Capacity Assessment of each ASEAN+3 country in Monitoring on Marine plastics and Microplastics and Marine Plastics Preventative Policy Effectiveness: Analysis and Experts Discussions

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Session on capacity assessment on marine plastics debris in ASEAN+3
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Part 1 - Our Data Source

1. ***Regional Research Inventory 2.0 (RRI 2.0)***

- An inventory of **publicly-accessible marine plastic research** in the region (ASEAN+3), published **between 2001 and June 2021**
- As of 21st Feb 2022, the inventory contains **702 publications**
  - This includes peer reviewed and grey literature such as conference proceedings and NGO reports
- A coordinated effort led by Youna Lyons (NUS-CIL) and Neo Mei Lin (TMSI) with colleagues from NUS and the support of a large regional research team

Part 1 - Our Data Source

2. *The regional team*

The project is being coordinated by National University of Singapore (NUS) with the Centre for International Law (CIL), and the Tropical Marine Science Institute (TMSI) as lead on the marine scientific data extraction. The work done is driven by the regional team, made up of more than 30 members across various countries:

- NUS-CIL, **Singapore**: Youna Lyons, Cheng Ling Lim, 刘雨露 (Yulu Liu), Bùi Quang Huy (Bui Quang Huy), Dennis Tan, Dita Liliansa, 정다운 (Dawoon Jung), Sng Wen Xin, Vũ Hải Đăng (Vu Hai Dang)
- TMSI, **Singapore**: Mei Lin Neo, Jenny Fong, Lee Hsien Rong Samuel and Theresa Su
- Universiti Sains Malaysia, **Malaysia**: Japareng Lalung and his team
- Swinburne Sarawak, **Malaysia**: Changi Wong and Moritz Mueller
- Can Tho University, **Vietnam**: Văn Phạm Đăng Trí (Van Pham Dang Tri) and Lê Hoàng Hải Anh (Le Hoang Hai Anh)
- University of the Philippines-Mindanao, the **Philippines**: Neil Angelo S. Abreo
- Marine Science Institute, the **Philippines**: Ronan Baculi and Deo Onda
- Chulalongkorn University, **Thailand**: ชวลิต เจริญพงษ์ (Chawalit Net Charoenpong), ปิ่นมนัส บูชา (Pinamas Bucha), เพ็ญใจ สมพงษ์ชัยกุล (Penjai Sompongchaiyakul) and ราฮุล เมโรทรา (Rahul Mehrotra)
- Indonesian Institute of Science (LIPI), **Indonesia**: Sulistiowati and Muhammad Reza Cordova
- Myanmar Ocean Project, **Myanmar**: □□□□□□□□□□□□□ (Thanda Ko Gyi)
- East China Normal University, **China**: 李道季 (Li Daoji) and 朱礼鑫 (Zhu Lixin) and their team

Part 1 - Our Data Source

3. *Metadata*

Article Information

20 different elements of general information on the publication, such as:

- Language
- Author(s)
- Research Group(s)
- Funding Information

Research Scope

16 different elements of research scope, including high-level substantive information on the research, such as:

- Aim of research
- Location of work
- Plastic sizes examined
- Coastal or offshore study

Research Methodology

21 different elements of underlying research methodology, including technical information on the equipment, such as:

- Methodologies Used
- Depth of sediment sampling
- Field sampling frequency
- Species name of biota studied

Research Findings

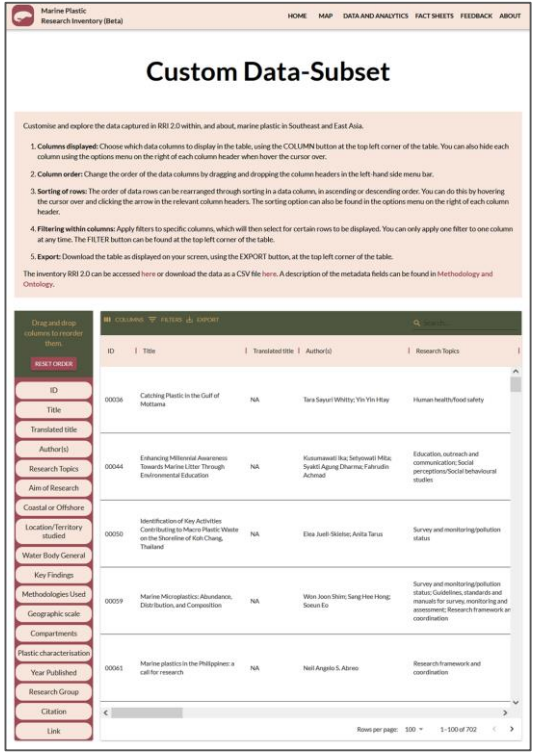
25 different elements of underlying research methodology, including technical information on the equipment, such as:

