

Importance of Dataset in the MPs research activity and the potential of AOMI: How will AOMI contribute to us

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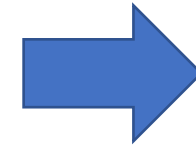
Kyushu University, JAPAN



Atlas of Ocean Microplastics;

AOMI 青海 (blue ocean)

was opened publicly from the website
from **9 May 2024**



<https://aomi.env.go.jp/>

What is AOMI?

- Multi-level dataset of microplastic (MP) abundance in the world's upper ocean
- It is available for everyone freely
- Anyone can upload/download the MP data through the AOMI website
- This is a MP data sharing project sponsored by Ministry of the Environment, Japan (MOEJ)

Atlas of Ocean Microplastics; AOMI 青海 (blue ocean)

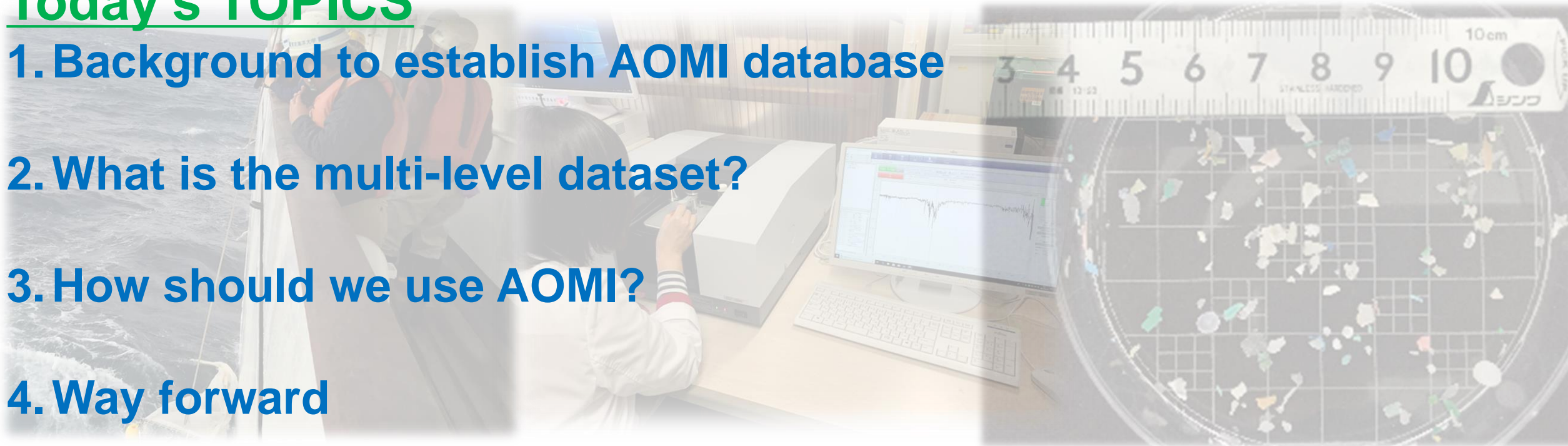
will be opened publicly from the website
from **9 May 2024**

