

Making sense of published data on pollution from marine plastics in ASEAN+3

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1. Background

Plastic debris of all sorts & sizes that enter the ocean are a global & transboundary problem, posing several recognized serious threats to the marine environment. However, the seas of Southeast & East Asia are often highlighted as a global hotspot for pollution from marine plastics. This is due to a combination of circumstances including half of the global production of virgin plastic coming from the region, high population level & density in coastal areas, rapid urbanization & overall weak waste management infrastructure. The geography of Southeast & East Asia makes it particularly vulnerable to marine pollution from land-based sources due to the distinctive length of populated coastal fronts, including in archipelagic states.

Whilst numerous reviews have highlighted knowledge gaps in the understanding of pollution from marine plastics in Southeast & East Asia,

research has been developing fast since 2017, leading to developing capacity, knowledge & understanding at regional & local levels, which are often misrepresented.

Led by a science-policy research team from NUS, a region-wide team conducted a compilation of science & humanities research publications on marine plastics in Southeast & East Asia to develop the Regional Research Inventory (RRI 2.0). This poster provides a summary of the methodology, the database developed, & a selection of key findings & elements from the publications.

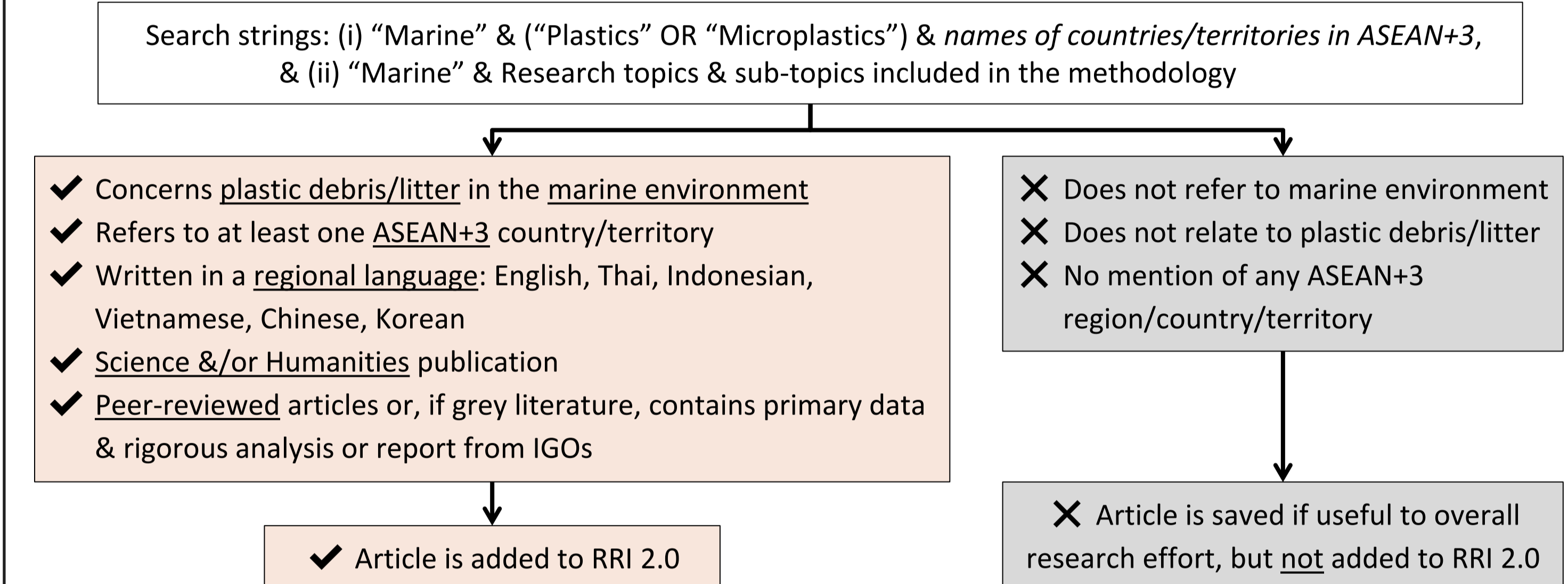
The RRI 2.0 aims to inform research gap analyses & research grant designs, facilitate data integration & consistency in research protocols, stimulate regional research collaboration & exchange, & bridge the science-policy divide.