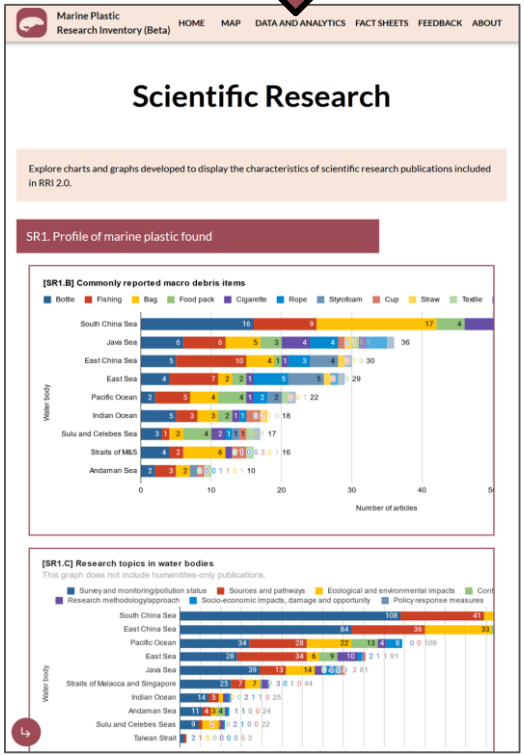
- Key Findings
- Research Topics
- Source of Plastics
- Shape and Polymer of plastics found

Part 1 - Our Data Source

4. *The online platform*

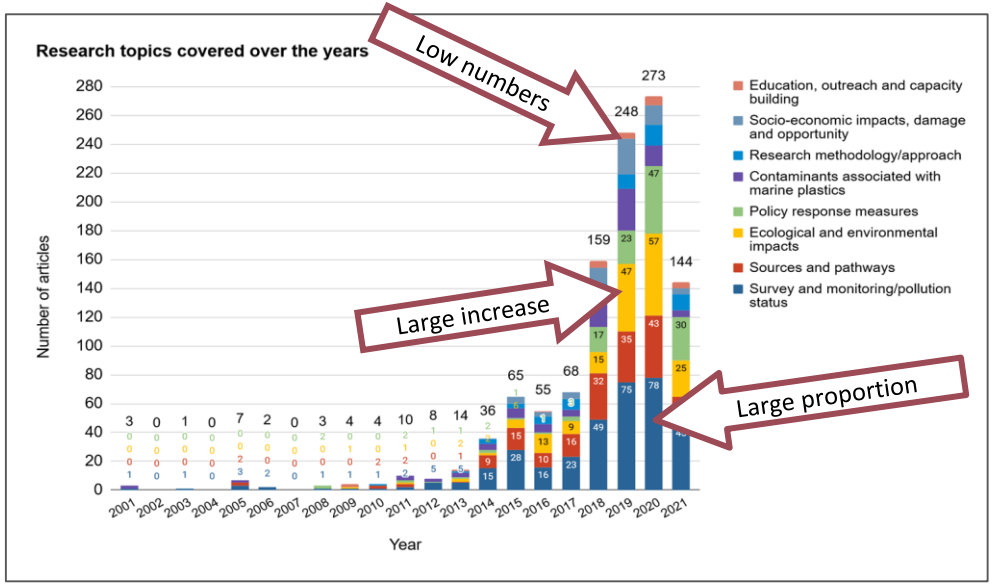
Data and Analytics

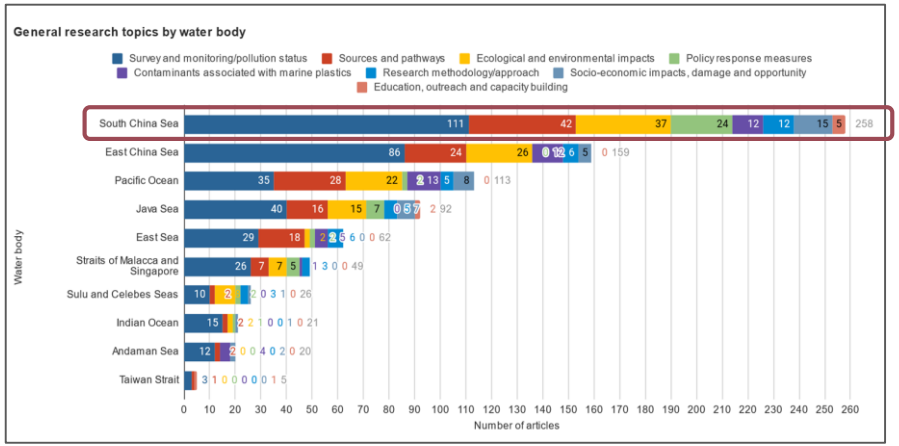




Part 1 - Our Data Source

4. *The online platform*





⚠ Note that this perspective is based on publicly-available online research published between 2001 and June 2021, that the research team has found, successfully accessed and documented. Studies that did not lead to accessible online publications could not be included.

