



# COBSEA – NUS Project 2021

Regional research inventory update and expansion, online data visualisation platform and recommendations to support the development of the GPML regional node

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# Outline

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## 1. Project Activities and Deliverables

## 2. Regional Team Members

## 3. Regional Research Inventory 2.0

- a. Scope and selection process for inclusion of publications in RRI 2.0
- b. Metadata: Information extracted from publications included in the Inventory
- c. A snapshot of RRI 2.0
- d. Updating of RRI 2.0

## 4. Online data visualisation platform

- a. Approach chosen (google data sheet as back-end and separate development of front end)
- b. The online platform (beta version)
- c. Examples of information that can be extracted
- d. Using the online platform: Some examples
- e. Factsheets

## 5. Platform maintenance and integration with GPML

- a. Maintaining the online platform for data visualisation and analytics
- b. Means of integration with GPML or other online platforms on marine litter

# Part 1: Project Activities and Deliverables

<u>Activity</u>	<u>Deliverables</u>
<b>A</b> Create the foundation for a regional research network of academic and research institutions on marine litter	<ul style="list-style-type: none"><li>→ Concept note for the development of a research network with a draft skeleton ToR</li><li>→ Summary of recommendations from pilot activities (4 webinar series)</li></ul>
<b>B</b> Create, populate, expand and update online database of marine litter research in the EAS region	<ul style="list-style-type: none"><li>→ Concept note for the development of the database</li><li>→ Populated database (online)</li><li>→ Online platform with visualisation of key data and findings (including on sources, pathways and impacts of plastic pollution and marine litter)</li></ul>
<b>C</b> Support development of knowledge management and networking services linked to the EAS Regional Node of the GPML.	<ul style="list-style-type: none"><li>→ Concept note on development of a catalogue of experts and of capacity building resources</li><li>→ Initial catalogues of expert individuals and institutions as well as capacity building resources</li></ul>

Focus of this presentation

# Part 2: Regional team members

Coordinated by the National University of Singapore (NUS) with the lead of Centre for International Law (CIL), and critical support of the Tropical Marine Science Institute (TMSI) on the marine scientific data extraction.

The outcome is a joint effort of the entire regional team, made up of more than 30 members across various countries:

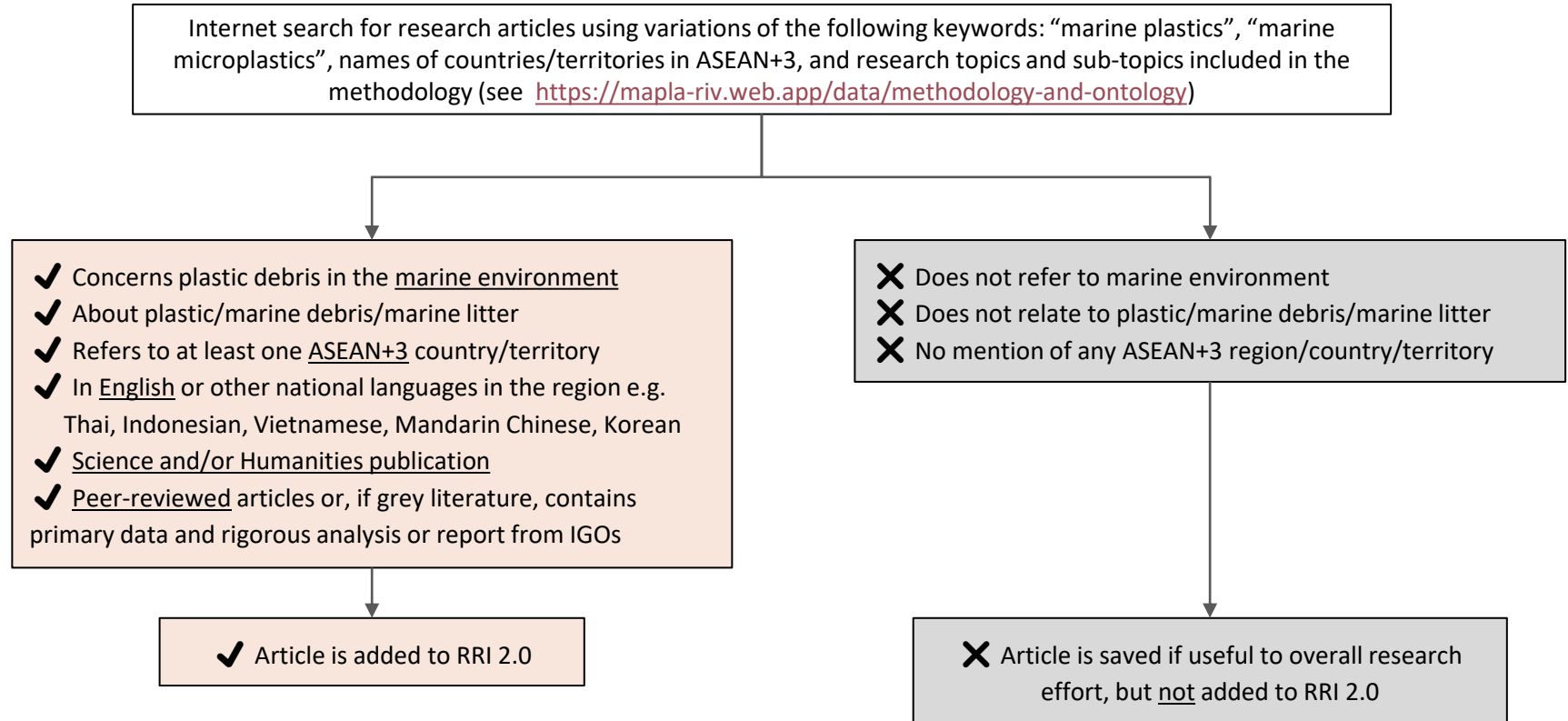
- NUS-CIL, **Singapore**: Youna Lyons, Cheng Ling Lim, 刘雨露 (Yulu Liu), Bui Quang Huy (Bui Quang Huy), Dennis Tan, Dita Liliansa, 정다운 (Dawoon Jung), Sng Wen Xin, Vũ Hải Đăng (Vu Hai Dang)

