 5-year plans
- reduce emissions by 10-15 % from 2015 levels
- ammonia nitrogen (10%), NOx emissions (10%)

Indonesia

- Water Quality Index system
- physical and chemical (NH4, NO3, PO4) parameters, dissolved metals, organism concentration, and radioactive materials
- Target indicators in Citarum Watershed, e.g. # water pollution control facilities

Targets for Nutrients and Pollution Reduction

Malaysia

- 10th and 11th national plans - targets for WQ improvement
- Assess maximum daily loads of pollutants
- Develop the National Marine Water Quality Index

ROK

- Many WQ standards and monitoring around all coastal areas
- Total Pollution Load Management System (TPLMS) for 5 Special Management Areas
- P reductions targets are applied to the TPLMS
- Three largest riverine systems, Geum, Yeongsang, and Nakdong have set water quality targets for P and BOD

Targets for Nutrients and Pollution Reduction

Singapore

- WQ targets in recreational beaches
- Intensive wastewater management facilities for reservoirs to serve potable and recreational use

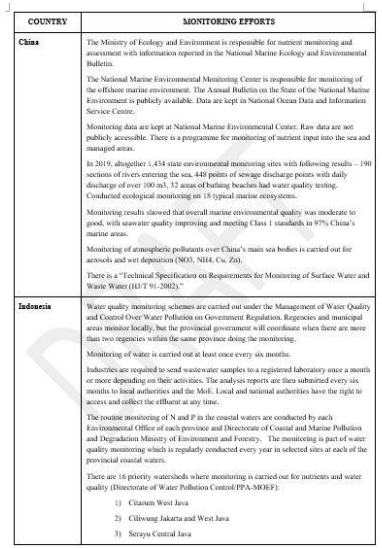
Vietnam

- WQ standards for surface, coastal and groundwater
- Standards for effluents from domestic, industrial and medical wastewater

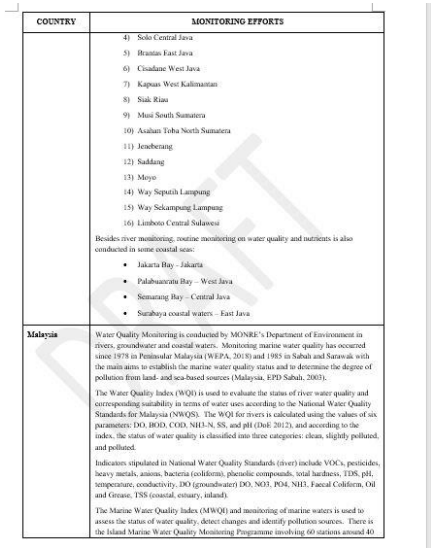
No specific targets set in Thailand, Cambodia or Philippines but have WQ standards

Monitoring Programmes

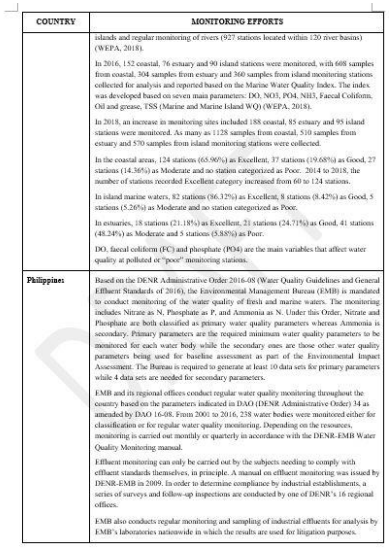
- Chapter 3.3
- Not sufficient in some countries
- Wish to improve/expand
- Coastal areas – in nearly all countries