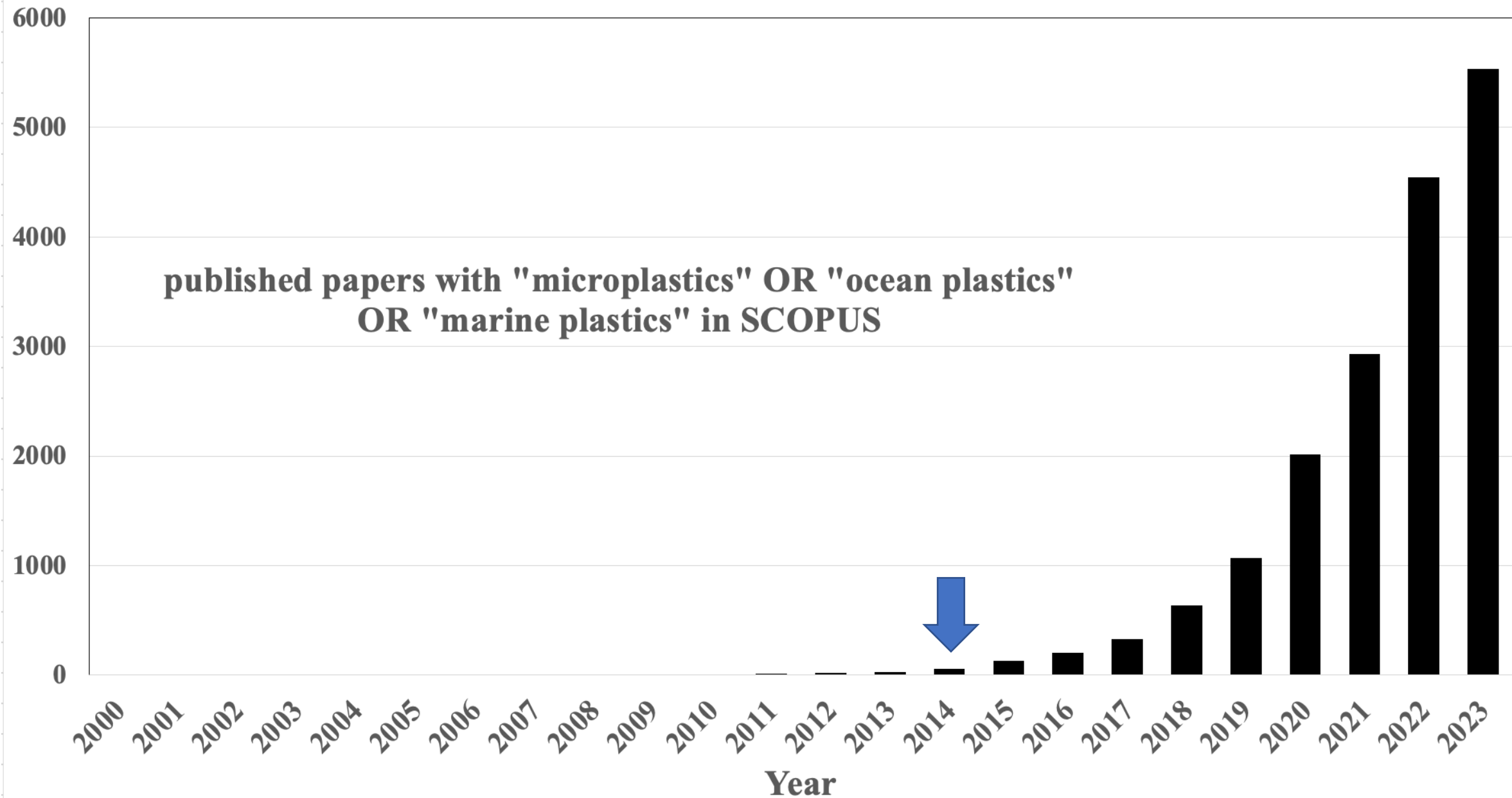


<https://aomi.env.go.jp/>

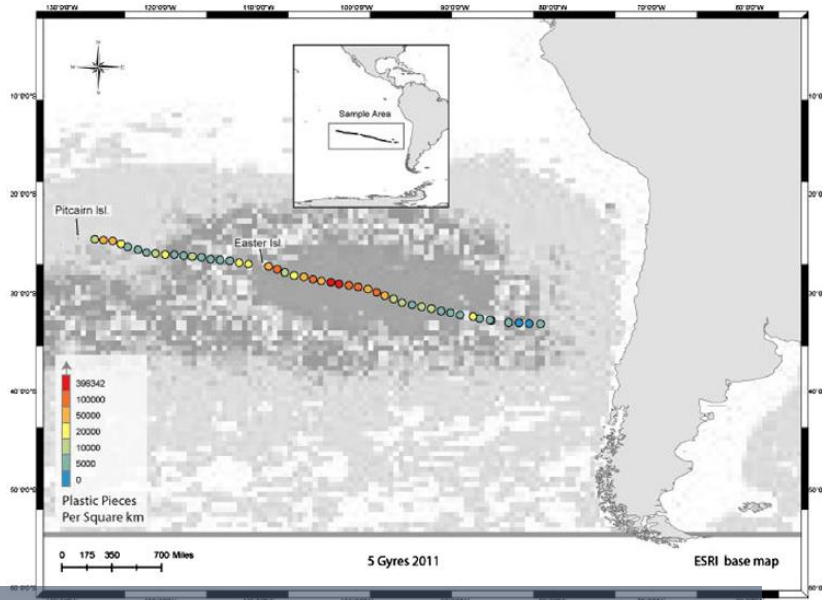
Today's TOPICS

1. Background to establish AOMI database
2. What is the multi-level dataset?
