

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

Presentation by Youna Lyons, Cheng Ling Lim and Yulu Liu
Centre for International Law, National University of Singapore

2nd ERIA's Experts Working Group on Marine Plastic Debris Meeting
Session on capacity assessment on marine plastics debris in ASEAN+3
2 March 2022, online

Outline

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2. The regional team
3. Metadata
4. Online platform

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2. Single-use Plastics
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Part 4: Conclusion and parting thoughts

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), Bui 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**: ชาวลิต เจริญพงษ์ (Chawalit Net Charoenpong), ปิ่นมนัส บุชา (Pinamas Bucha), เพ็ญใจ สมพงษ์ชัยกุล (Penjai Sompongchaiyakul) and ราสุล เมโรทรา (Rahul Mehrotra)
- Indonesian Institute of Science (LIPI), **Indonesia**: Sulistiowati and Muhammad Reza Cordova
- Myanmar Ocean Project, **Myanmar**: စံသာကိုဂျီ (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

Marine Plastic Research Inventory (Beta) HOME MAP DATA AND ANALYTICS FACT SHEETS FEEDBACK ABOUT

Custom Data-Subset

Customise and explore the data captured in RRI 2.0 within, and about, marine plastic in Southeast and East Asia.

- Columns displayed:** Choose which data columns to display in the table, using the COLUMN button at the top left corner of the table. You can also hide each column using the options menu on the right of each column header when hover the cursor over.
- Column order:** Change the order of the data columns by dragging and dropping the column headers in the left hand side menu bar.
- Sorting of rows:** The order of data rows can be rearranged through sorting in a data column, in ascending or descending order. You can do this by hovering the cursor over and clicking the arrow in the relevant column headers. The sorting option can also be found in the options menu on the right of each column header.
- Filtering within columns:** Apply filters to specific columns, which will then select for certain rows to be displayed. You can only apply one filter to one column at any time. The FILTER button can be found at the top left corner of the table.
- Export:** Download the table as displayed on your screen, using the EXPORT button, at the top left corner of the table.

The Inventory RRI 2.0 can be accessed here or download the data as a CSV file here. A description of the metadata fields can be found in [Methodology and Ontology](#).

Drag and drop columns to re-order them.	COLUMNS	FILTERS	EXPORT
NEXT ORDER	ID	Title	Translated title
ID	00036	Casting Plastic in the Gulf of Malacca	NA
Translated title			Tara Sapat Whitty; Yin Yin Hui
Author(s)			Human health/food safety
Research Topics	00044	Enhancing Millennial Awareness Towards Marine Litter Through Environmental Education	NA
Aim of Research			Education, outreach and communication; Social perceptions/Social-behavioural studies
Coastal or Offshore			
Location/Territory studied	00050	Identification of Key Activities Contributing to Marine Plastic Waste on the Shoreline of Kuching, Thailand	NA
Water Body General			Eisa Jael-Skitter, Aulia Tara
Key Findings			Survey and monitoring/behavior status
Methodologies Used	00059	Marine Microplastics: Abundance, Distribution, and Composition	NA
Geographic scale			Woon Joon-Skim, Sang Hee Hong, Sooun Eo
Compartments			Survey and monitoring/pollution status; Guidelines, standards and manuals for surveys, monitoring and assessment; Research framework or coordination
Plastic characterisation	00061	Marine plastics in the Philippines: a call for research	NA
Year Published			Neil Angelo S. Alvaro
Research Group			Research framework and coordination
Citation			
Link			

Rows per page: 500 * 1-100 of 702 < >

Marine Plastic Research Inventory (Beta) HOME MAP DATA AND ANALYTICS FACT SHEETS FEEDBACK ABOUT

Methodology and Database Ontology

This section provides information on the development of RRI 2.0 and this website. The inventory and metadata can be found [here](#).

Overall Methodology

Identification of relevant publications and data extraction

The identification of relevant publications and data extraction was carried out by the Singapore based core team and the extended regional team, according to the area of expertise of each researcher. Target publications for inclusions are those that relate to any aspect of pollution from marine plastics in Southeast and East Asia until July 2021, not including publications that would relate solely to the production of plastic material and products or the upstream management of waste. The RRI 2.0 builds on the publications already captured in the previous version of the inventory [here](#).

In RRI 2.0, the inventory was updated to include more recent publications, and publications in non-English languages. The search for publications was limited to contents which could be found online (even if only the abstract). Various keywords were used in numerous search engines, including Google Scholar, ScienceDirect, Scopus, and ProQuest (see guidance below). Domestic academic collections accessible to the regional team were also considered - this enabled the inclusion of relevant research (such as dissertations) conducted in the region. Japanese language papers could not be searched due to the lack of a Japanese researcher in the regional team. It is hoped that the regional team can be enlarged to new researchers from Japan and Korea in order to complete the database, make it more representative and improve the accessibility of the papers.

RRI 2.0 includes non-peer-reviewed publications provided that they contain primary research content and/or verifiable data presented with rigour so that the metadata fields could be filled reliably. In countries where there has been less peer-reviewed publications released, non-peer publications can be particularly useful substitutes. Furthermore, not all sampling reports lend themselves to a research publication whilst being fully relevant to and useful in the context of this database. Of note in this context, most of the non-English papers that could be found were peer-reviewed.

Website Development

This website is developed using two open-source libraries: React.js and Material UI.