2. Methodology: Developing the RRI 2.0

(1) Discovery & selection of published articles for inclusion in the inventory

Web searches were conducted in various online databases, such as Google Scholar, Web of Science, Scopus, & some locally-driven databases such as the Burapha Science Journal (Thailand) & Korean Studies Information Service System (KISS).

The flowchart below provides a summarised overview of the keyword search & articles selection process using set criteria. For more details, scan the QR code to read our methodology on the inventory webpage



(2) Designing metadata to extract information from the articles

Next, information was extracted from the research articles, guided by our inventory metadata. The metadata comprises 82 input fields, to capture information about (a) the research article, (b) the scope of the research, (c) the methodology used in the research, & the (d) research findings. The research topic(s) covered

in each article were identified according to a list of 25 research topics grouped in several broader categories including: Movement of plastics in water bodies, Fragmentation & degradation, Microbial assemblages, Human health/ food safety, Laws, administrative measures, Communication & coverage of marine plastic.

Category	Description	Examples
Article Information	20 elements of general information on the publication	<ul style="list-style-type: none"> Language Author(s) Research Group(s) Funding Information
Research Scope	16 elements of substantive information on the scope	<ul style="list-style-type: none"> Aim of research Location of work Plastic sizes examined Coastal or offshore study
Research Methodology	21 elements on the methodology, including technical information	<ul style="list-style-type: none"> Methodologies Used Depth of sampling Sampling frequency Biota examined
Research Findings	25 elements of the research findings & results	<ul style="list-style-type: none"> Key Findings Research Topics Source of Plastics Plastic polymers found

(3) Populating & validating the RRI

The regional team had several virtual meetings to ensure a consistent understanding of the metadata before reviewing the Thai, Indonesian, Vietnamese, Mandarin Chinese, or Korean articles. The author's verbatim language was preferred when filling in the metadata fields, while avoiding subjective interpretations, to remain close to the article & fully verifiable.

Each article is tagged with a unique ID, & data is validated by at least two team members. Discrepancies identified during the validation process highlighted the importance of having adequate training on the metadata. This ensures the data structure & format required for subsequent data analysis, & usability of the database (e.g., date formats, water bodies naming & units of measure).

4. Database Use & Applications

RRI 2.0 provides a robust starting point to examine the status of regional knowledge, shape new research hypotheses, frame new research projects, & identify technical capacity on specific topics.

Specific examples of use of the database known to the team includes research on:

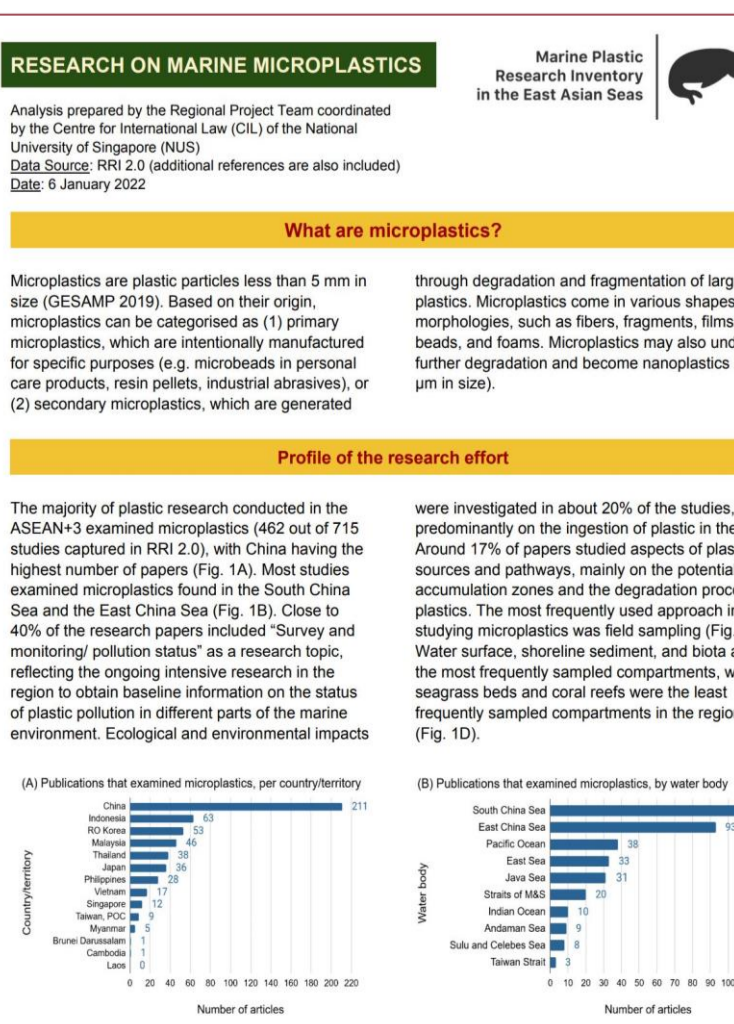
- Variations in the type, location & state of single-use plastics found in the marine environment & effectiveness of response policies,
- Identification of plastic polymer sources found in specific locations,
- Impacts of marine plastics on macrofauna, &
- Plastisphere, associated contaminants & pathogens.