3. How should we use AOMI?
4. Way forward

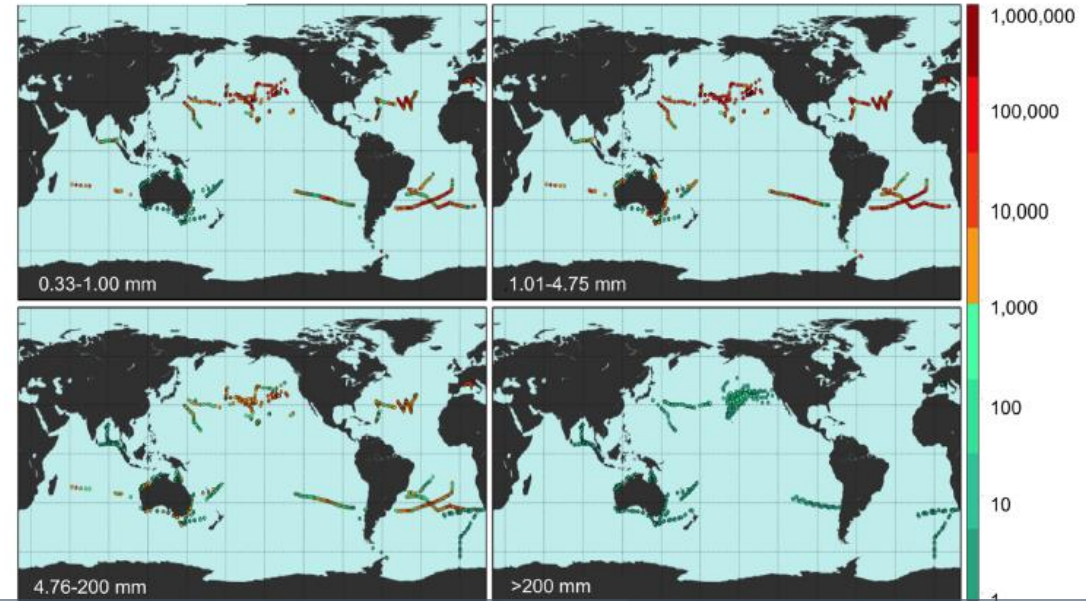




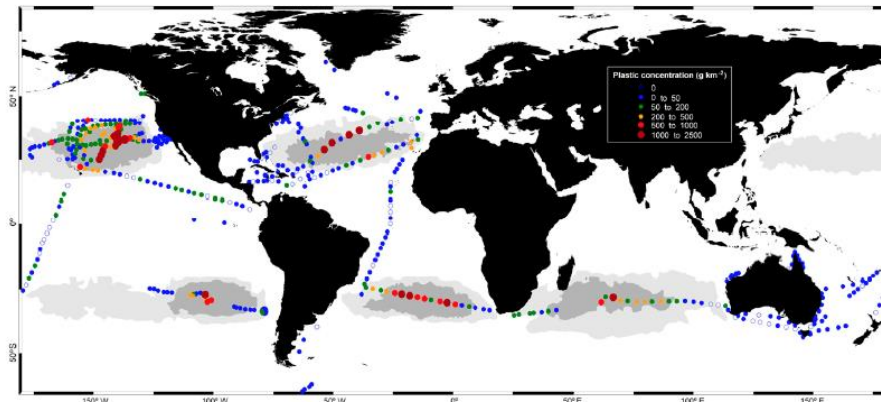
It was not well harmonized/standardized even in “metrics”