Part 2: Assess the regional capacity to monitor marine plastics with RRI 2.0

1. Understanding survey and monitoring

Consistent data collection over time
is essential to develop baselines to better understand marine plastics pollution

Examples of the use of survey and monitoring data:

- Assess the state and level of marine plastic pollution and impacts on the environment
- Provide objective information to design mitigation measures
- Assess the effectiveness of interventions and promote adaptive management

Inform response to pollution from marine plastics
(Example: ASEAN and COBSEA Regional action plans on marine litter)

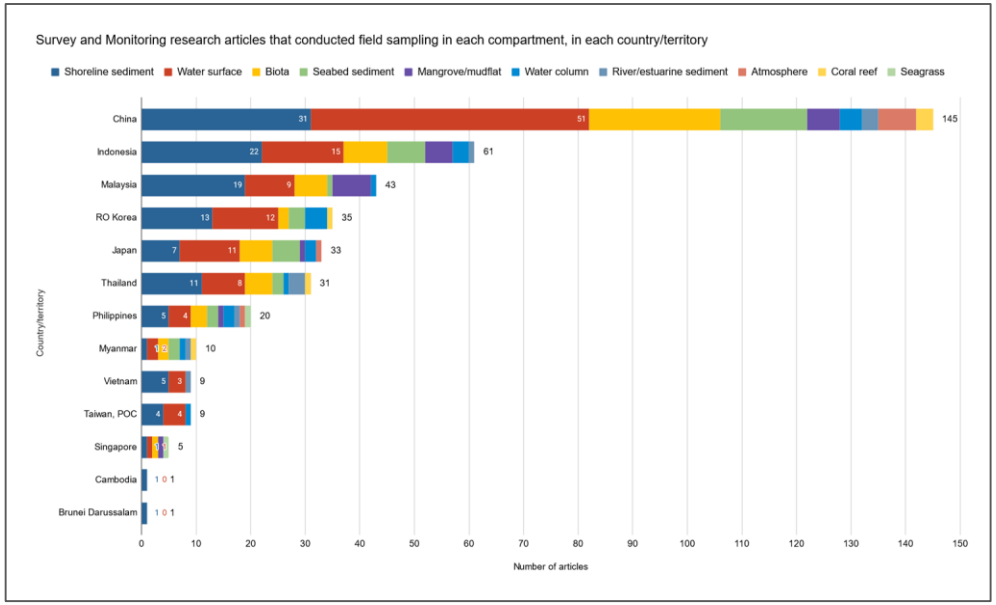
Survey/monitoring and field sampling of marine plastic in scientific research can occur in a number of different situations and for different purposes : the methodology chosen depends on the purpose and context

- One-time surveying at one site
- One-time surveying at specific sites
- Multiple surveying at specific sites over short-term
- Multiple surveying at specific sites over long-term

Part 2: Assess the regional capacity to monitor marine plastics with RRI 2.0

2. *Current status of marine plastic research and monitoring in ASEAN+3*

- RRI 2.0 has captured **303 research articles** that are related to surveying/monitoring, and conducted field sampling
- Metadata used for comparison include the **country, compartment sampled, plastic sizes examined, plastic polymer identification** etc.



Most frequently sampled: Shoreline sediment and Water surface

- Marine plastics that have ended up along beaches, or floating on water surfaces

Least frequently sampled: Seagrass and Coral Reef

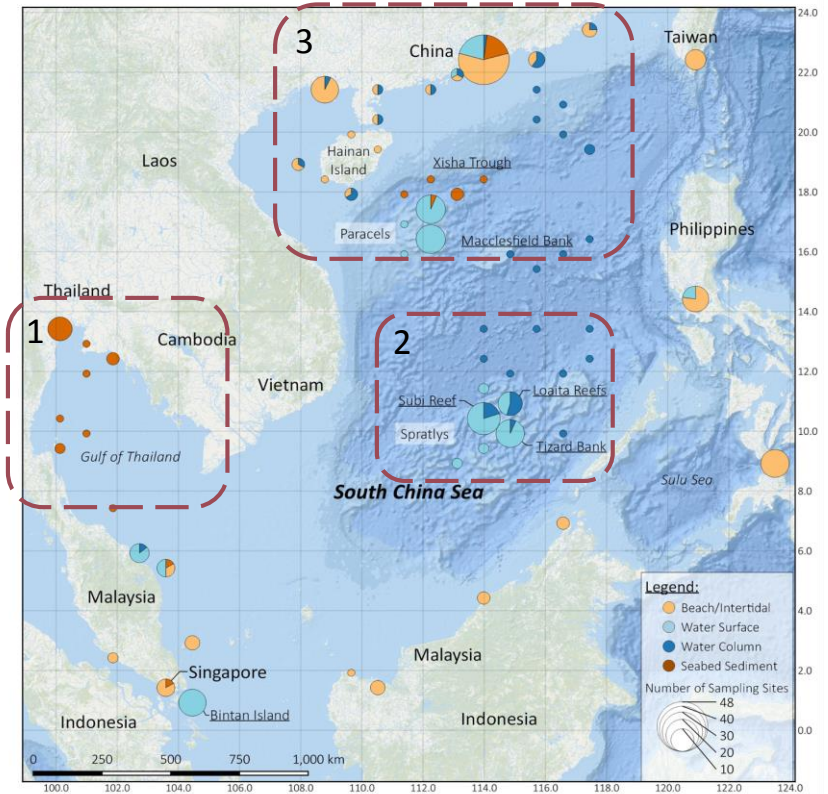
- Lack of information on sensitive habitats, which may be more severely affected by marine plastics

Part 2: Assess the regional capacity to monitor marine plastics with RRI 2.0

2. *Current status of marine plastic research and monitoring in ASEAN+3*

Compartments sampled across the South China Sea:

1. Seabed sediment is the main compartment sampled in the Gulf of Thailand
2. Water surface and water column are the only compartments sampled in the Spratlys
3. More sampling conducted in the North than the South



Harris, P.T., Tamelander, J., Lyons, Y., Neo, M.L. and Maes, T., 2021. Taking a mass-balance approach to assess marine plastics in the South China Sea. Marine Pollution Bulletin, 171, pp.112708.