Shaping hypotheses & potential research that would be of interest to policy-making have been identified. A catalogue of expertise & technical capacity in the region is under development, supported by the Economic Research Institute for Asian & East Asia (ERIA).

Example: Factsheet on Microplastics in the region

The factsheet highlights:

- variations in definitions of microplastics,
- profile of the research effort,
- preferred sampling methods & challenges encountered,
- findings on abundance & distribution, &
- the status of societal concerns & responses.

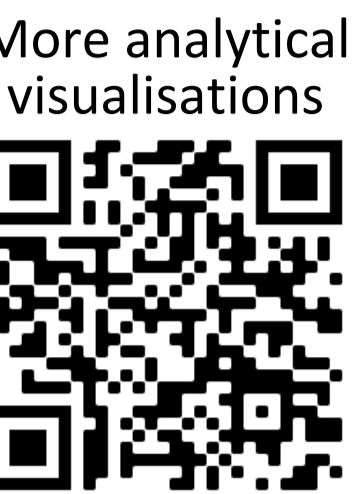


While several articles hypothesize that microplastics are more abundant in near-coast areas, we could not firmly conclude so due to differences in sampling methods, sample processing protocols, & reporting units on abundance & distribution.

Some articles provide pointers on prospects for potential bioindicators for monitoring variations across systems & habitats. Sensitive habitats in the region (e.g., coral reefs & seagrass beds) are poorly sampled, resulting in a knowledge gap on the extent of microplastic pollution.

3. Results & Discussion

As of July 2022, the inventory is an information-rich Google spreadsheet containing 703 rows of research articles, with 82 columns of extracted information per article. Some key findings are highlighted below. Scan the QR code to view more analytical visualizations on the inventory webpage.