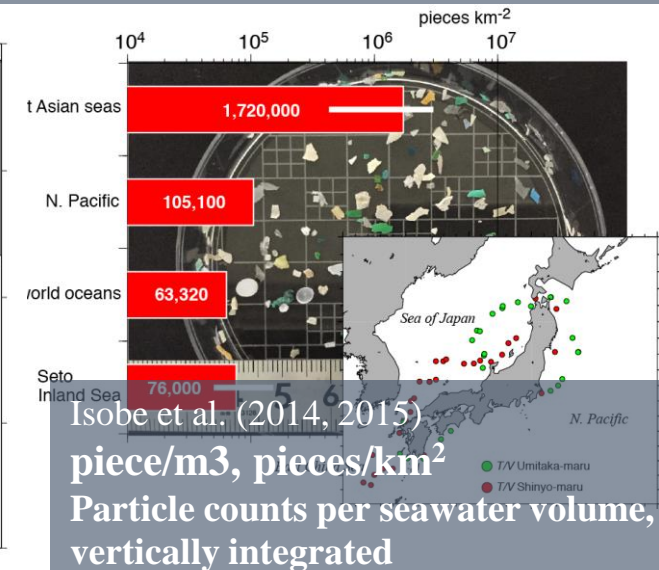
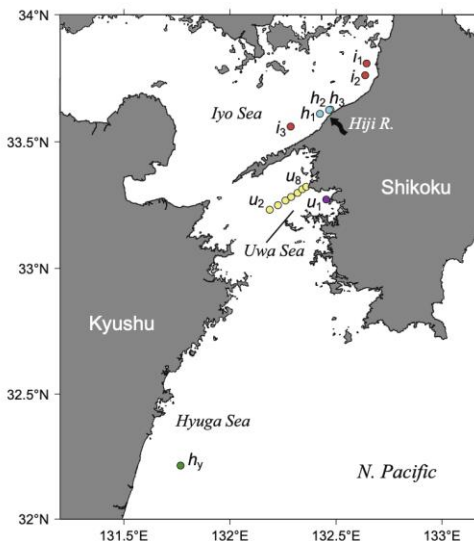
Eriksen et al. (2013)
pieces/km² Particle counts per study area



Eriksen et al. (2014)
pieces/km²; Particle counts per seawater volume time net height



Cozar et al. (2014)
weight/km²
Weight per seawater volume time net height



Isobe et al. (2014, 2015)
piece/m³, pieces/km²
Particle counts per seawater volume, per area vertically integrated

Background to establish the AOMI database by MOEJ

- In 2015 at the **G7 summit**, it was established as a priority to harmonize monitoring and standardize data
- It was agreed that Japan would take on a leading role in data harmonization and standardization for ocean microplastics
- In 2019 at the **G20 Osaka summit**, marine plastic pollution was set as a priority issue
- The "**G20 Implementation Framework for Actions on Marine Plastic Litter**" was endorsed, which includes sharing information and knowledge
- During a **G20 workshop**, MOEJ voluntarily took the lead to address the key issues for harmonizing monitoring and compiling data.



2015, Elmau G7 summit, Germany



2019, Osaka G20 summit, Japan

Background to establish the AOMI database by MOEJ

Harmonization/ Standardization of monitoring methods of ocean microplastics

Guidelines for Harmonizing Ocean Surface Microplastic Monitoring Methods

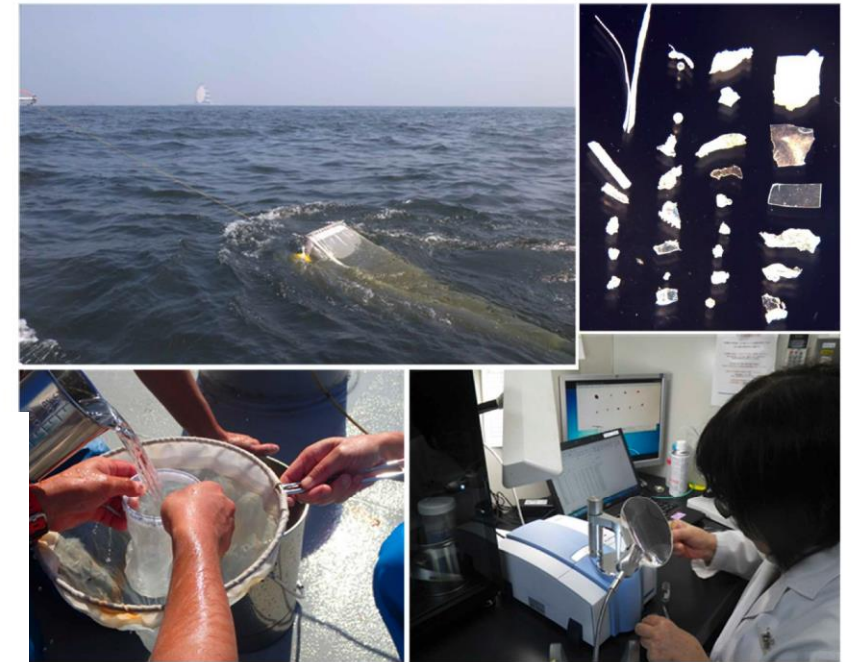
Guidelines for Harmonizing Ocean Surface Microplastic
Monitoring Methods