COUNTRY	MONITORING EFFORTS
China	The Ministry of Ecology and Environment is responsible for nutrient monitoring and assessment with information reported in the National Marine Ecology and Environmental Bulletin. The National Marine Environmental Monitoring Center is responsible for monitoring of the offshore marine environment. The Annual Bulletin on the State of the National Marine Environment is publicly available. Data are kept in National Ocean Data and Information Service Centre. Monitoring data are kept at National Marine Environmental Center. Raw data are not publicly accessible. There is a programme for monitoring of nutrient input into the sea and managed areas. In 2019, altogether 1,434 state environmental monitoring sites with following results – 190 sections of rivers entering the sea, 448 points of sewage discharge points with daily discharge of over 100 m3, 32 areas of bathing beaches had water quality testing. Conducted ecological monitoring on 18 typical marine ecosystems. Monitoring results showed that overall marine environmental quality was moderate to good, with seawater quality improving and meeting Class 1 standards in 97% China's marine areas. Monitoring of atmospheric pollutants over China's main sea bodies is carried out for aerosols and wet deposition (NO_3^-, NH_4^+, Cu, Zn). There is a "Technical Specification on Requirements for Monitoring of Surface Water and Waste Water (HJ/T 91-2002)."
Indonesia	Water quality monitoring schemes are carried out under the Management of Water Quality and Control Over Water Pollution on Government Regulation. Regencies and municipal areas monitor locally, but the provincial government will coordinate when there are more than two regencies within the same province doing the monitoring. Monitoring of water is carried out at least once every six months. Industries are required to send wastewater samples to a registered laboratory once a month or more depending on their activities. The analysis reports are then submitted every six months to local authorities and the MoE. Local and national authorities have the right to access and collect the effluent at any time. The routine monitoring of N and P in the coastal waters are conducted by each Environmental Office of each province and Directorate of Coastal and Marine Pollution and Degradation Ministry of Environment and Forestry. The monitoring is part of water quality monitoring which is regularly conducted every year in selected sites at each of the provincial coastal waters. There are 16 priority watersheds where monitoring is carried out for nutrients and water quality (Directorate of Water Pollution Control/PPA-MOEF): 1) Citarum West Java 2) Ciliwung Jakarta and West Java 3) Serayu Central Java



COUNTRY	MONITORING EFFORTS
	4) Solo Central Java 5) Brantas East Java 6) Cisadane West Java 7) Kapuas West Kalimantan 8) Siak Riau 9) Musi South Sumatera 10) Asahan Toba North Sumatera 11) Jeneberang 12) Saddang 13) Moyo 14) Way Seputih Lampung 15) Way Sekampung Lampung 16) Limboto Central Sulawesi Besides river monitoring, routine monitoring on water quality and nutrients is also conducted in some coastal seas: • Jakarta Bay – Jakarta • Palabuanratu Bay – West Java • Semarang Bay – Central Java • Surabaya coastal waters – East Java
Malaysia	Water Quality Monitoring is conducted by MONRE's Department of Environment in rivers, groundwater and coastal waters. Monitoring marine water quality has occurred since 1978 in Peninsular Malaysia (WEPA, 2018) and 1985 in Sabah and Sarawak with the main aims to establish the marine water quality status and to determine the degree of pollution from land- and sea-based sources (Malaysia, EPD Sabah, 2003). The Water Quality Index (WQI) is used to evaluate the status of river water quality and corresponding suitability in terms of water uses according to the National Water Quality Standards for Malaysia (NWQS). The WQI for rivers is calculated using the values of six parameters: DO, BOD, COD, NH_3-N, SS, and pH (DoE 2012), and according to the index, the status of water quality is classified into three categories: clean, slightly polluted, and polluted. Indicators stipulated in National Water Quality Standards (river) include VOCs, pesticides, heavy metals, anions, bacteria (coliform), phenolic compounds, total hardness, TDS, pH, temperature, conductivity, DO (groundwater) DO, NO_3, PO_4, NH_3, Faecal Coliform, Oil and Grease, TSS (coastal, estuary, inland). The Marine Water Quality Index (MWQI) and monitoring of marine waters is used to assess the status of water quality, detect changes and identify pollution sources. There is the Island Marine Water Quality Monitoring Programme involving 60 stations around 40