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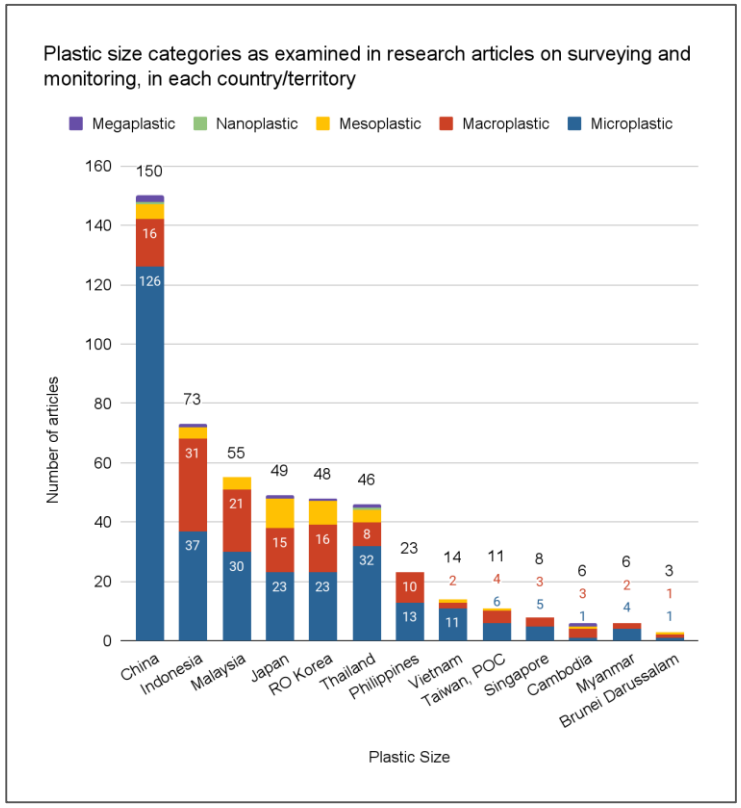
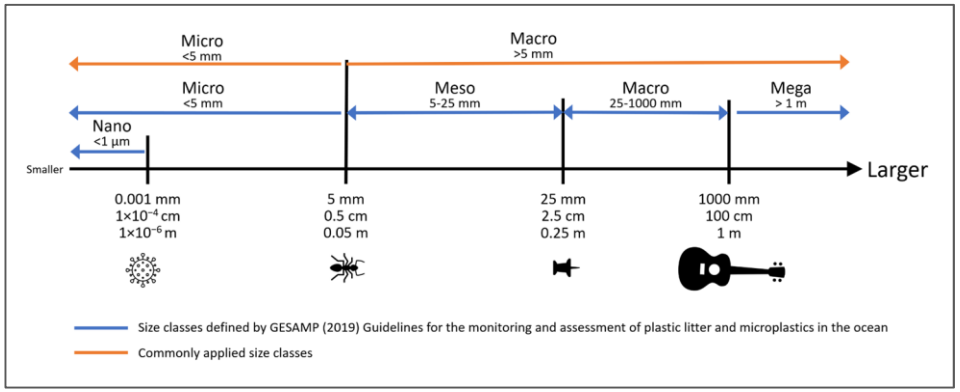
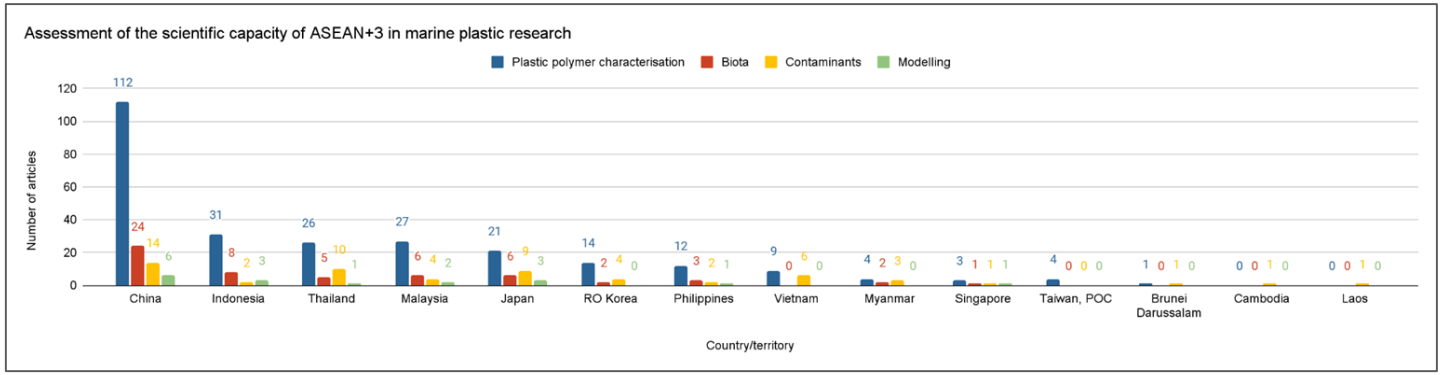