Version 1.0, May 2019

Yutaka Michida¹, Suchana Chavanich², Andrés Cózar Cabañas³, Pascal Hagmann⁴, Hirofumi Hinata⁵, Atsuhiko Isobe⁶, Peter Kershaw⁷, Nikolai Kozlovskii⁸, Daoji Li⁹, Amy L. Lusher¹⁰, Elisa Martí³, Sherri A. Mason¹¹, Jingli Mu¹², Hiroaki Saito¹, Won Joon Shim¹³, Agung Dhamar Syakti¹⁴, Hideshige Takada¹⁵, Richard Thompson¹⁶, Tadashi Tokai¹⁷, Keiichi Uchida¹⁷, Katerina Vasilenko¹⁸, Juying Wang¹²



1. Planning
2. Equipment
3. Sampling
4. On-board processing
5. Lab analysis



Ministry of the Environment, JAPAN
May, 2019

Michida et al., (2019)

A prototype of the AOMI database

~2D mapping project of surface microplastic abundance in the world's ocean ~

Isobe et al. *Microplastics and Nanoplastics* (2021) 1:16
<https://doi.org/10.1186/s43591-021-00013-z>

Microplastics and
Nanoplastics

(Isobe et al., 2021, *Micropla. & Nanopla.*)

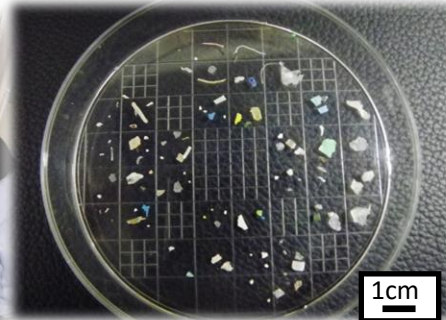
RESEARCH ARTICLE

Open Access

A multilevel dataset of microplastic abundance in the world's upper ocean and the Laurentian Great Lakes

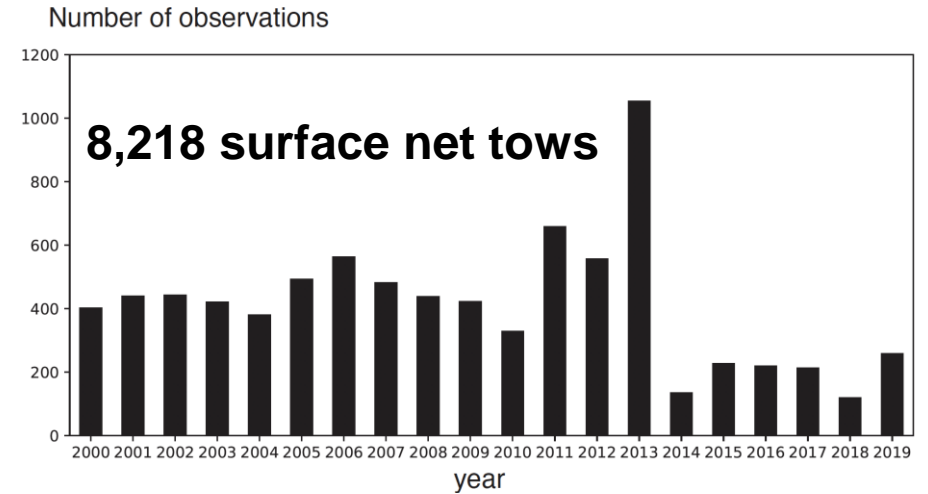


Atsuhiko Isobe^{1*}, Takafumi Azuma², Muhammad Reza Cordova³, Andrés Cózar⁴, Francois Galgani⁵, Ryuichi Hagita⁶, La Daana Kanhai⁷, Keiri Imai⁸, Shinsuke Iwasaki⁹, Shin'ichiro Kako¹⁰, Nikolai Kozlovskii¹¹, Amy L. Lusher^{12,13}, Sherri A. Mason¹⁴, Yutaka Michida¹⁵, Takahisa Mituhashi², Yasuhiro Morii¹⁶, Tohru Mukai¹⁷, Anna Popova¹¹, Kenichi Shimizu¹⁸, Tadashi Tokai¹⁹, Keiichi Uchida¹⁹, Mitsuharu Yagi¹⁸ and Weiwei Zhang²⁰



reliable dataset of ocean plastic debris

- future prediction
- policy making
- public awareness



2000~2019

Microplastics > ~0.3 mm, but filaments were discarded in analyses.