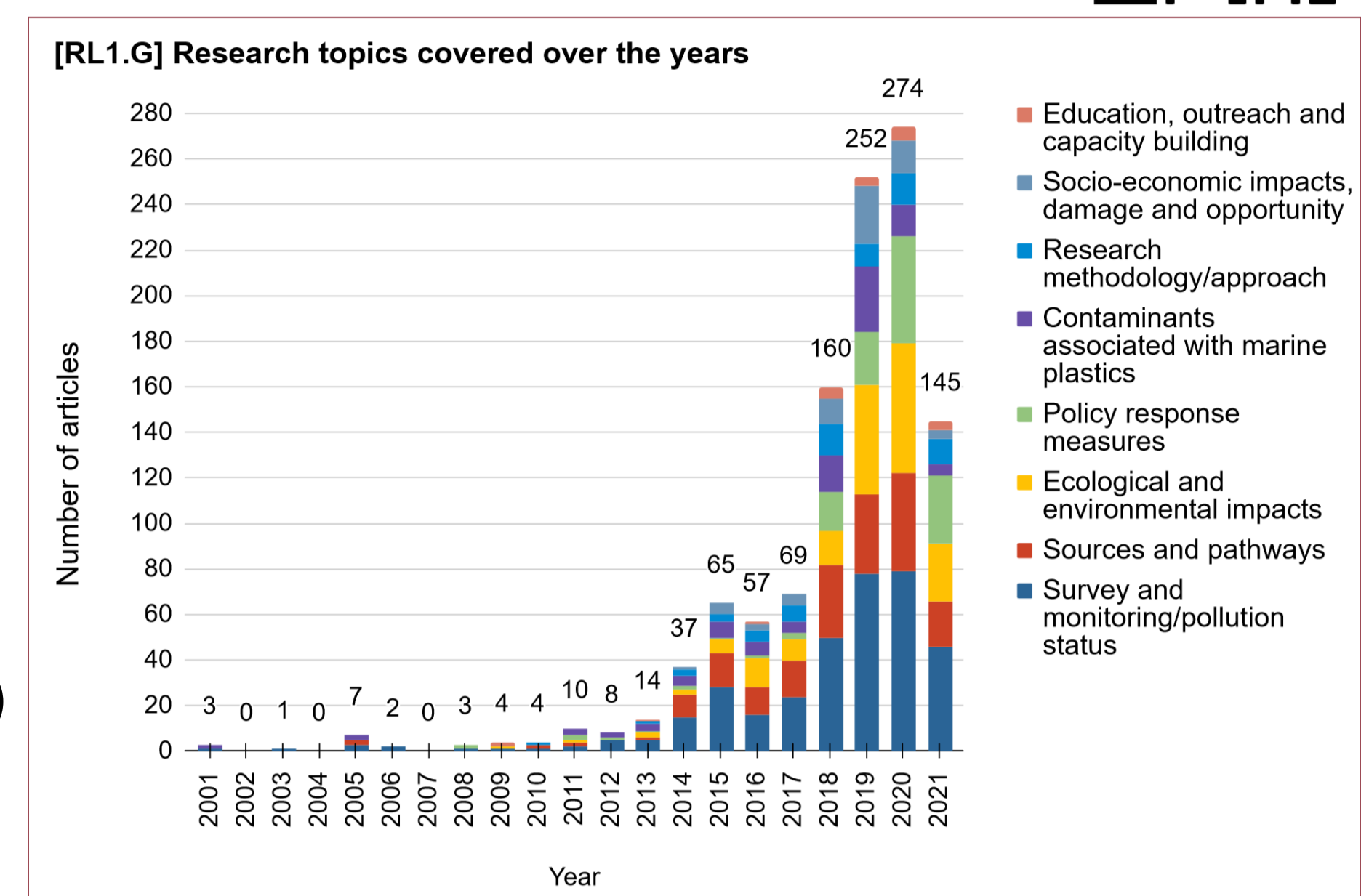


(1) Research Landscape

Most research captured in the RRI have been conducted:

- within China (57.9%), Indonesia (28.6%), Japan (22.3%), & RO Korea (20.3%);
- within South China Sea (37.1%), East China Sea (22.8%), Pacific Ocean (16.2%), & Java Sea (13.2%).