- **Plastic size categories are not consistent across all studies**
- **Microplastic**: usually categorized as plastic of size less than 5 millimeter, microplastics is the most frequently examined, in survey and monitoring studies
  - Except in Cambodia (Macroplastic)
- **Least** examined plastic sizes are
  - Nanoplastics: less than 1 micrometer
  - Megaplastics: larger than 1 meter
- The smaller sizes of plastics usually require more technical instruments to capture and examine

Part 2: Assess the regional capacity to monitor marine plastics with RRI 2.0

2. *Current status of marine plastic research and monitoring in ASEAN+3*

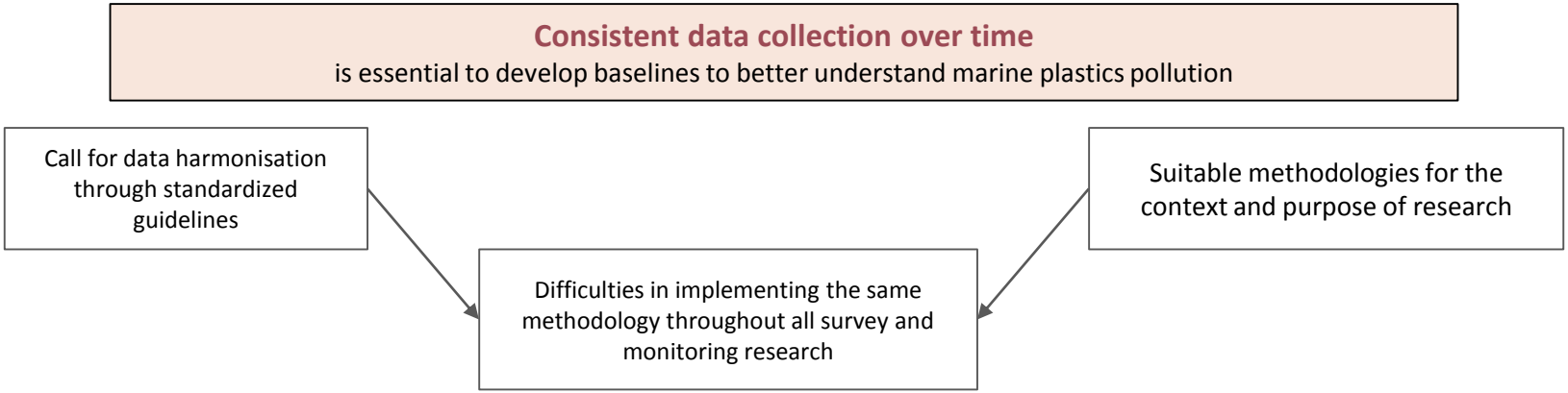


Generally across the region, low numbers of published survey/monitoring research articles that:

- Conducted plastic polymer identification
- Sampled biota for plastic particles
- Examined contaminants such as persistent organic pollutants, heavy metals
- Used modelling to examine plastic movement patterns in the region