All the data is queried directly from the database inventory on Google Sheet. The data is then transformed into a format that is easily accessible and usable by the website. This approach simplifies the development and maintenance needed and facilitates the migration of the dataset or the visualisation to a different platform. The website content is dynamic and is refreshed everyday.

The website codebase is readily available publicly on [Github](#).

Guidance to the Research Inventory metadata fields

The metadata input fields are grouped into 4 broad categories, as shown below. The detailed metadata, including the instructions on filling in the inventory can be found [here](#).

Article Information

This first category of input fields capture general information on the publication. This includes basic information such as the language of the publication, the names of authors, and funding information.

- ID
- Geographical Scale
- Link to source
- Title
- First Author
- Editor(s)
- Country/Territory of Research Institution
- Academic type
- Country/territory studied
- Language
- Translated title
- Corresponding author
- Book Title
- Funding Information
- Year Published
- Type
- Citation
- Author(s)
- Journal
- Research Group(s)

Marine Plastic Research Inventory (Beta) HOME MAP DATA AND ANALYTICS FACT SHEETS FEEDBACK ABOUT

Scientific Research

Explore charts and graphs developed to display the characteristics of scientific research publications included in RRI 2.0.

SR1. Profile of marine plastic found

[SR1.B] Commonly reported macro debris items

Water body	Bottle	Fishing	Bag	Food pack	Cigarettes	Rope	Gyrodam	Cup	Straw	Trelle
South China Sea	16	9	17	4						
Java Sea	6	6	5	3	4	4	1	1	1	36
East China Sea	3	10	4	1	3	1	1	1	1	30
East Sea	4	7	2	2	1	2	1	1	1	29
Pacific Ocean	2	3	4	4	1	2	1	1	1	22
Indian Ocean	5	3	3	2	1	1	1	1	1	18
Sulu and Celebes Sea	3	1	2	1	1	1	1	1	1	17
Straits of MMS	4	2	4	1	1	1	1	1	1	16
Andaman Sea	2	2	1	1	1	1	1	1	1	10

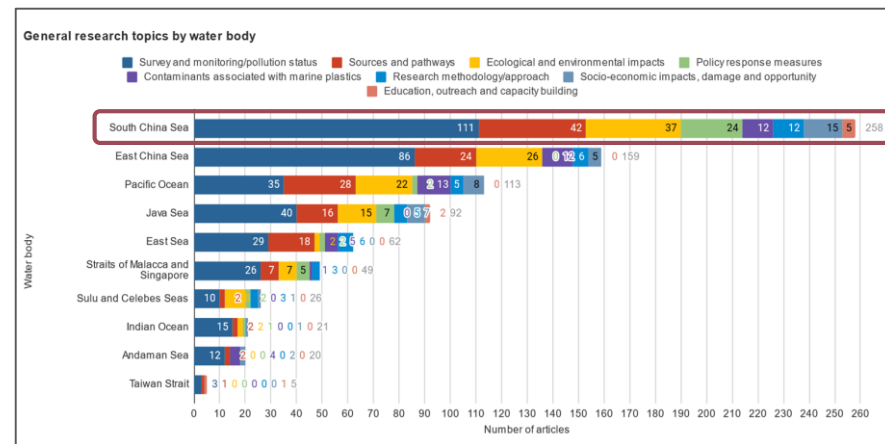
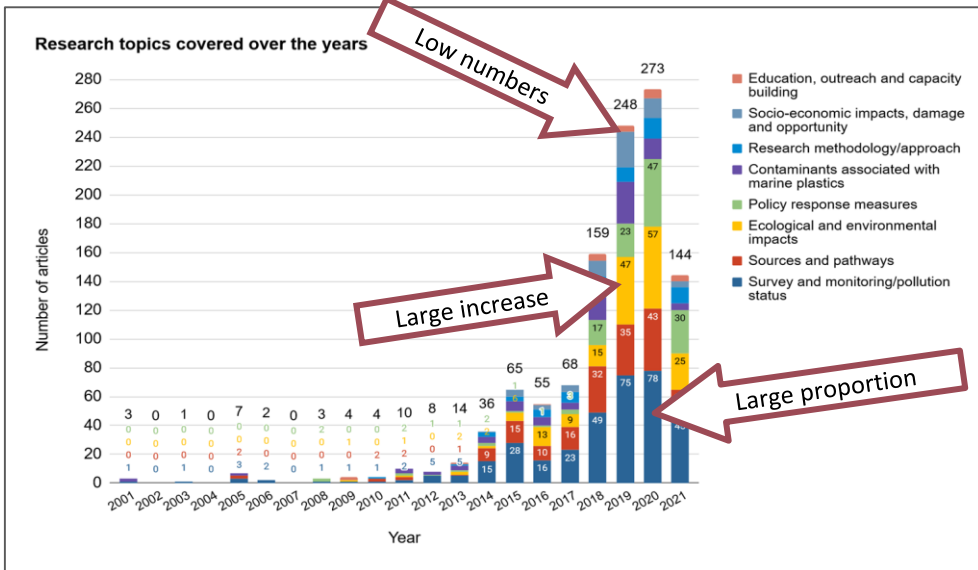
[SR1.C] Research topics in water bodies

This graph does not include humanities-only publications.