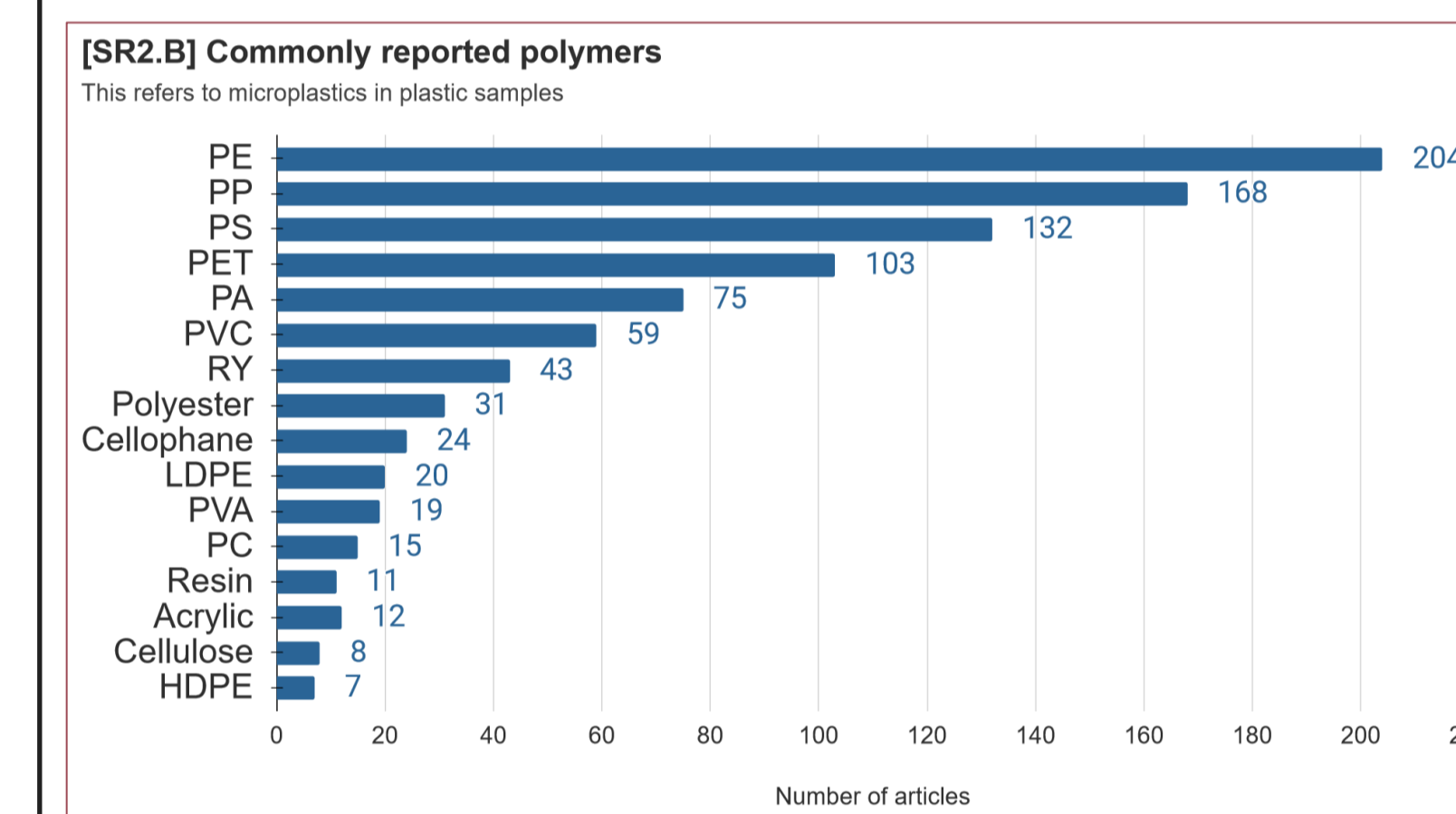
Research in the region is mainly dominated by scientific literature (77.9%) as compared to humanities (17.2%) & interdisciplinary studies (4.8%).