Part 2: Assess the regional capacity to monitor marine plastics with RRI 2.0

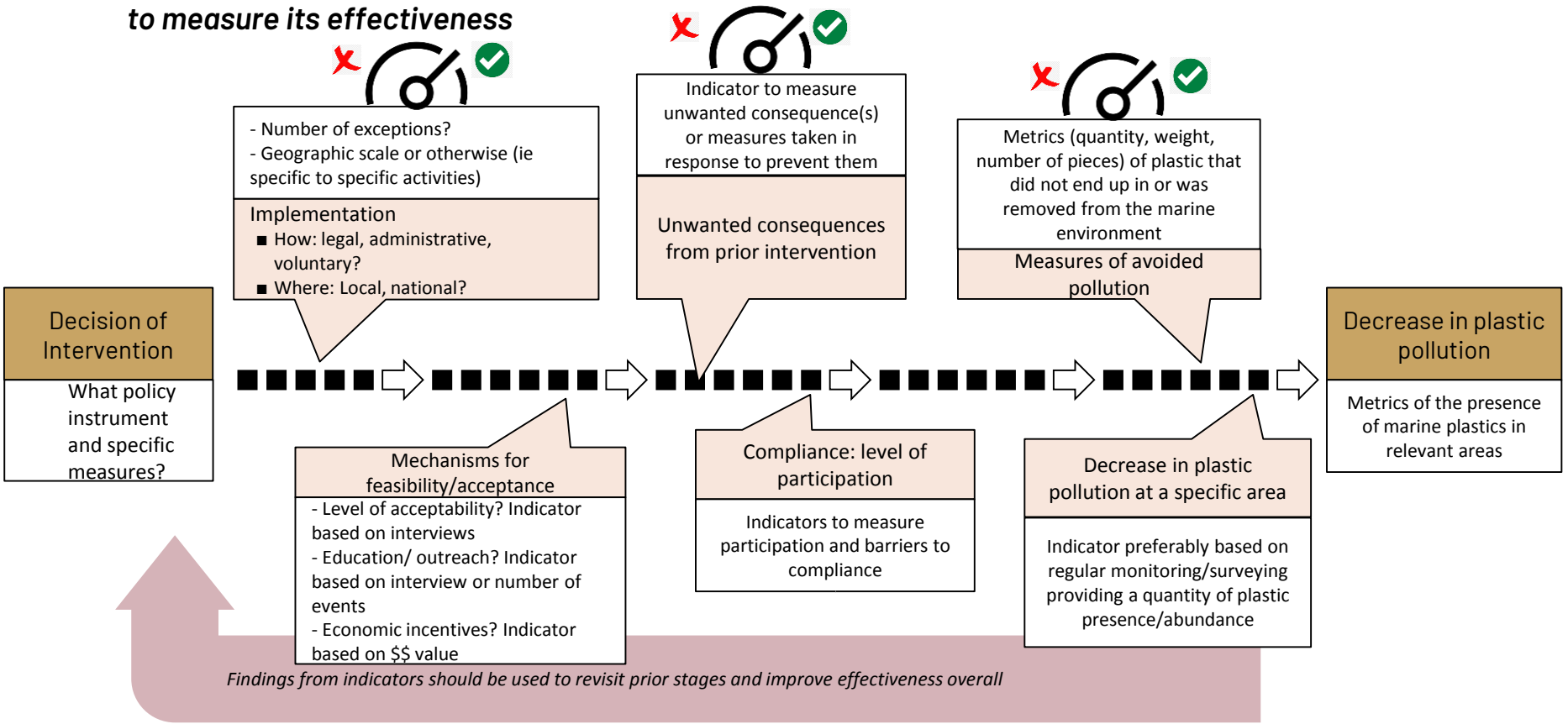
2. *Current status of marine plastic research and monitoring in ASEAN+3*



- Considerations on data comparability within/across countries/territories
  - Different reporting units are often linked to field sampling constraints in different parts of the region, even within the same country
  - Indicators and proxies are used in other regional seas (e.g. OSPAR, Mediterranean Sea) to overcome this problem
    - Using animals and their digestive guts to measure plastic particles. E.g. sea birds, turtles, and filter feeders like mussels etc.
    - Identifying a set of specific representative locations, and sample consistently across long periods of time
      - Well-designed methodology, same location = more comparable, and development of baselines

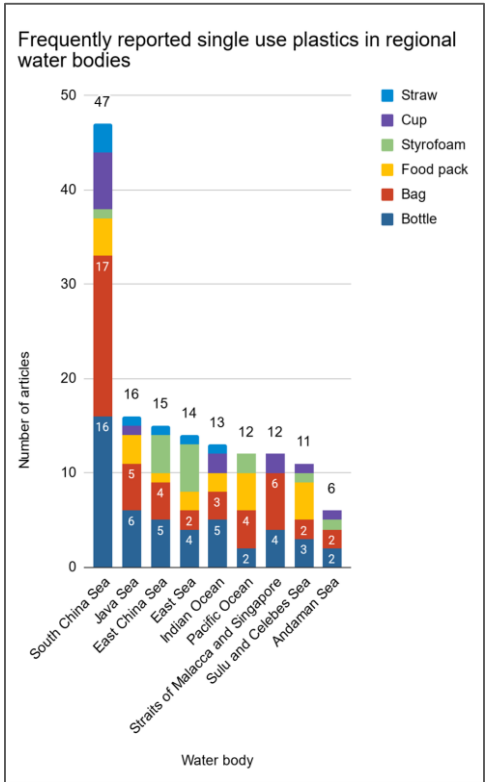
Part 3: Evaluate the effectiveness of interventions with RRI 2.0

1. ***Indicators can be considered at different stages of development of intervention and its implementation to measure its effectiveness***



Part 3: Evaluate the effectiveness of interventions with RRI 2.0

2. *Single-use Plastics*



- Several cities (in the Philippines, in Bali, Indonesia, etc) have banned the use of SUPs in food packaging, goods delivery (#00144) and SUP bags, plastic straws and styrofoam containers (#00106).
- In Brunei, plastic bags were banned in supermarkets in 2019, and the customers were encouraged to shift to reusable bags. Similarly, a ban on plastic straw was imposed in Malaysia in 2018 (#00105).
- In 2008, Mainland China introduced a charging system to impose restrictions on using ultra-thin plastic bags in markets (#00234), plastic bags <25µm thick were banned from 2008 (#00052). Similarly, in Taiwan, plastic straws were banned in all food and beverage outlets (#00087).
- The city of Yangon in Myanmar prohibited the production, use and sale of plastic bags in 2011 (#00052).
- Vietnam National Action Plan on Sustainable Consumption and Production focused on limiting the use of SUPs by introducing eco-friendly packaging in the supply chain by establishing a linkage between distributors, retailers and suppliers (Ministry of Industry and Trade The Socialist Republic of Vietnam, 2020).
- Publications relating to interventions that do not refer to marine plastics have not been captured in RRI 2.0

Part 3: Evaluate the effectiveness of interventions with RRI 2.0

2. *Single-use Plastics Bans*

Decision of Intervention

National action plan on marine litter/national bans on SUP bags

Is there a national ban?