Water body	Survey and monitoring/pollution status	Sources and pathways	Ecological and environmental impacts	Cont	Research methodology/approach	Socio-economic impacts, damage and opportunity	Policy response measures
South China Sea	54	10	30	11	1	1	1
Pacific Ocean	34	23	22	13	1	1	1
East Sea	29	34	9	10	2	1	1
Java Sea	20	17	14	11	1	1	1
Straits of Malacca and Singapore	13	7	2	3	1	1	1
Indian Ocean	11	11	2	1	1	1	1
Andaman Sea	11	2	1	1	1	1	1
Sulu and Celebes Sea	9	5	1	1	1	1	1
Taiwan Strait	2	1	0	0	0	0	0

Part 1 - Our Data Source

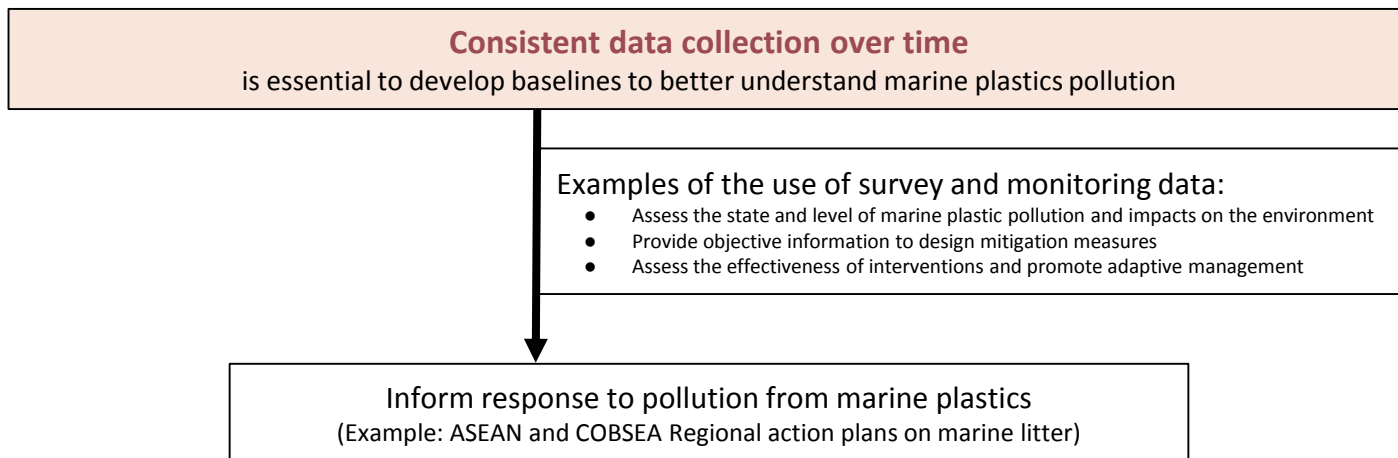
4. The online platform



△ 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



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

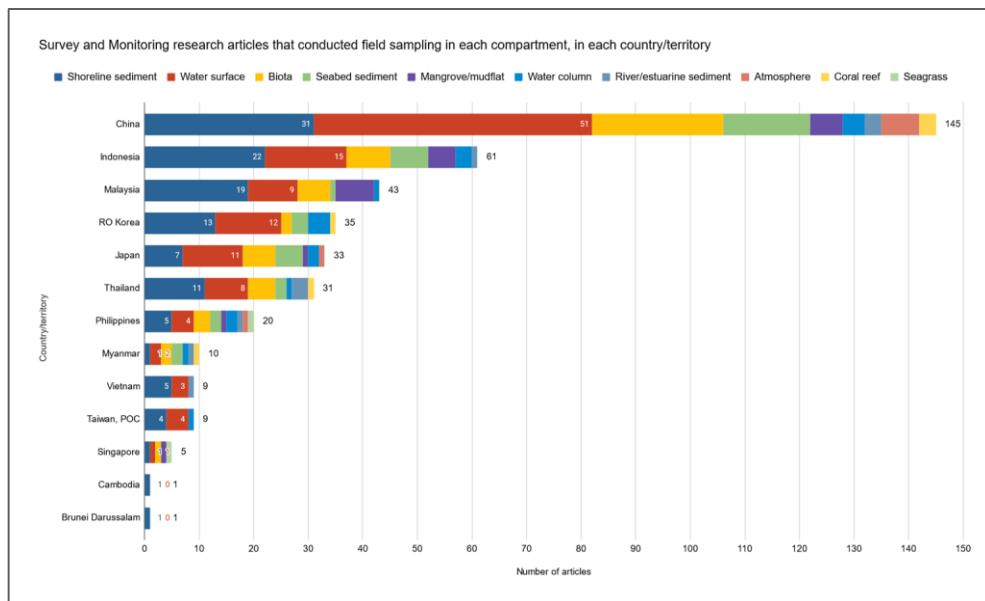
Multiple surveying at specific sites over short-term