NUS-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**: ชาลิต เจริญพงษ์ (Chawalit Net Charoenpong), ปิ่นมัส บุษชา (Pinamas Bucha), เพ็ญใจ สมพงษ์ชัยกุล (Penjai Sompongchaiyakul) and ราฮุล เมห์โรตรา (Rahul Mehrotra)
- Indonesian Institute of Science (LIPI), **Indonesia**: Sulistiowati and Muhammad Reza Cordova
- Myanmar Ocean Project, **Myanmar**: သန္တာကိုကြီး (Thanda Ko Gyi)
- East China Normal University, **China**: 李道季 (Li Daoji) and 朱礼鑫 (Zhu Lixin) and their team

# Part 3: The Regional Research Inventory 2.0 (RRI 2.0)

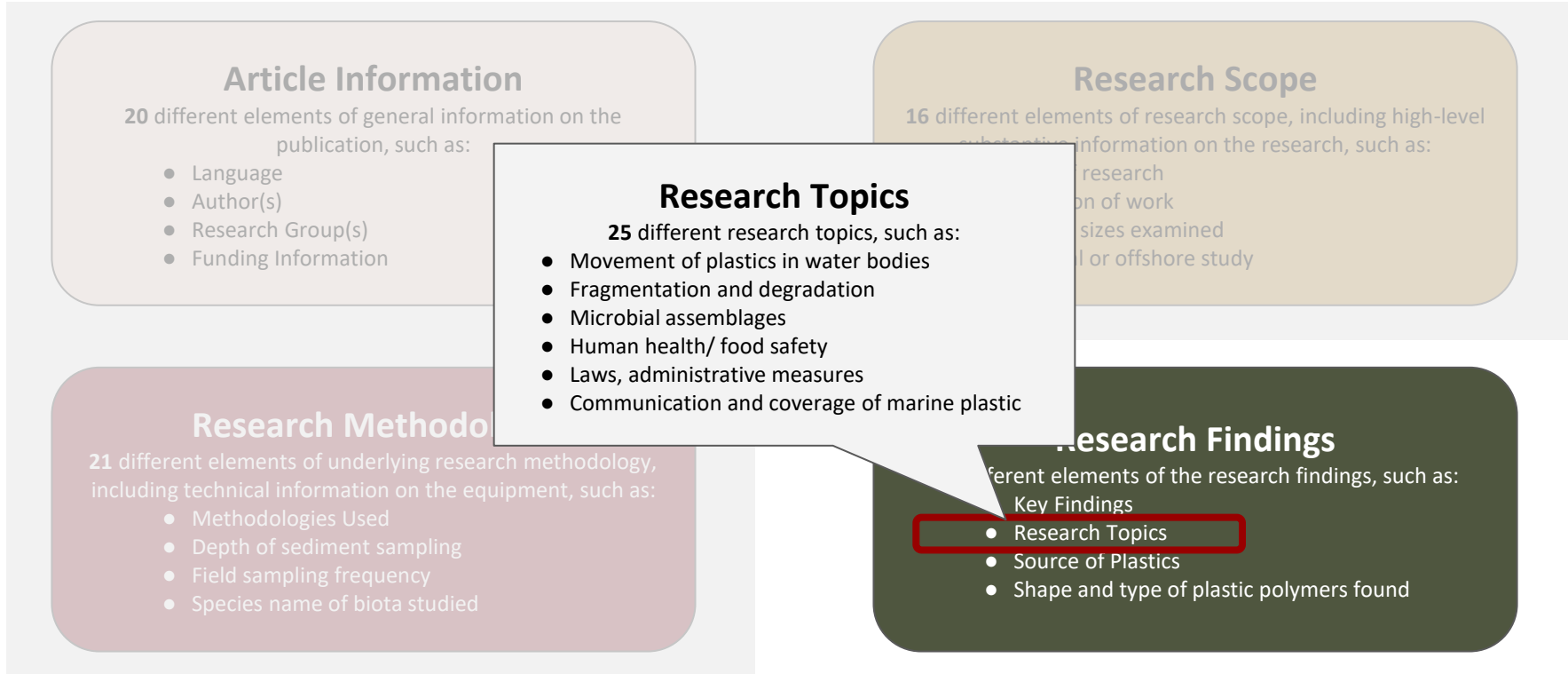
## *a - Scope and selection process for inclusion of publications in RRI 2.0*