Implementation
- How: legal, administrative, voluntary?
- Where: Local, national?

Mechanisms for feasibility/buy-in

Need for sanction and enforcement?
Economic incentive
Outreach and education

Increase in the production of thick plastic/ new non-degradable bags

Unwanted consequences from prior intervention

Compliance: level of participation

How many cities participate?
Outreach activities, campaigns, behaviour changes observed

Numbers of plastic bags/ other SUP products saved because of SUP bans

Measure of avoided pollution

Decrease in plastic pollution at specific area

Numbers of plastics bags compared with baseline

Decrease in plastic pollution

Metrics of the presence of marine plastics in relevant areas

Part 3: Evaluate the effectiveness of interventions with RRI 2.0

3. Clean-ups

16 Publications deal with a variety of examples of clean-up initiatives:

- Clean-up is referred to expressly in national and regional action plans: Indonesian action plan #00066, Chinese proposed action plan #00335, NOWPAP RAP MALI (promotes member states to participate in International Coastal Clean-ups), #00698
- Government-led clean-ups: #00119 (Microplastic management to prevent risk of persistent and bioaccumulative substance), #00330 (public participation in marine litter governance)
- Use of beach clean-up for awareness raising: #00044 (youth awareness of marine litter), #00334 (public awareness raising), #00529 (marine turtle)
- Small plastic left behind in beach clean-ups: #00212

@greennudgesg

Part 3: Evaluate the effectiveness of interventions with RRI 2.0

3. *Clean-ups*

- Voluntary or government organised clean-ups
- Local or national coastal clean-ups

Implementation
- How: legal, administrative, voluntary?
- Where: Local, national?

Decision of Intervention

National clean-ups projects/ proposal

Mechanisms for feasibility/buy-in

Outreach and education, citizen science

Land-based pollution into the ocean continues

Unwanted consequences

Compliance: level of participation

Numbers of clean-ups conducted, and numbers of participants, campaigns. Are there behaviour changes or Social perspectives changes observed

Numbers/ weight/ volume of waste collected

Measure of avoided pollution

Decrease in plastic pollution at specific area

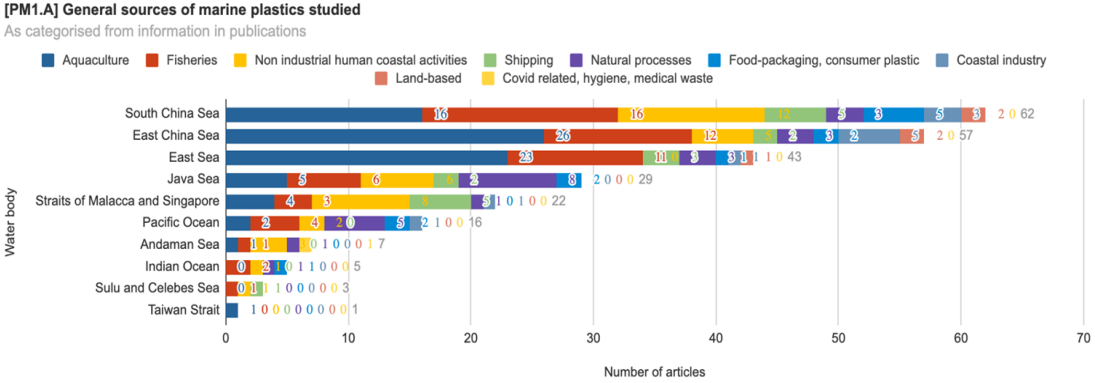
Decrease in beach litter of different sizes

Decrease in plastic pollution

Metrics of the presence of marine plastics in relevant areas

Part 3: Evaluate the effectiveness of interventions with RRI 2.0

4. *Fishing for Litter*



- **Regional research publications show that fishing gear is an important source of marine plastics:**
  - 101/702 publications studied fishing gear, out of which 36 research on humanities topics;
  - In 101 publications, 43 study aquaculture/ fisheries as sources of marine plastics;
  - Fishing for (marine floating) litter: #00415 #00200 (incentive programs for fishers, how to make the outcomes more consistent).

- **Despite, robust research on impacts of fishing gear and the pressure on the environment from it, very few responses are captured in RRI 2.0**
  - 10 publications study entanglement of ships by fishing gear. These research papers evaluate the frequency of entangled ships, the amount of DFG disentangled, the loss of fishery production (ghost fishing), and the expenses of driver's labour spent for disentanglement

Part 3: Evaluate the effectiveness of interventions with RRI 2.0

4. *Fishing for Litter (for payment)*

Decision of Intervention

Fishing for litter with economic incentive/payment

Government- community- or industry-financed programmes; Local or national programme

Implementation
- How: legal, administrative, voluntary?
- Where: Local, national?