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

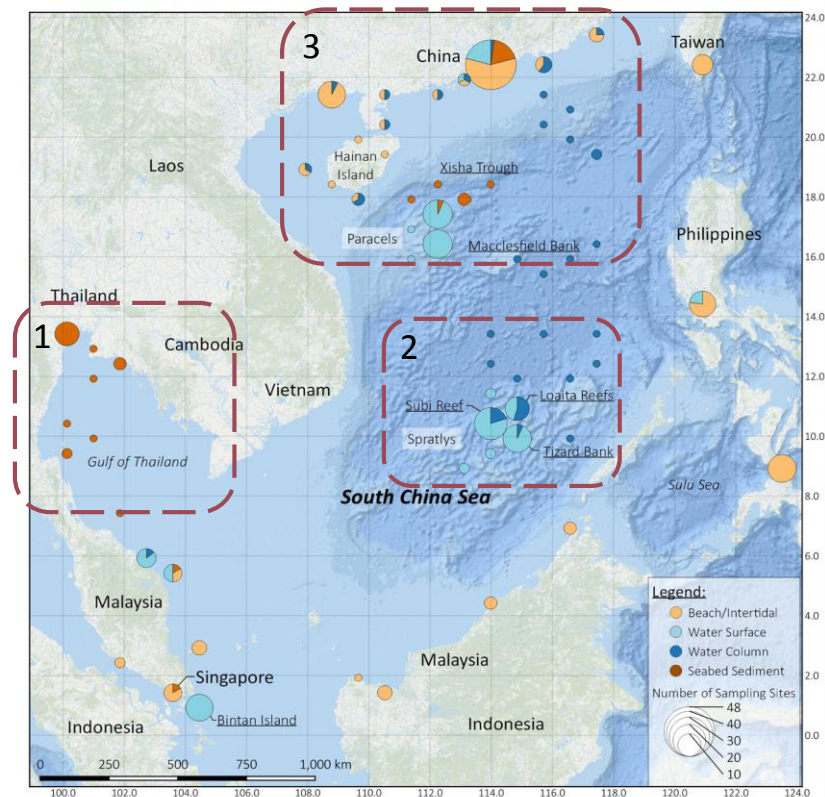
- Lack of information on sensitive habitats, which may be more severely affected by marine plastics

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

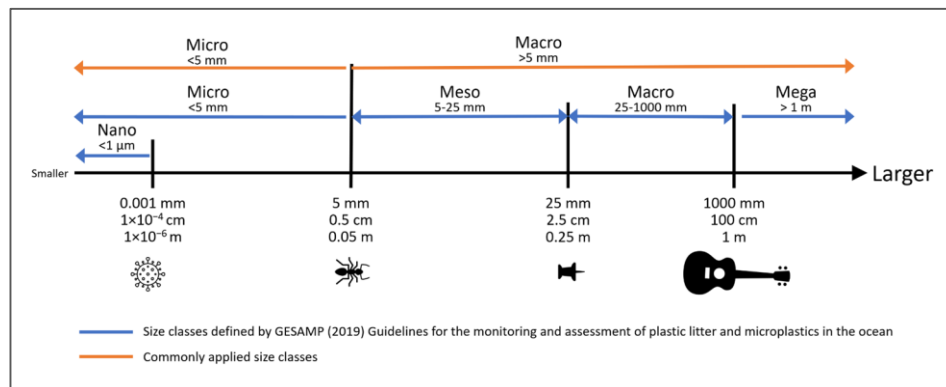
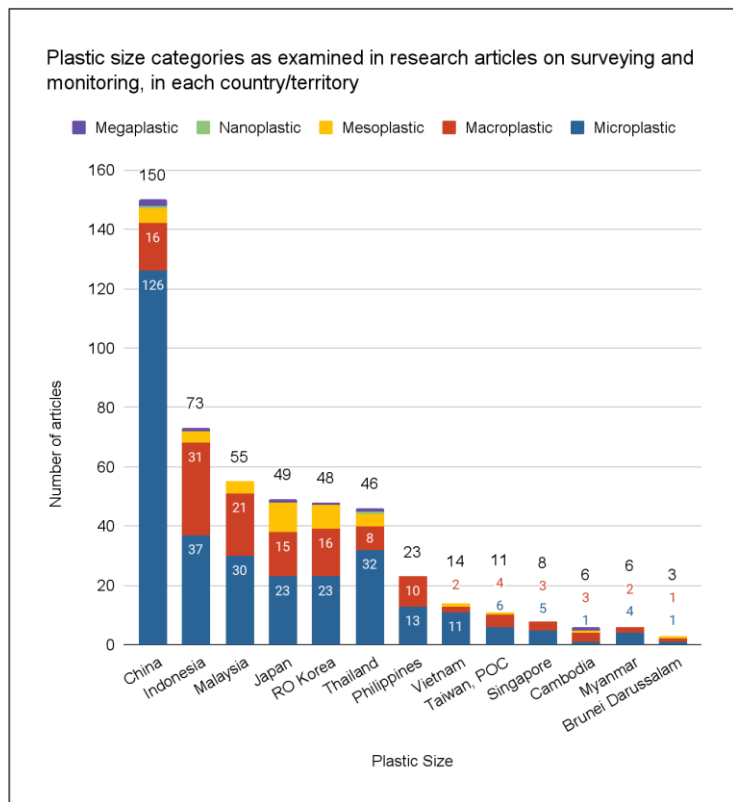
Compartments sampled across the South China Sea:

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



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

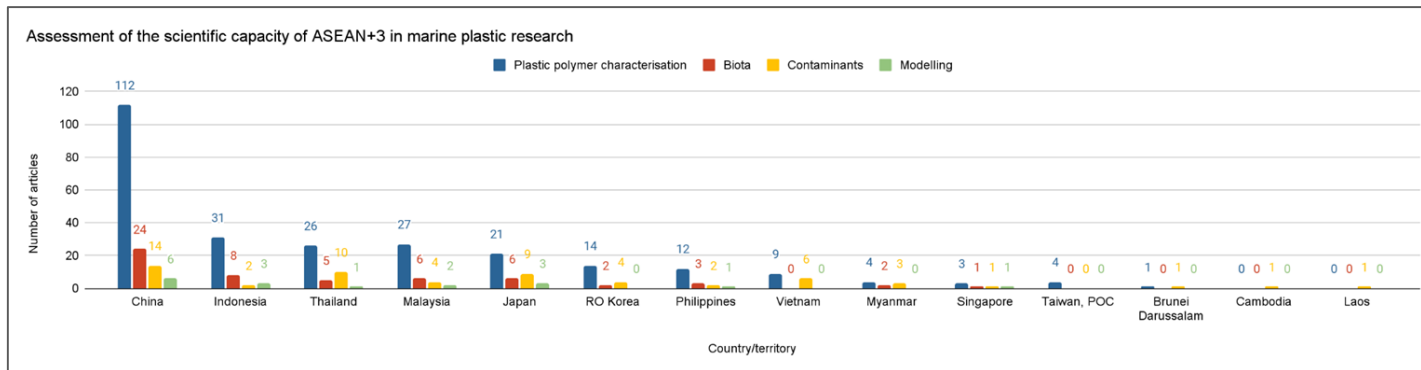
2. Current status of marine plastic research and monitoring in ASEAN+3



- **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

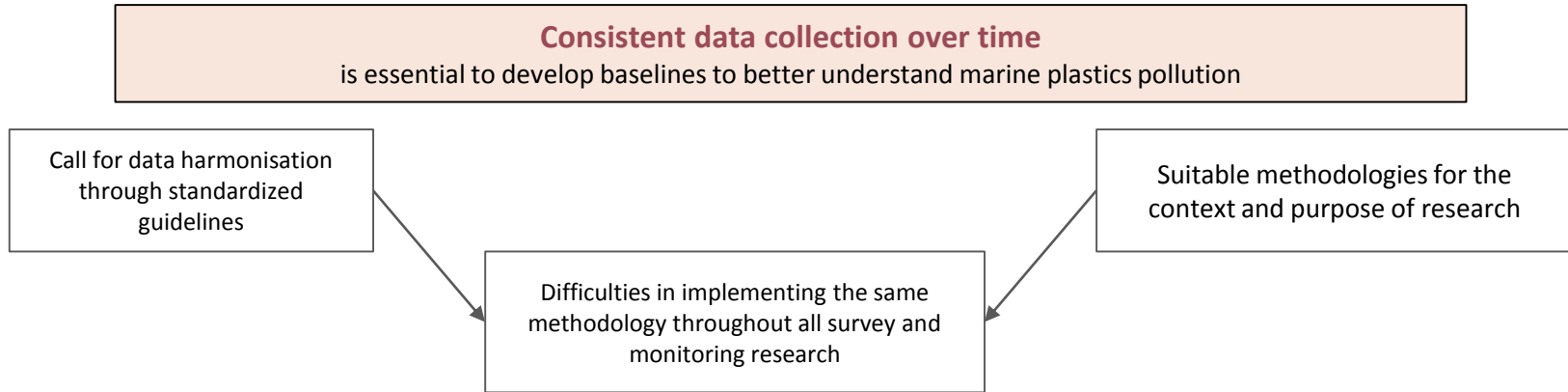


Generally across the region, low numbers of published survey/monitoring research articles that:

- 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

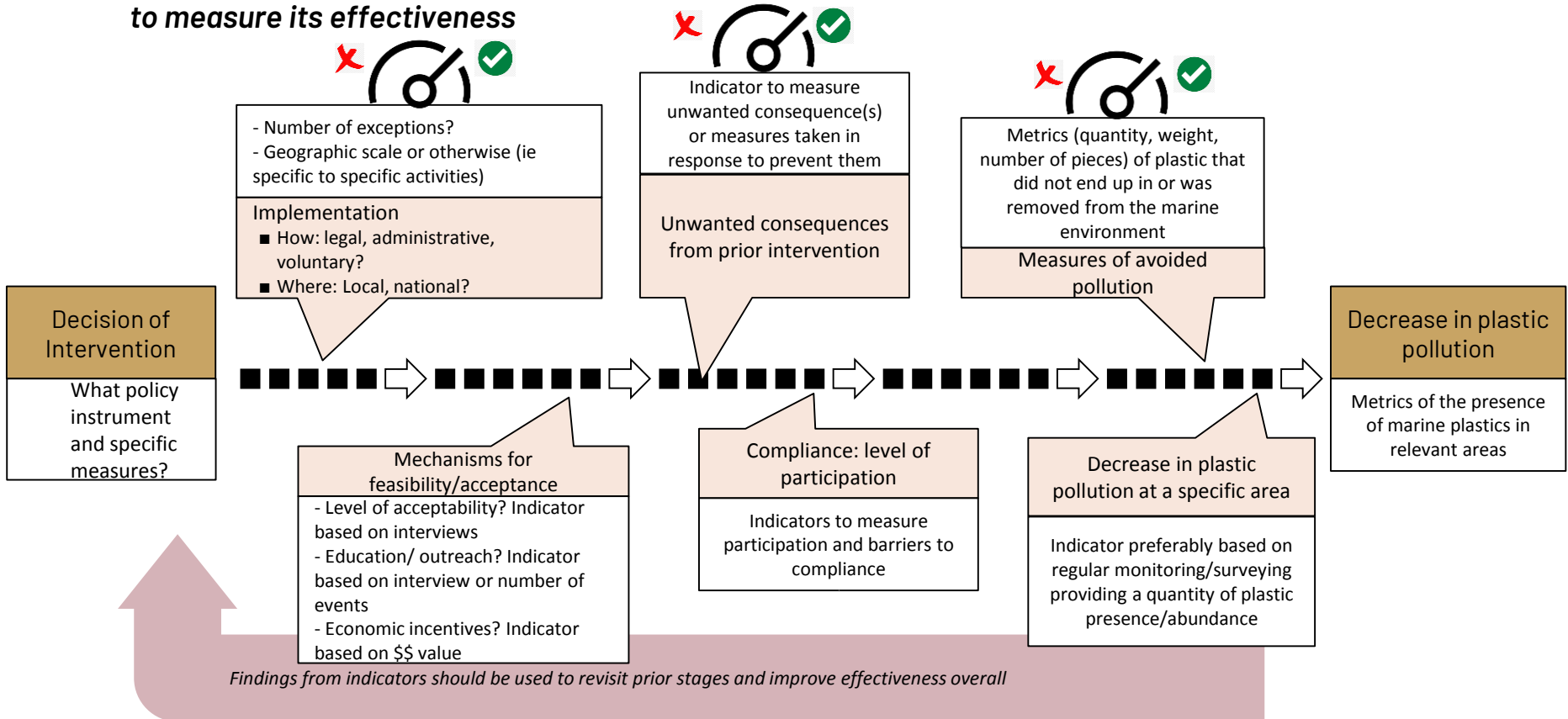
2. *Current status of marine plastic research and monitoring in ASEAN+3*