COUNTRY	MONITORING EFFORTS
	islands and regular monitoring of rivers (927 stations located within 120 river basins) (WEPA, 2018). In 2016, 152 coastal, 76 estuary and 90 island stations were monitored, with 608 samples from coastal, 304 samples from estuary and 360 samples from island monitoring stations collected for analysis and reported based on the Marine Water Quality Index. The index was developed based on seven main parameters: DO, NO_3, PO_4, NH_3, Faecal Coliform, Oil and grease, TSS (Marine and Marine Island WQI (WEPA, 2018). In 2018, an increase in monitoring sites included 188 coastal, 85 estuary and 95 island stations were monitored. As many as 1128 samples from coastal, 510 samples from estuary and 570 samples from island monitoring stations were collected. In the coastal areas, 124 stations (65.96%) as Excellent, 37 stations (19.68%) as Good, 27 stations (14.36%) as Moderate and no station categorized as Poor. 2014 to 2018, the number of stations recorded Excellent category increased from 60 to 124 stations. In island marine waters, 82 stations (86.32%) as Excellent, 8 stations (8.42%) as Good, 5 stations (5.26%) as Moderate and no station categorized as Poor. In estuaries, 18 stations (21.18%) as Excellent, 21 stations (24.71%) as Good, 41 stations (48.24%) as Moderate and 5 stations (5.88%) as Poor.
Philippines	Based on the DENR Administrative Order 2016-08 (Water Quality Guidelines and General Effluent Standards of 2016), the Environmental Management Bureau (EMB) is mandated to conduct monitoring of the water quality of fresh and marine waters. The monitoring includes Nitrate as N, Phosphate as P, and Ammonia as N. Under this Order, Nitrate and Phosphate are both classified as primary water quality parameters whereas Ammonia is secondary. Primary parameters are the required minimum water quality parameters to be monitored for each water body while the secondary ones are those other water quality parameters being used for baseline assessment as part of the Environmental Impact Assessment. The Bureau is required to generate at least 10 data sets for primary parameters while 4 data sets are needed for secondary parameters. EMB and its regional offices conduct regular water quality monitoring throughout the country based on the parameters indicated in DAO (DENR Administrative Order) 34 as amended by DAO 16-08. From 2001 to 2016, 238 water bodies were monitored either for classification or for regular water quality monitoring. Depending on the resources, monitoring is carried out monthly or quarterly in accordance with the DENR-EMB Water Quality Monitoring manual. Effluent monitoring can only be carried out by the subjects needing to comply with effluent standards themselves, in principle. A manual on effluent monitoring was issued by DENR-EMB in 2009. In order to determine compliance by industrial establishments, a series of surveys and follow-up inspections are conducted by one of DENR's 16 regional offices. EMB also conducts regular monitoring and sampling of industrial effluents for analysis by EMB's laboratories nationwide in which the results are used for litigation purposes.

- **Cambodia** – monthly monitoring of freshwater; no regular marine and coastal water quality monitoring system yet
- **China** – along the coast & in atmosphere over the seas; results reported in Annual Marine Bulletin
- **Indonesia** – each Directorate monitors N and P in their coast & in watersheds

Monitoring Programmes

- **Malaysia** – MWQI & specific island monitoring
- **Philippines** – EMB & regional offices monitor monthly or quarterly; freshwater & marine areas
- **ROK** – all coastal areas – publicly available data online

NIFS – use of technology – RS, ocean colour, physical, chemical, biological monitoring

- **Singapore** – recreational beaches; real-time data available to the public
- **Thailand** – 2x a year in the coast, some data available in Thai to the public
- **Vietnam** – at least 2x a year in the coast; offshore & island monitoring