# Part 3: The Regional Research Inventory 2.0 (RRI 2.0)

## *b - Metadata: Information extracted from publications included in the Inventory*

(see <https://mapla-riv.web.app/data/methodology-and-ontology>)



# Part 3: The Regional Research Inventory 2.0 (RRI 2.0)

## *b – Metadata: Information extracted from publications included in the Inventory*

(see <https://mapla-riv.web.app/data/methodology-and-ontology>)

### 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 has been 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 consulted – this enabled the inclusion of relevant research (such as dissertations) conducted in the region. It is hoped that the regional team can make it more representative and improve the accessibility of the papers.

RRI 2.0 includes non peer-reviewed publications provided that they can be filled reliably. In countries where there has been no useful substitutes. Furthermore, not all sampling reports lend themselves to database. Of note in this context, most of the non-English papers that could

#### Website Development

This website is developed using two open-source libraries: React.js and All the data is queried directly from the database inventory on Google the website. This approach simplifies the development and maintenance 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  | • Academic type             | • Year Published    |
| • Geographical Scale                        | • Country/territory studied | • Type              |
| • Link to source                            | • Language                  | • Citation          |
| • Title                                     | • Translated title          | • Author(s)         |
| • First Author                              | • Corresponding author      | • Journal           |
| • Book Title(s)                             | • Book Title                | • Research Group(s) |
| • Country/territory of Research Institution | • Funding Information       |                     |

##### Research Scope

This second category of input fields captures the different elements of research scope. It includes high-level substantive information on the research and publication. This enables a better understanding of the research, such as whether it is a coastal or offshore study, whether it has social/cultural elements, or whether the research examined contaminants.

- |                             |                                |                               |
|-----------------------------|--------------------------------|-------------------------------|
| • Aim of research           | • Period of study              | • Period of study_Year        |
| • Location of work          | • Relevant water body_Detailed | • Relevant water body_General |
| • Coastal or offshore study | • Plastic sizes examined       | • Adapted GESAMP size         |
| • Microplastic size         | • Contaminants examined        | • Fishing gear examined       |
| • Legal/regulatory study    | • Social/cultural study        | • Economic/management study   |
| • Policy study              |                                |                               |

#### Research Findings

This fourth category starts with a summary of key findings for each publication. Plastic sources (whether implied or traced), counts and/or weights are recorded. Where ever possible, the reported average values and standard deviations are recorded verbatim.

- |  |   |  |
|--|---|--|
| • Key Findings                           | • Source of Plastics                      | • Source of Plastics_General               |
| • Research Topics                        | • Plastic Characterisation_Conducted      | • Plastic Characterisation_Colour          |
| • Plastic Characterisation_Colours Found | • Plastic Characterisation_Shape          | • Plastic Characterisation_Shapes Found    |
| • Plastic Characterisation_Polymer       | • Plastic Characterisation_Polymers Found | • Macro_Uses                               |
| • Macro_Mean Abundance_Count             | • Macro_Mean Abundance_Weight             | • Water_Mean Abundance_Count               |
| • Water_Mean Abundance_Weight            | • Shoreline Sediment_Mean Abundance_Count | • Shoreline Sediment_Mean Abundance_Weight |
| • Seabed Sediment_Mean Abundance_Count   | • Seabed Sediment_Mean Abundance_Weight   | • Mangrove_Mean Abundance_Count            |
| • Mangrove_Mean Abundance_Weight         | • Biota_Mean Abundance_Count              | • Biota_Mean Abundance_Weight              |
| • Degradation Indicated                  |   |  |