(2) Scientific research

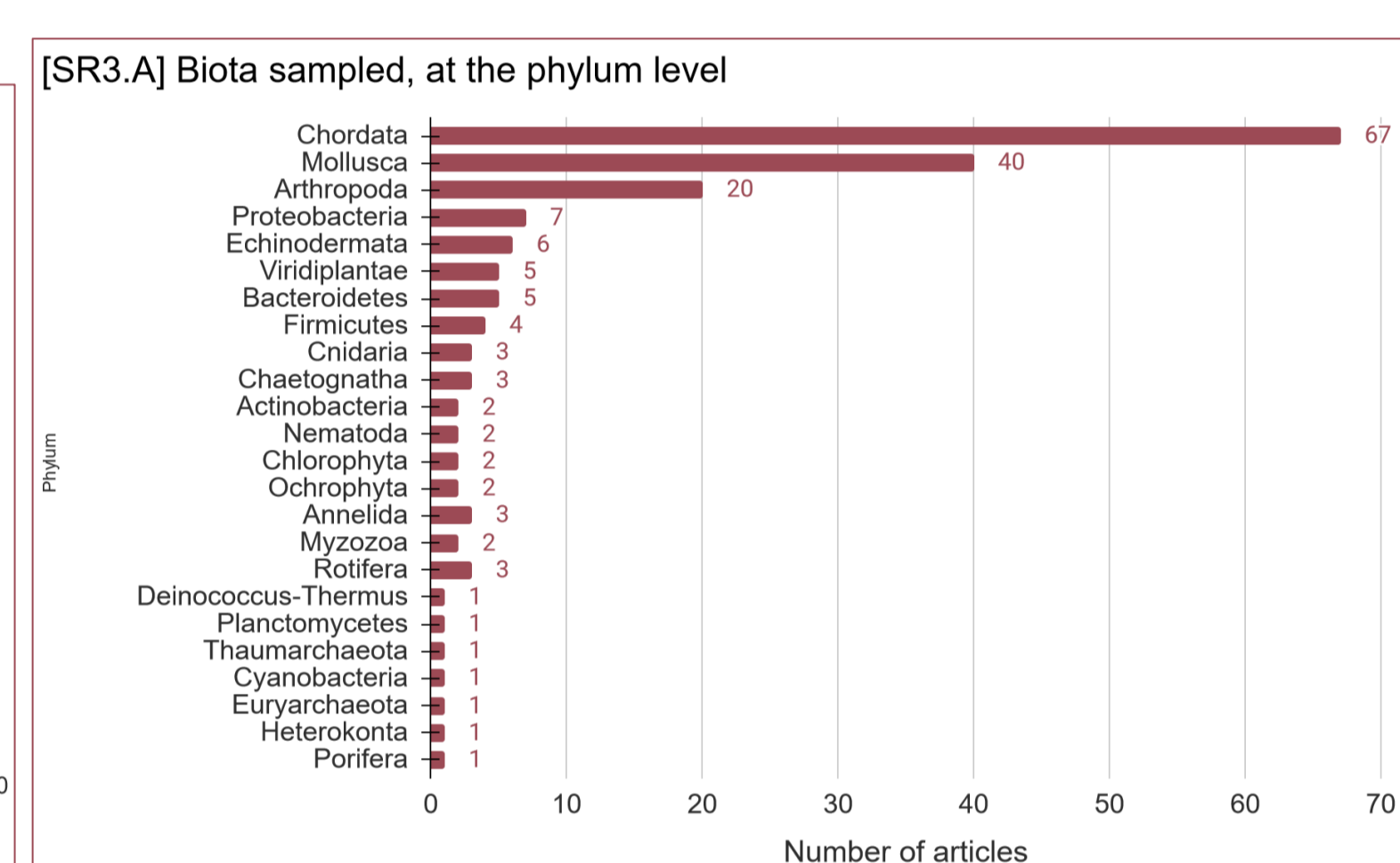
Most studies conducted field sampling (62.7%), especially on microplastics (64.8% of field sampling articles). They focused on topics relating to survey & monitoring/pollution status (n=277), ecological & environmental impacts (n=153), & sources & pathways of marine plastics (n=125).

In microplastics studies, polyethylene (PE: 21.9%), polypropylene (PP: 18.0%), polystyrene (PS: 14.2%) & polyethylene terephthalate (PET: 11.1%) were commonly found. These are commonly used



in plastic bottles, bags, food packaging & used to manufacture fishing gears.

Sampling for plastics were conducted in multiple compartments (e.g., water surface, sediment) & in biota. At the phylum level, Chordata (36.6%), Mollusca (21.9%) & Arthropoda (10.9%) are commonly sampled. We also used the applied names of the species within the data to generate information for policy-making in the next section.



(3) Research for Policy-making & Humanities

The data in RRI 2.0 shows that there is more scientific research than research in humanities (including social behaviour & psychology, law & economics) conducted on pollution from marine plastics in the ASEAN+3 region.