- 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

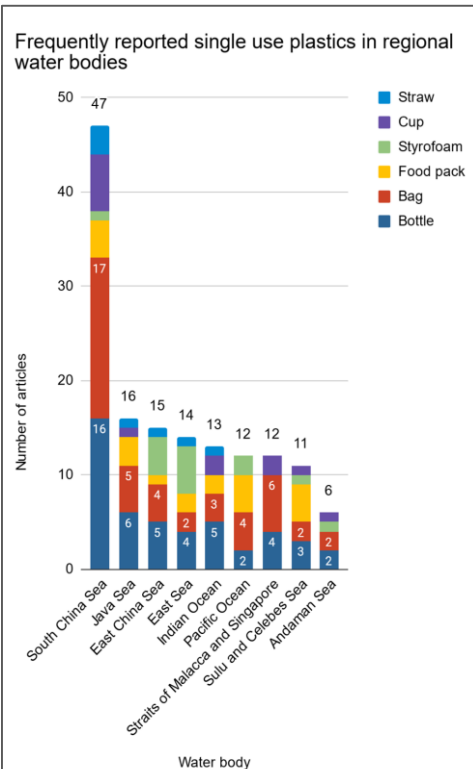
Part 3: Evaluate the effectiveness of interventions with RRI 2.0

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

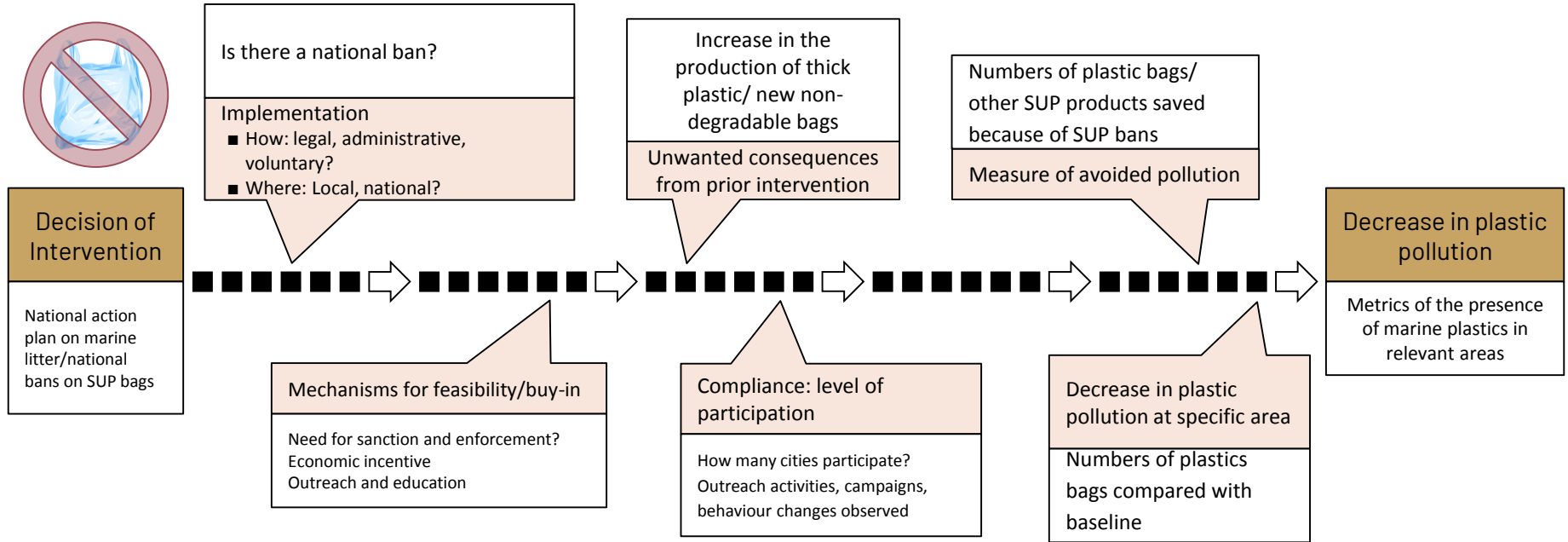
2. Single-use Plastics



- 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 <math>< 25\mu\text{m}</math> 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