Within the input field **Research Topics**, the values for input as stated below:

- |  |   |  |
|--|---|--|
| • Survey and monitoring/pollution status               | • Experimental studies of physicochemical impacts | • Methodologies and technologies for research on marine microplastic |
| • Contribution from rivers                             | • Impact on endangered species                    | • New 'or' emerging technologies for marine plastic                  |
| • Contribution from fisheries/ALDFG                    | • Trophic transfer of plastic                     | • Methodologies and technologies for marine plastic                  |
| • Discharge from offshore infrastructures and shipping | • Marine plastics as pathways for introduction of |  |
| • Port reception facilities                            |   |  |

#### Research Methodology

This third category of input fields describes the underlying research methodology, approach. Where ever possible, technical information on the equipment and technology used. This is particularly useful to understand capacity needs and elements of data comparability.

- |  |                                     |  |
|--|-------------------------------------|--|
| • Methodologies Used                       | • Field sampling_Conducted          | • Field sampling_Compartment           |
| • Field sampling_Frequency                 | • Survey/Interview_Conducted        | • Other sampling_Type                  |
| • Biota_Species                            | • Biota_Phylum                      | • Biota_Applied                        |
| • Common names                             | • Literature review_Conducted       | • Literature review_Volume             |
| • Desktop/deductive analysis               | • Modeling_Reviewed                 | • Modeling_Type Plankton net_Mesh size |
| • Water sampling_Depth                     | • Shoreline sediment sampling_Depth | • Seabed sediment sampling_Depth       |
| • Mangrove/mudflat sediment Sampling_Depth | • Control/blanks                    |  |

Under the input field **Methodologies Used**, the values for input are stated below:

- |   |   |   |
|---|---|---|
| • Review (literature or social)                       | • Monitoring  | • Quantification  |
| • Identification                                      | • Sampling  | • Simulation model  |
| • In-situ experimental work                           | • Laboratory experimental work (Sorption of pollutants/chemicals) | • Laboratory experimental work (Toxicity of plastic on development in marine biota life stages) |
| • Laboratory experimental work (Heavy metal analysis) | • Plastics extraction/preparation                                 | • Plastics characterisation, identification, quantification                                     |
| • Remote imagery and analysis                         | • Field study (Socio/economic)                                    | • Social survey/Interview/Questionnaire   |
| • Desktop quantitative analysis                       | • Desktop qualitative analysis                                    |   |