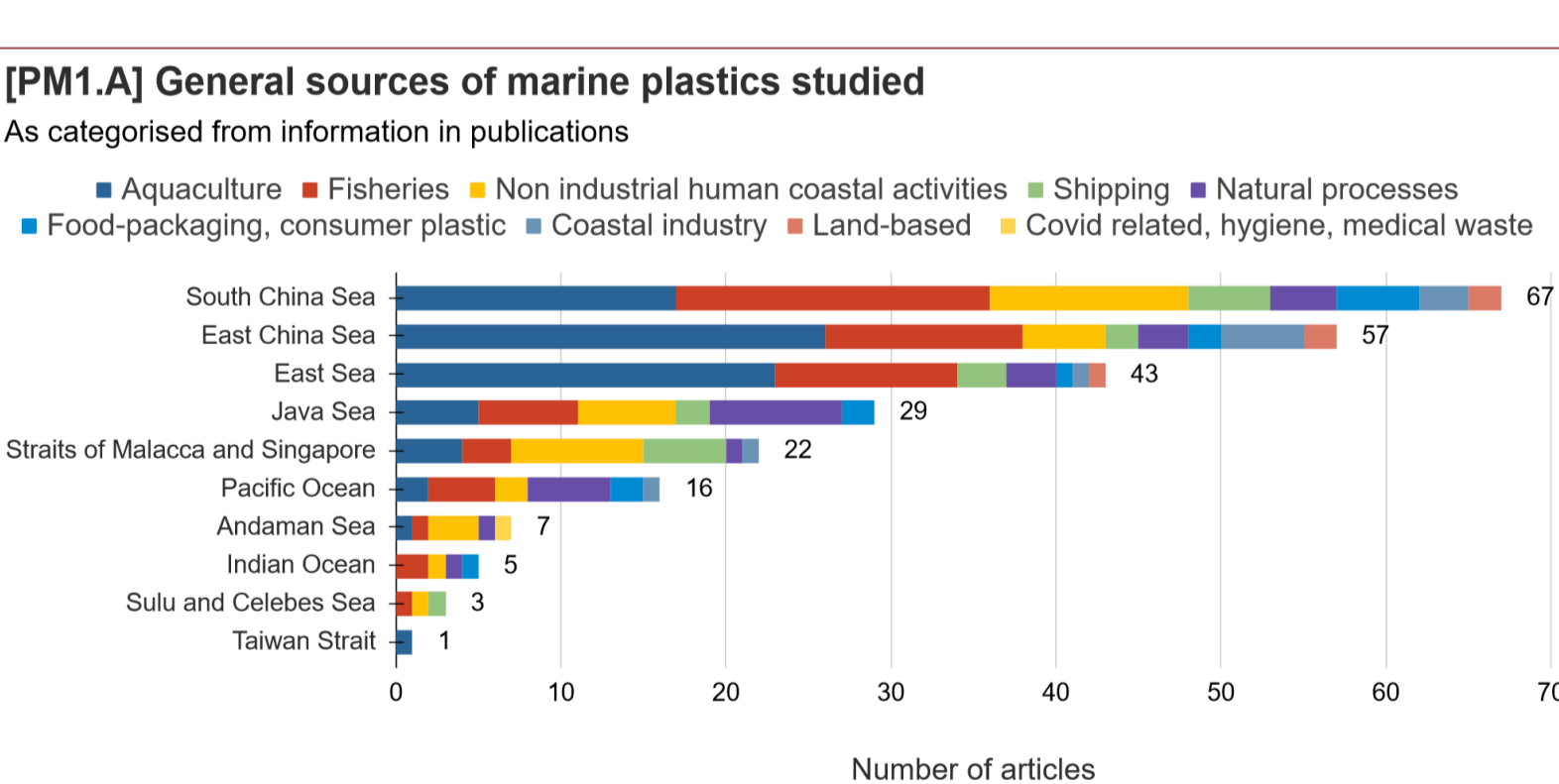
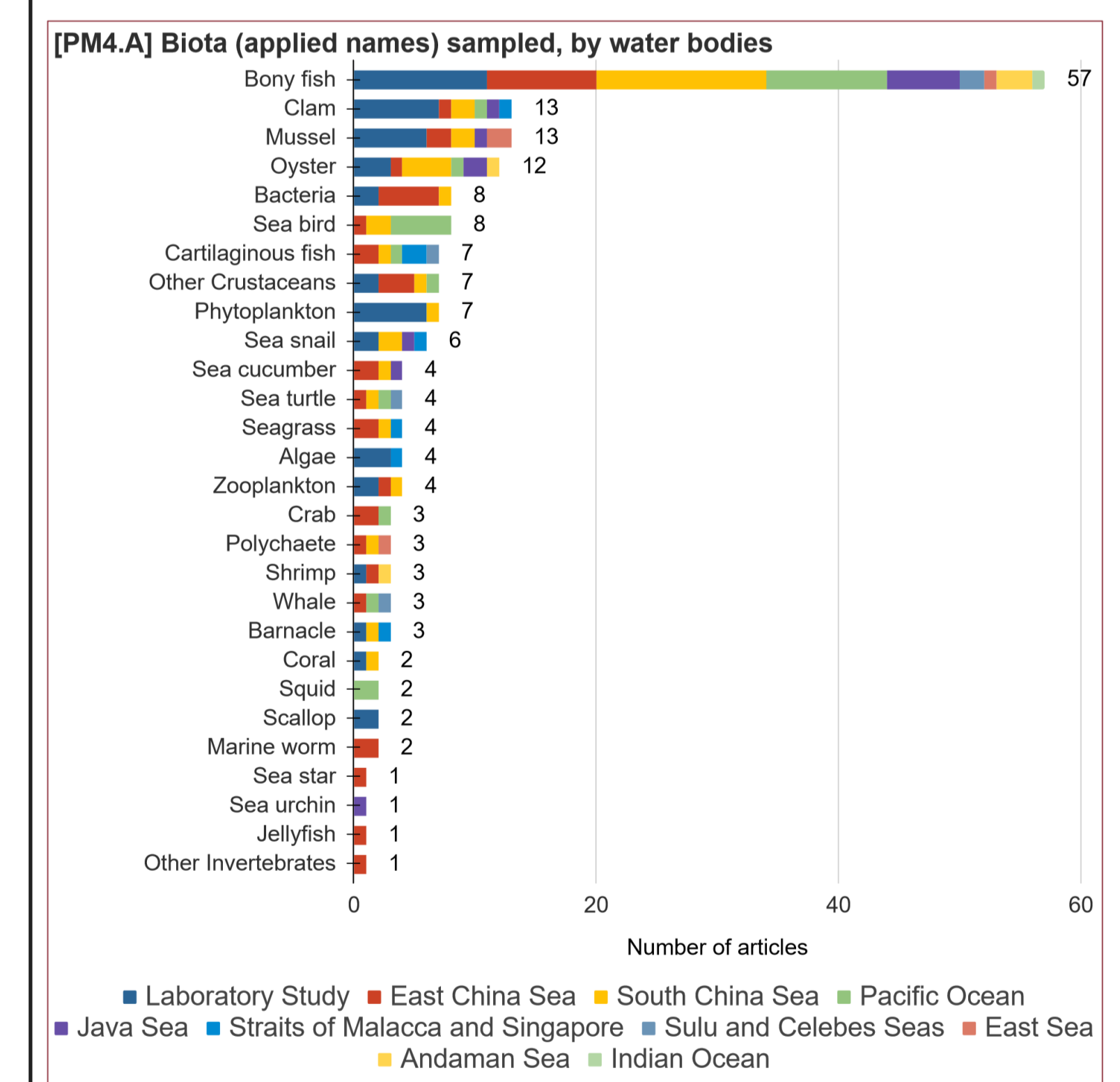
Humanities & interdisciplinary research commonly focus on: (i) Policy response measures, such as on legal & regulatory analysis, or social perceptions

towards policies, (ii) Education, outreach & capacity building, such as citizen science, & (iii) Socio-economic impacts, damage & opportunity, such as on economic loss & cost.

Data from scientific and humanities research were integrated to answer some recurring policy questions.

Sources of plastic, a key information for policy-making, are frequently reported in the following order: aquaculture, fisheries & non-industrial human coastal activities.

Using applied names of species in [PM4.A], we see that bony fishes were frequently sampled, followed by clams & mussels, & oysters. This can inform the identification of potential indicator species based on the available expertise.



5. Acknowledgements

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This is a joint effort of the entire regional team, comprising:

Coordinating team in Singapore

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