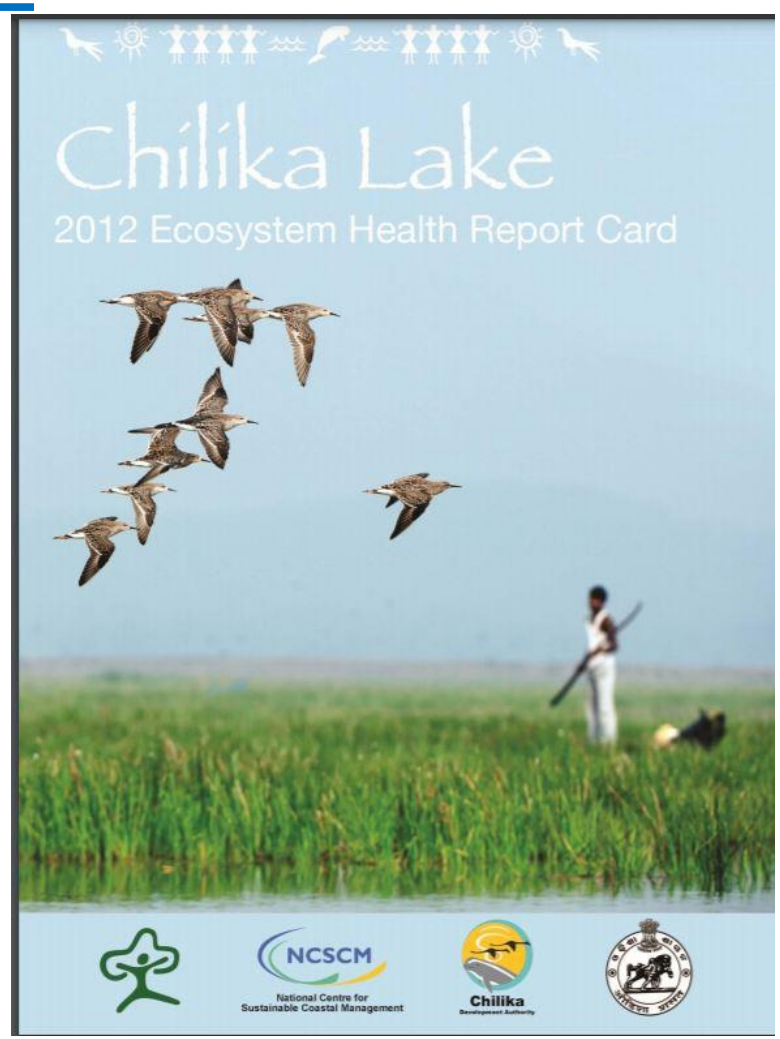
Regional & Global Measures to Tackle Pollution

- ASEAN – WQ monitoring and guidelines
- RC3S – Regional Capacity Centre, Bali
- UNEP Regional Seas Programme

Caribbean – Cartegena Convention, strategy under development

SACEP (South Asian Seas) – nutrients projects, scoping study, ecosystem health report card, N Hub

NOWPAP – Common Procedures, eutrophication tool



Regional & Global Measures to Tackle Pollution

Other UNEP Projects & Programmes

INMS – focus on N, N cycle, global assessment of threats and benefits of N; N Hub for South Asia

- Quantify N flows and impacts
- Improve N management in agriculture and the wider circular economy, e.g. making better use of manure

South Asia Nitrogen Hub

- Studies the impacts of different types of pollution for a better understanding of and formulation of a more coherent picture of the N cycle
- Examines the role of N in agriculture
- Provides options for more profitable, efficient, and cleaner farming.
- “Recycle” N pollution back into fertiliser

Regional & Global Measures to Tackle Nutrients and Pollution

- GNC – Global N Cycle – modelling for nutrient reduction strategies, Manila Bay as demo site
- GPNM – already mentioned by Mahesh
- SCS-SAP – South China Sea Strategic Action Progamme
    - National action plans and ocean model under development
    - Nutrient carrying capacity of water bodies

Regional & Global Measures to Tackle Nutrients and Pollution

Data bases and tools:

- TWAP data portal of river basin & ocean assessment globally
- HydroATLAS, IMAGE, NEWS – info on rivers, watersheds, nutrient sources, models

Gaps and Opportunities

- Need for more data and knowledge

✔ Enough?