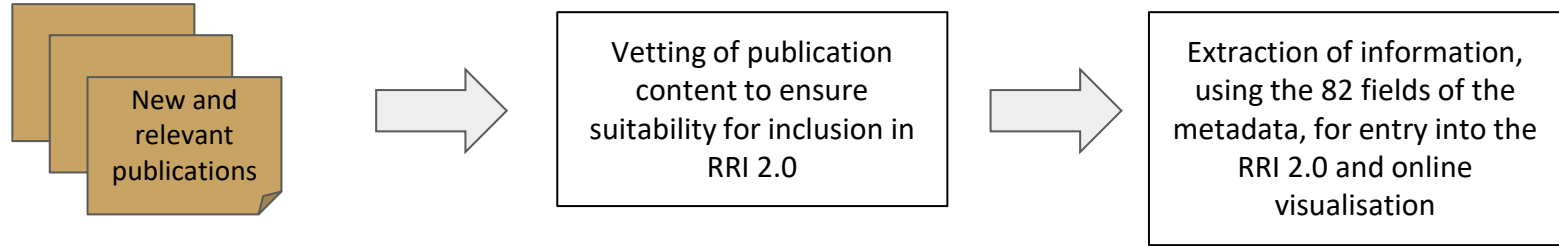






## Part 3: The Regional Research Inventory 2.0 (RRI 2.0)

### *d - Updating of RRI 2.0*

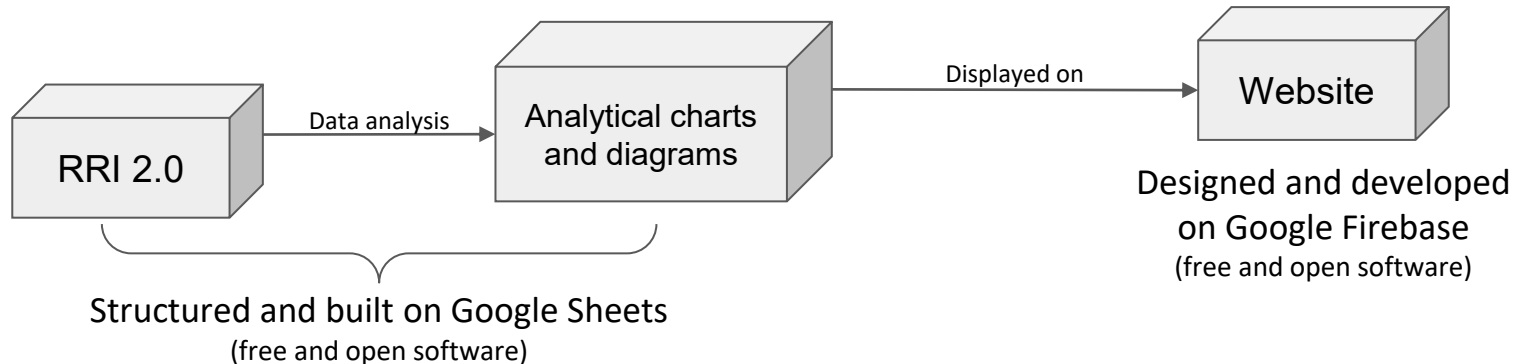


- Updating of the RRI 2.0 is necessary for the information to remain relevant and current
- Expertise in data organisation, a familiarity with the metadata & utilizing the RRI 2.0 and technical understanding of relevant fields of research on marine plastics are necessary
- The publication may also be in non-english language and require fluency in ASEAN +3 languages and access to local databases
- Publications are commonly behind paywall and require subscriptions, such as through academic institutions, to access

# Part 4: Online Data & Visualisation Platform

## *a - Approach chosen for the development*

- Key concern was to create content that could easily be imported to other platforms
- The overall architecture of the RRI 2.0 and of the visualisation platform are like that of Lego© blocks - the parts can exist on their own and are also able to connect with other similar pieces
- Information on publications are extracted and stored on the RRI 2.0, which is set up within a Google Sheet (therefore easily exportable on any other repository)
- Data within the Google Sheet are analysed to create charts and diagrams
- Online data analytics and visualisation platform is designed and developed, separately, on Google Firebase
- Data, charts and diagrams from Google Sheet are communicated to Google Firebase and displayed on the online platform



# Part 4: Online Data Visualisation Platform

## b - The online platform - beta version (<https://mapla-riv.web.app/data>)

### 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 hovering 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 reorder them

NEXT ORDER

ID Title Translated title Author(s) Research Topics Aim of Research Location or Offshore Coastal/Territory studied Water Body General Key Findings Methodologies Used Geographic scale Compartments Plastic characterisation Year Published Citation Link

ID	Title	Translated title	Author(s)	Research Topics
00036	Catching Plastic in the Gulf of Malaysia	NA	Tan Sze Yee/Whitty, Yin Yin Hui	Human health/food safety
00044	Enhancing Millennial Awareness Towards Marine Litter Through Environmental Education	NA	Kusumawati, Sri Setiawan/ Miki Sugiarto/Agung Dharma/ Fakhruddin Achmad	Education, outreach and communication/Social perceptions/Social behavioural studies
00050	Identification of the Activities Contributing to Marine Plastic Waste on the Shoreline of Kut Cheng, Thailand	NA	Elisa Juuti-Skärholm, Anila Tania	Survey and monitoring/Institution status
00059	Marine Microplastics: Abundance, Distribution, and Composition	NA	Woon Joon/Hee, Sang Hee Hong/ Soeun Eo	Survey and monitoring/publication status/ Guidelines, standards and manuals for survey, monitoring and assessment/ Research framework or coordination
00065	Marine plastic in the Philippines: a call for research	NA	Neil Angelo S. Alarcon	Research framework and coordination

Rows per page: 500 1-100 of 702

Marine Plastic Research Inventory (Beta)

HOME MAP DATA AND ANALYTICS FACT SHEETS FEEDBACK ABOUT

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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 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

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### 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

Bar chart showing the number of articles reporting commonly reported macro debris items across various water bodies. The items are: Bottle, Fishing, Bag, Foot pack, Cigarette, Rope, Styrofoam, Cup, Straw, and Toilet.