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:

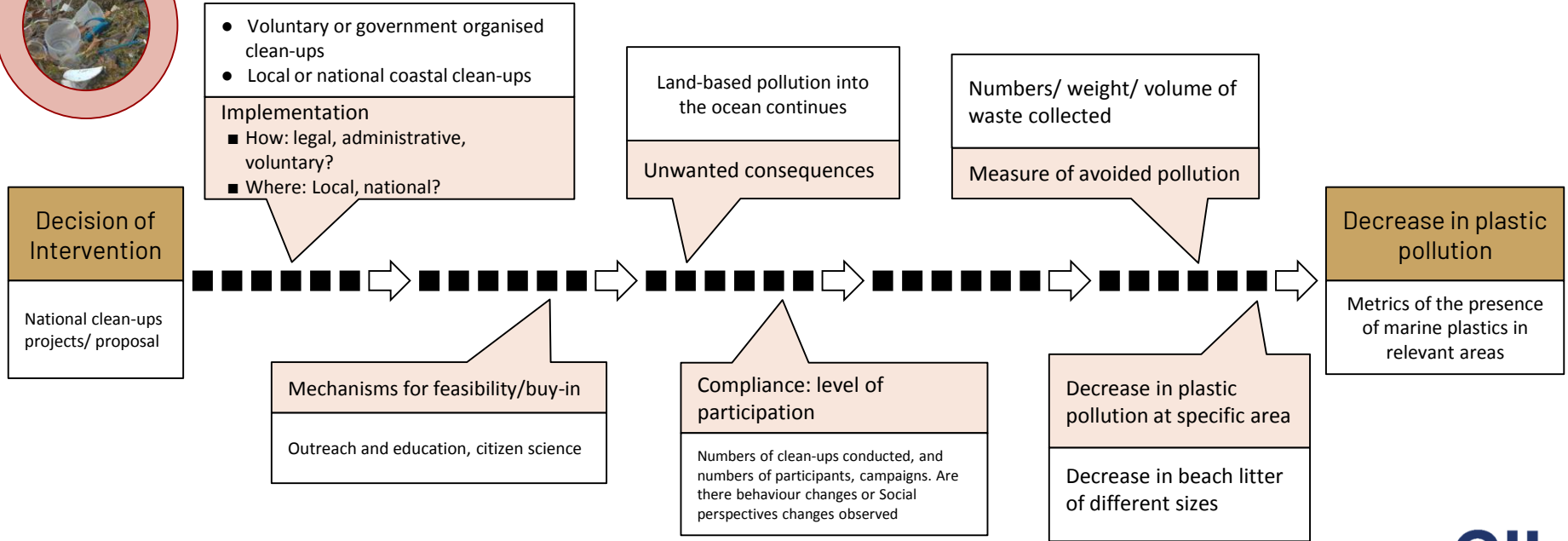
- Clean-up is referred to expressly in national and regional action plans: Indonesian action plan #00066, Chinese proposed action plan #00335, NOWPAP RAP MALI (promotes member states to participate in International Coastal Clean-ups), #00698
- Government-led clean-ups: #00119 (Microplastic management 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

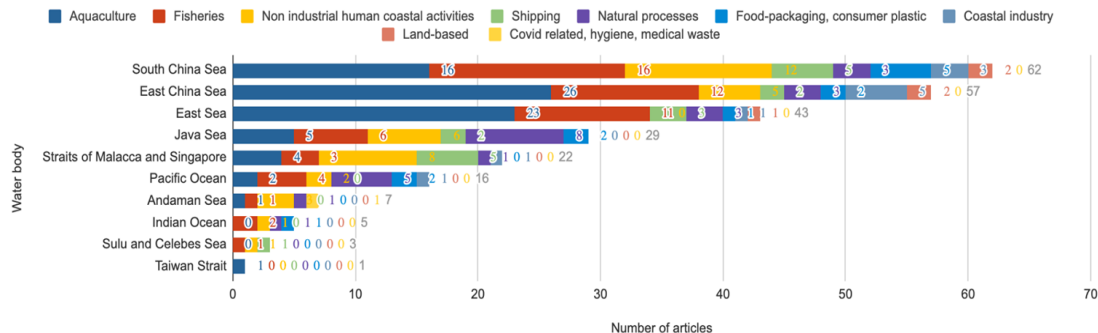


Part 3: Evaluate the effectiveness of interventions with RRI 2.0

4. Fishing for Litter

[PM1.A] General sources of marine plastics studied

As categorised from information in publications



- **Regional research publications show that fishing gear is an important source of marine plastics:**