✔ Where are data?

✔ Access

✔ More sharing and monitoring in some places

- Need to strengthen coordination

➢ Across agencies, with NGOs & all stakeholders

➢ Law enforcement, compliance, self-regulation, fines

➢ Jurisdiction over different land areas

Gaps and Opportunities

- Research and analytical capacity to be increased

➢"More reliable" data

➢Calibrated and comparable data

➢Research for carrying capacity and NUE

- Insufficient understanding of non-point sources – research, hard and soft technology

- Insufficient waste management approaches

➢Carried out in limited areas

➢Insufficient budget and manpower

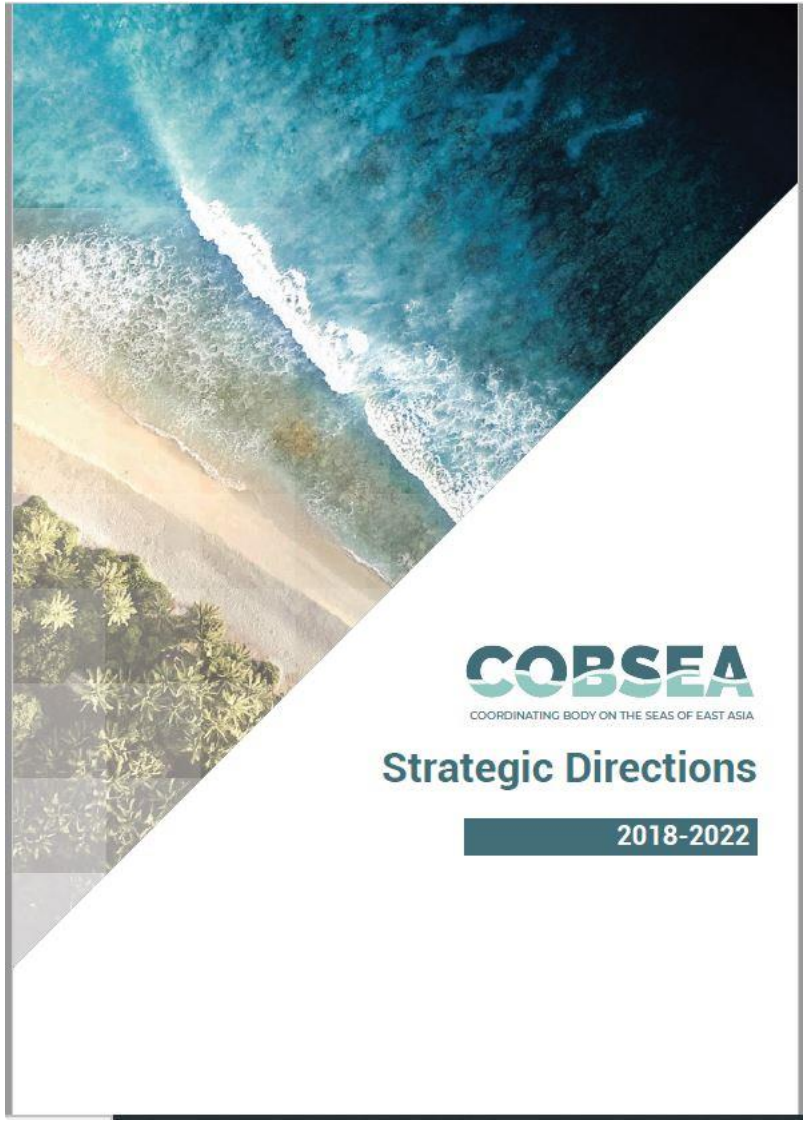
➢More affordable measures (technology)