Water body	Bottle	Fishing	Bag	Foot pack	Cigarette	Rope	Styrofoam	Cup	Straw	Toilet
South China Sea	16	0	17	4	0	0	0	0	0	0
Java Sea	6	5	5	3	4	4	0	0	0	36
East China Sea	5	10	4	1	3	0	0	0	0	30
East Sea	4	7	2	2	3	5	0	0	0	29
Pacific Ocean	2	5	4	4	1	2	0	0	0	22
Indian Ocean	5	3	3	2	1	0	0	0	0	16
Sulu and Celebes Sea	3	2	4	2	1	1	0	0	0	17
Straits of MSL	4	2	4	0	0	2	0	0	0	16
Andaman Sea	2	2	0	0	1	1	0	0	0	10

#### [SR1.C] Research topics in water bodies

This graph does not include humanities-only publications.

Bar chart showing the number of articles reporting research topics in water bodies across various water bodies. The topics are: 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.

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	65	0	0	0	100	0	0
Pacific Ocean	34	23	22	13	11	0	0
East Sea	29	34	6	9	10	2	1
Java Sea	20	12	14	0	0	2	0
Straits of Malacca and Singapore	13	0	0	0	0	0	0
Indian Ocean	0	0	0	0	0	0	0
Andaman Sea	11	0	0	0	0	0	0
Sulu and Celebes Sea	5	0	0	0	0	0	0
Taiwan Strait	2	1	0	0	0	0	0

# Part 4: Online Data Visualisation Platform

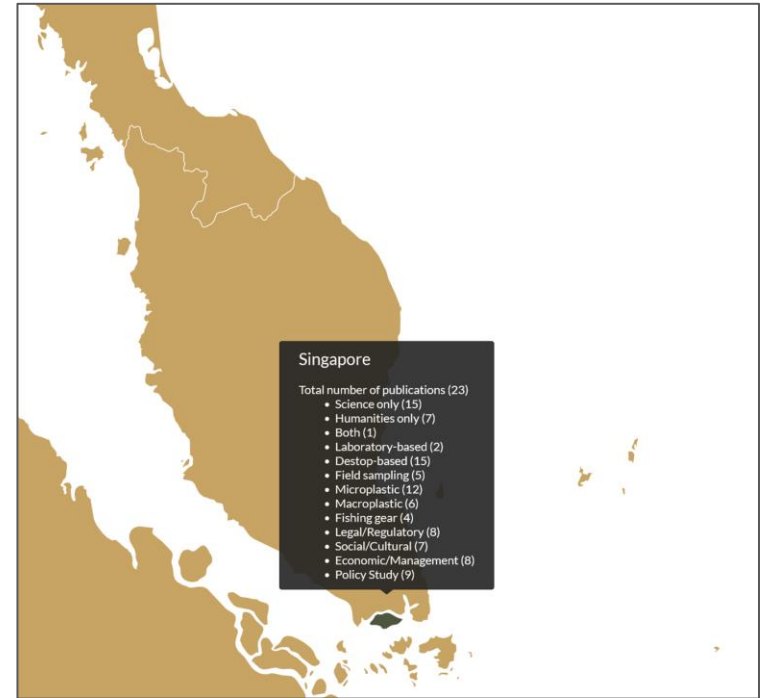
*b - The online platform - beta version* (<https://mapla-riv.web.app/data>)

## Map

This interactive map provides a visual representation of the geographic extent of RRI 2.0 as well as an extract of data analysis. When clicking on a country/territory, the following information is provided in relation to that country/territory:

First, the total number of publications in RRI 2.0; Second, the number of publications on sub-topics is included: Science-only, Humanities-only, Both (i.e. Science and Humanities), Laboratory-based, Desktop-based, Field sampling, Microplastic, Macroplastic, Fishing gear, Legal/Regulatory, Social/Cultural, Economic/Management, Policy Study.

The RRI 2.0 can be accessed [here](#).



*c - Examples of information available*

**Fig. 1A** Scientific and socio-economic research articles in the region

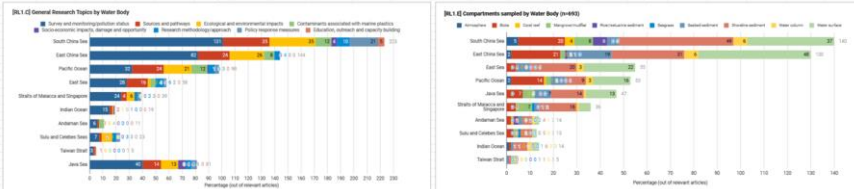
Figure 1A is a donut chart illustrating the distribution of scientific and socio-economic research articles by country. The data is as follows:

Country	Percentage
China	64%
USA	24%
Europe	12%

**Fig. 1B** General Research Topics by Country

Figure 1B is a horizontal bar chart showing research topics by country. The data is as follows:

Country	Science and technology	Economic and social	Environmental and natural	Education and culture
China	145	105	105	105
USA	105	145	105	105
Europe	105	105	145	105



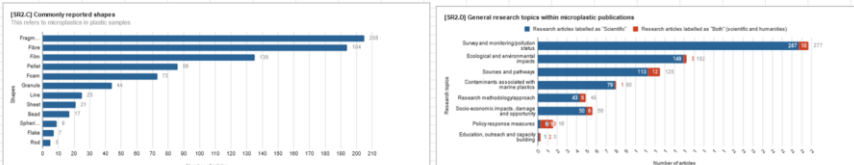
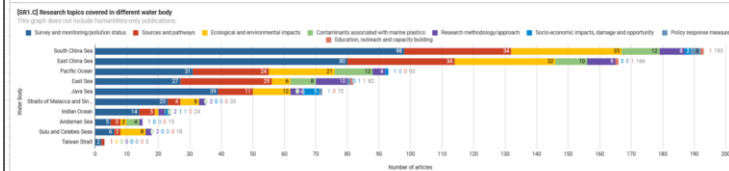
**[1992-02] Plastic waste classes studied**

Plastic waste class	Number of polymers
Miscellaneous	462
Other	18
Cellulose	115
Other (non-cellulose)	160

**[1992-02] Commonly reported polymers**

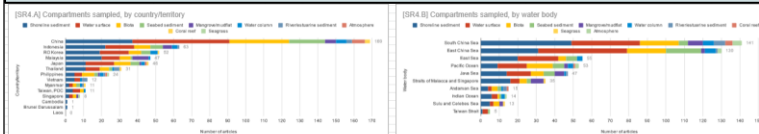
This refers to microplastics in plastic samples.

Polymer	Number of polymers
PE	202
PP	194
PET	152
PS	120
PMD	98
PMMA	90
Polystyrene	82
Cellulose	78
LDPE	68
PI	58
PEI	48
PC	38
Acrylic	28
Carbon fiber	18
HDPE	7

[illegible]

**[16S rDNA] Biotic sampling, at the phylum level**

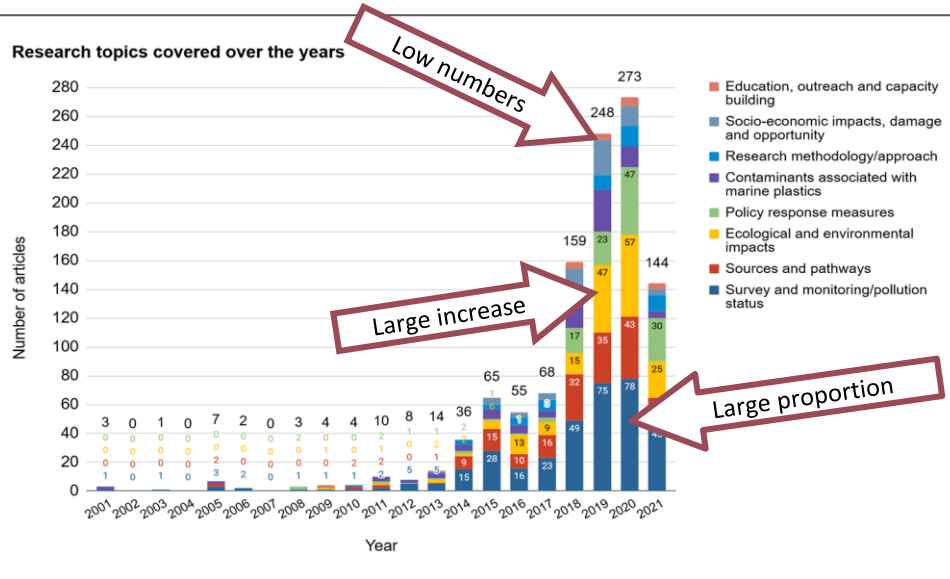
**[16S rDNA] Biotic sampling in each water body at the phylum level**