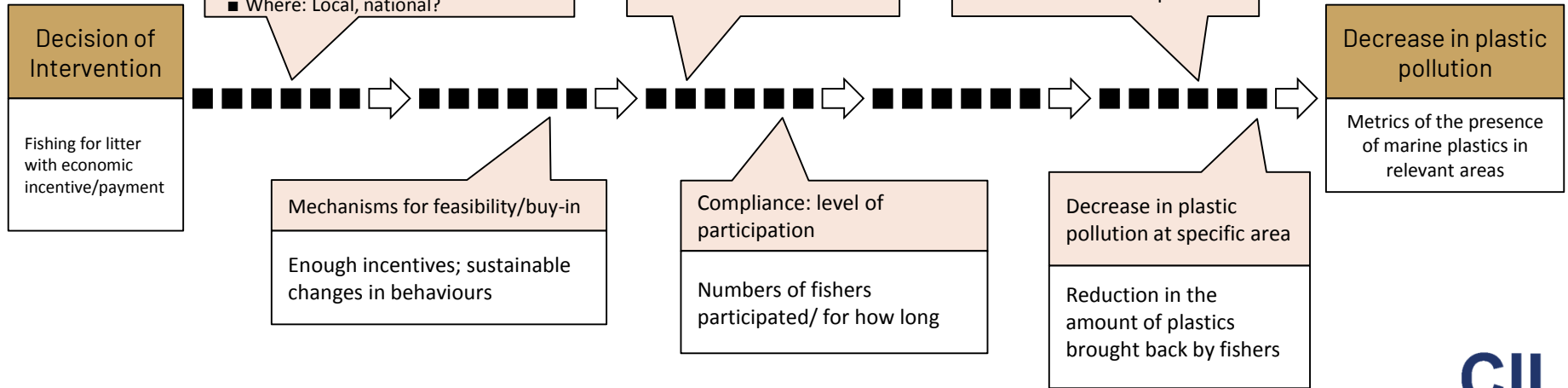
- 101/702 publications studied fishing gear, out of which 36 research on humanities topics;
- In 101 publications, 43 study aquaculture/ fisheries as sources of marine plastics;
- Fishing for (marine floating) litter: #00415 #00200 (incentive programs for fishers, how to make the outcomes more consistent).

- **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

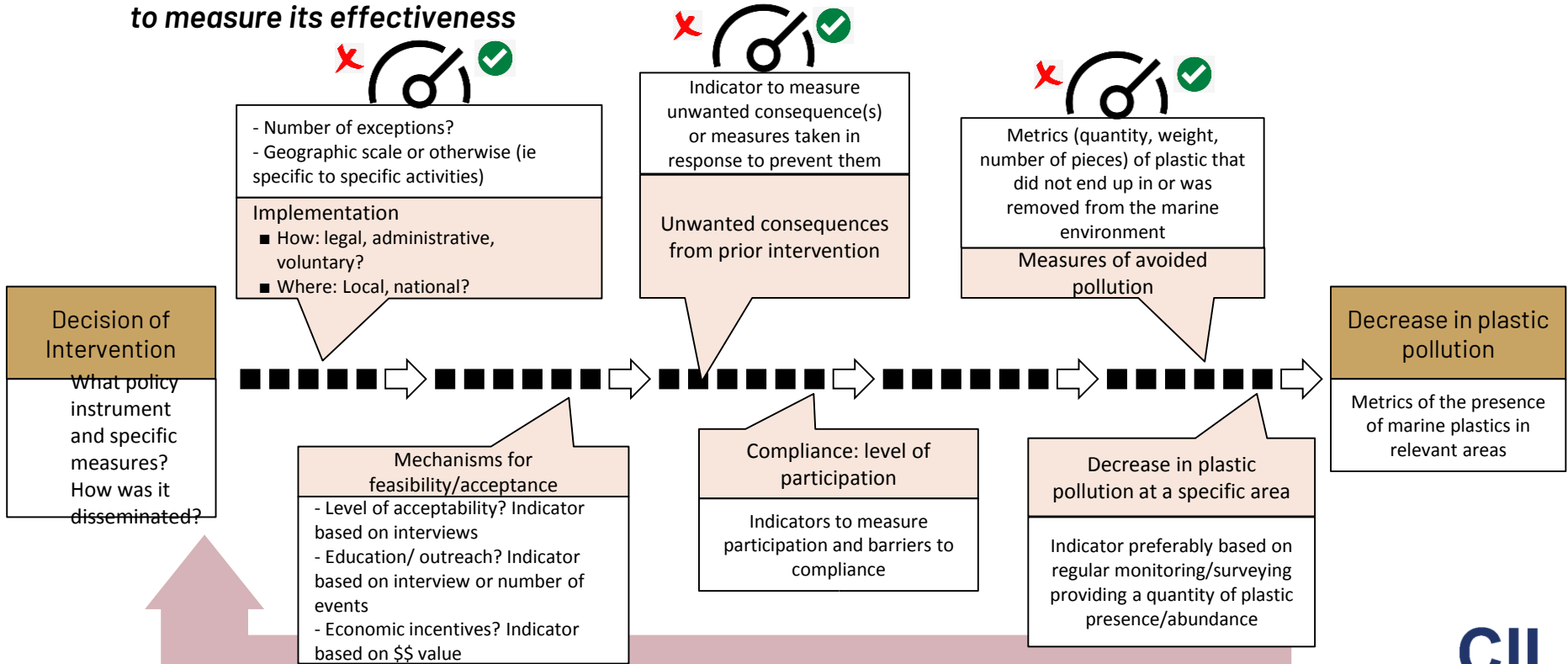
Part 3: Evaluate the effectiveness of interventions with RRI 2.0

4. Fishing for Litter (for payment)



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



Findings from indicators should be used to revisit prior stages and improve effectiveness overall

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