Proposed Regional Responses

Purpose: To prevent and reduce eutrophication and sedimentation and their impact on the marine and coastal environment

Activities:

1. Development of regional guideline for identifying and addressing sources of nutrients, sediments and wastewater
2. Policy and information exchange, including sharing of outputs, results and best practice from projects addressing land-based sources of pollution, including activities towards implementation of the Strategic Action Programme (SAP) for the South China Sea
3. Technical training and capacity building



Proposed Regional Responses

Monitoring and assessment

- Support to develop/improve monitoring programmes
- Improve on existing ones – seasonal variability
- Ecosystem health report cards – examples from Lake Chilika and Manila Bay
- Common procedures, harmonized monitoring

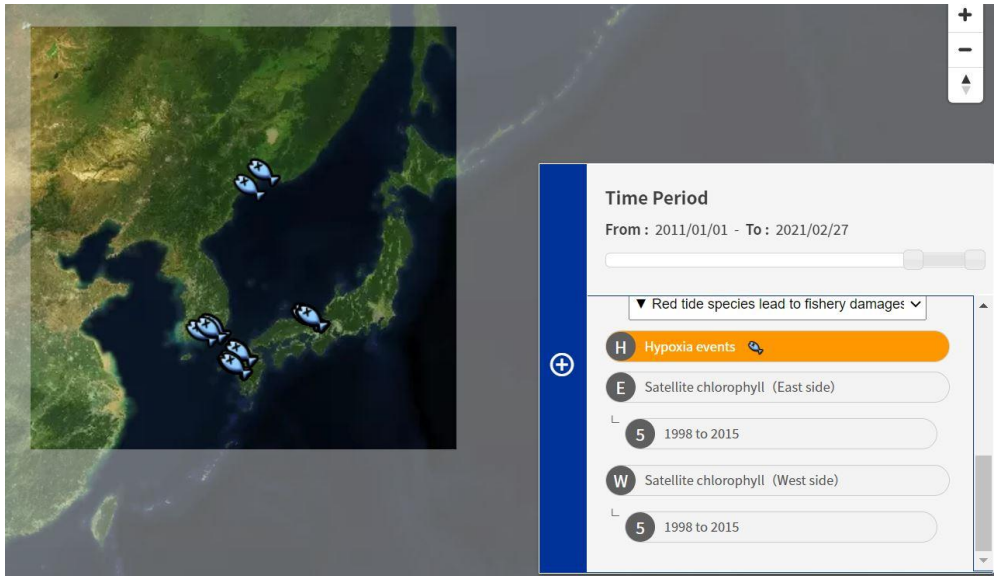
Research and Knowledge Sharing

- NUE, quantify usage chain
- Platform for experience and knowledge exchange: non-point sources, recycling N and P wastes, technology, carrying capacity
- Develop realistic & reacheable WQ standards esp. for coastal areas, setting targets

Proposed Regional Responses

Data Services

- Refine/adapt existing ones for the region
- Data storage – hubs?
- Fill monitoring gaps
- Scoping studies
- INMS modelled the ECS, where else needs this? Hotspots?
- NOWPAP Eutrophication Tool & SCS-SAP project results for future action