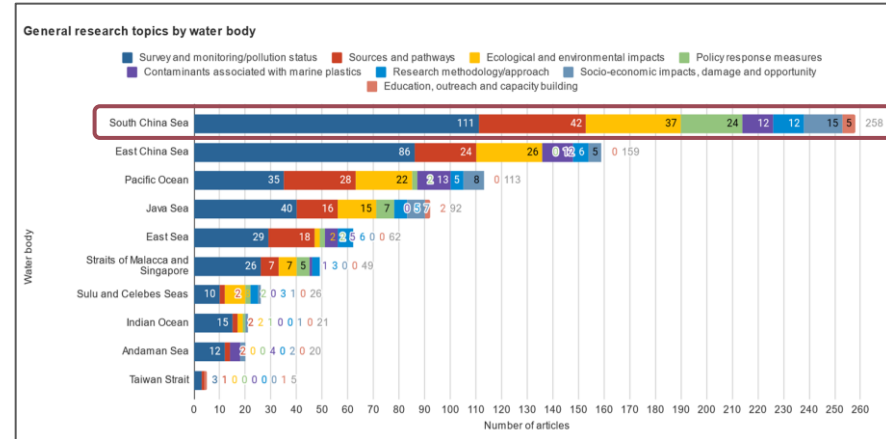
# Part 4: Online Data & Visualisation Platform

## d - Using the online platform: some examples

Research topics covered over time



Research topics in different water bodies



△ 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.

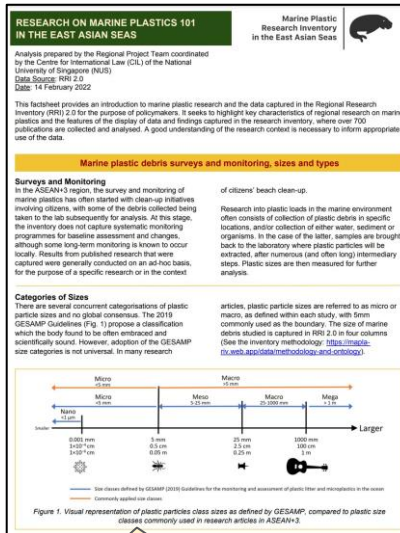
# Part 4: Online Data & Visualisation Platform

## e-Factsheets (<https://mapla-riv.web.app/factsheets>)

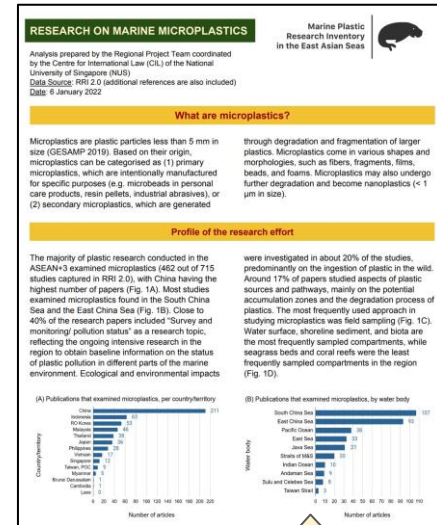
- Two factsheets are available on the (beta) data visualisation online platform
- They are based on data from the inventory
- They were prepared to demonstrate the way in which data included in the inventory can be used for different applications, especially policy-making purposes
- Our vision is that many more factsheets will be added to answer specific questions in the context of the region or parts of the region. We have several in the work and hope that others from the region will join.

Examples include:

- **Single-use plastic and consumer plastics**
- **Contaminants associated to marine plastics and the micro-plastisphere**
- **Social and cultural factors in pollution from marine plastics**
- **Economic costs, risks and hotspots**
- **Fisheries and aquaculture**
- **Marine plastics and biota**
- **Regional features: tropical climate condition, extreme events and hazards**



- Marine plastic debris surveys and monitoring, sizes and types
- Research topics
- Evolution of the research focus
- Understanding sources and pathways
- Understanding impacts
- Responses and interventions
- Limitations and opportunities for policy-making



- What are microplastics
- Profile of the research effort
- Sampling methods and challenges
- Findings on abundance and distribution
- Societal concerns and response
- Unanswered research questions



## Part 5: Platform maintenance and integration with GPML

### *a- Maintaining the online platform for data visualisation and analytics*

Examples of maintenance tasks:

1. Edits to textual content on the platform, as required
2. Review of the platform to ensure any changes to the RRI 2.0 are reflected in the data analytics
3. Update all softwares involved and their compatibility as needed
4. Ensure the components written by code are functional
5. Ensure security/cyber-security

## Part 5: Platform maintenance and integration with GPML

### *b- Means of integration with GPML or other online platforms on marine litter*

Several avenues can be explored, including:

1. Importing of inventory dataset onto GPML-hosted website
  - a. The issue of updating of the inventory to be handled
2. Importing of visualisation and analytics onto the GPML-hosted website that would pull data from inventory
  - a. Inventory will still be hosted and maintained by regional team and academia
3. Link to data hosted on current beta-temporary online platform



We are looking forward to this regional research network and joint-effort on the research inventory and data extraction to develop further

If you have any feedback, please share them here - <https://tinyurl.com/cobsea-nus>

Please contact us for any clarification or further discussion at  
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