Mechanisms for feasibility/buy-in

Enough incentives; sustainable changes in behaviours

Dependence on financial incentive and no change of behaviour

Unwanted consequences

Compliance: level of participation

Numbers of fishers participated/ for how long

Numbers/ weight/ volume of floating marine litter collected and brought back &/or $$$$ loss saved

Measure of avoided pollution

Decrease in plastic pollution at specific area

Reduction in the amount of plastics brought back by fishers

Decrease in plastic pollution

Metrics of the presence of marine plastics in relevant areas

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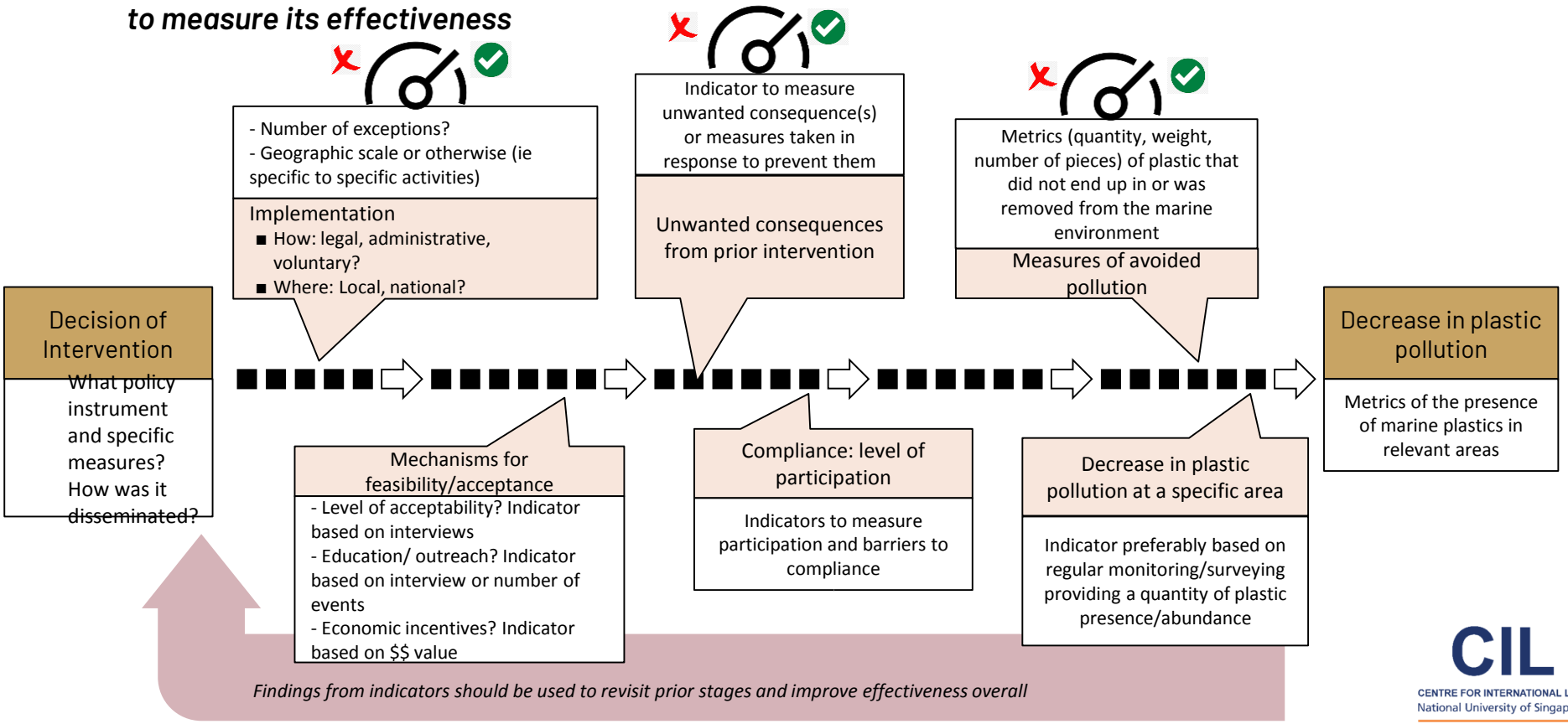
Part 3: Evaluate the effectiveness of interventions with RRI 2.0

1. ***Indicators can be considered at different stages of development of intervention and its implementation to measure its effectiveness***



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Part 4: Conclusion and parting thoughts

On regional capacity for monitoring

- The capacity in expertise and technical material has greatly evolved and the increase in publications on monitoring shows it - more developing capacity may concern polymer identification and plastic < 0.3mm
- RRI 2.0 can be used to identify regional experts and research entities on different topic areas
- Gaps in monitoring (geographic, compartments, biota, associated contaminants) can be extracted from RRI 2.0 (e.g. coral reefs, seagrass, southern parts of the SCS basin)
- Agreement on proxies or indicators may help develop baselines and assess the evolution of pollution over time

On regional capacity to measure effectiveness of interventions

- 20+ publications discuss interventions from industries/ governments/ the public from different angles but they do not discuss the effectiveness of these interventions
- Additional research on upstream processes would be necessary to assess the effectiveness of some interventions, e.g. consumer plastics (SUPs) and waste management
- Further investigation into suitable regional indicators to evaluate the effectiveness of interventions at different stages would be useful
- An essential measurement would be conclusive findings from monitoring for marine plastic abundance at local level first