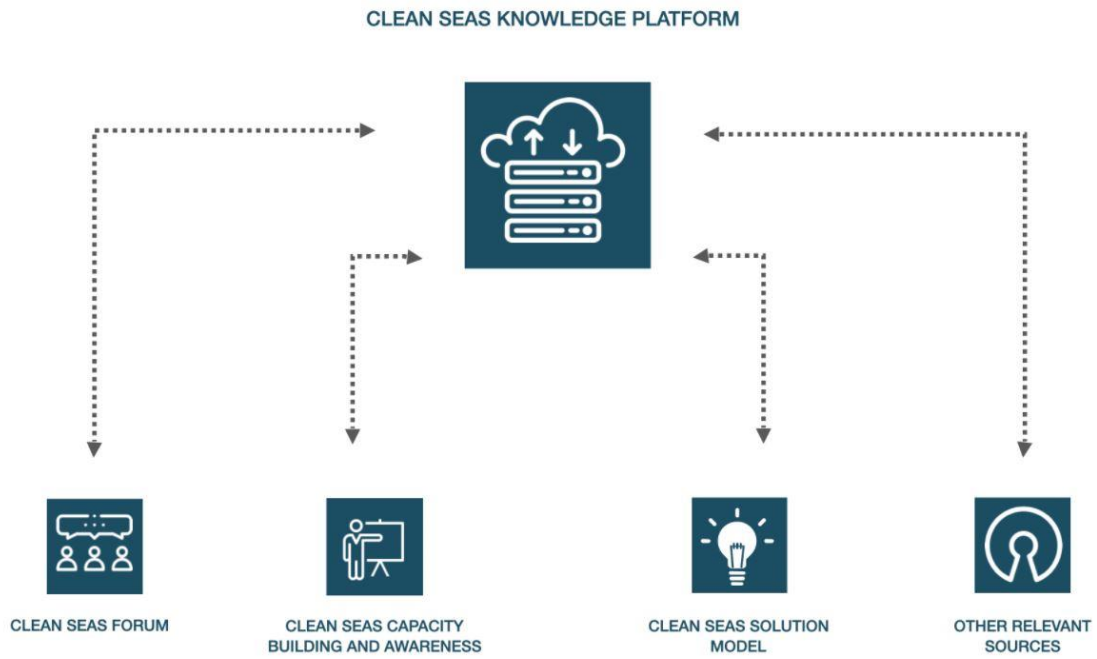
Capacity building

- GPNM Training on Phosphorus
- Sustainable aquaculture
- Intercalibration for “reliable” data

Proposed Regional Responses

Regional Hub

- Knowledge service center
- Service capacity building needs
- Mirror S. Asia N Hub



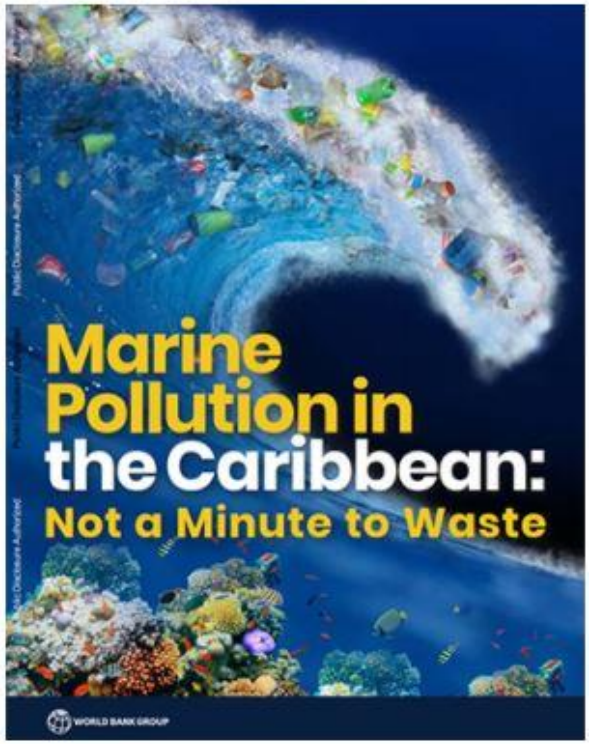
Integration and coordination

- Meeting international commitments
- Link to and support from international progammes, e.g. CBD, GPA, other Regional Seas
- Stronger stakeholder involvement

Proposed Regional Responses

Regional Strategy, Guidelines and/or Action Plan

- Caribbean Programme's example



Expert Working Group

- Prioritise the actions to take
- Advise on what and how to implement actions

What's Next?

- Finalise report in mid-March
- COBSEA Secretariat to take further action based on agreement by COBSEA countries