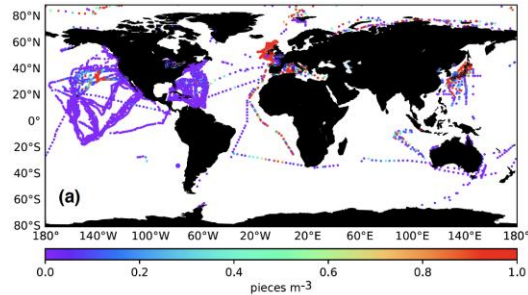
sponsored by Ministry of
the Environment, Japan



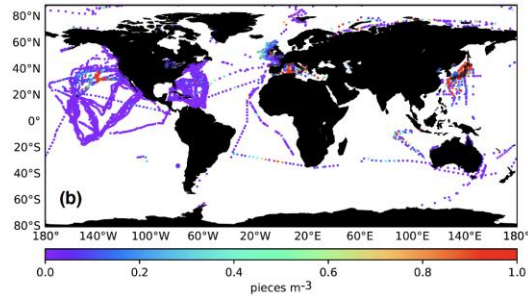
Coauthors:

Japan, China, Indonesia
Spain, France, Russia, Norway
USA, Trinidad & Tobago,

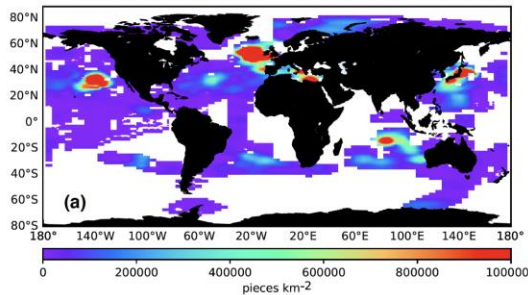
What is the multi-level dataset?



particle count per unit volume
LEVEL 0



without fibrous microplastics
LEVEL 1



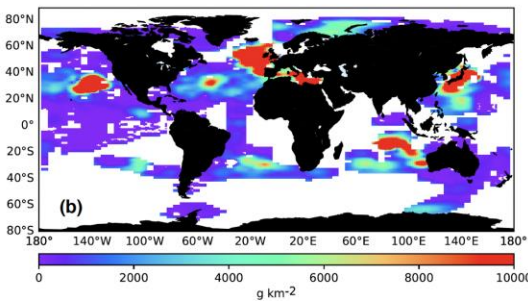
particle count per unit area **LEVEL 3p**

Optimum Interpolation Method (Kako et al., 2011)

$$A_g = B_g + \sum_{i=1}^N (O_i - B_i) W_i,$$

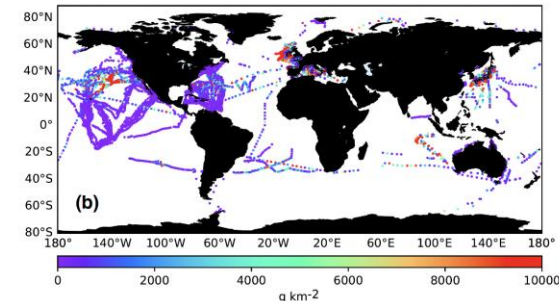
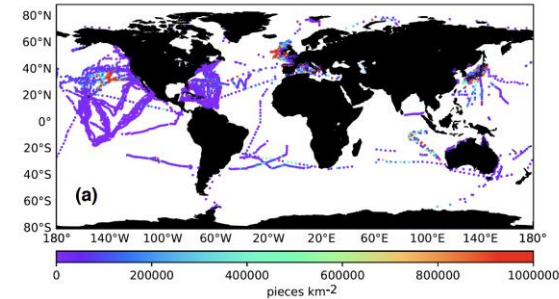
$$\sum_{j=1}^N \sum_{i=1}^N (\mu_{ij}^B + \mu_{ij}^O) W_i = \mu_{ig}^B,$$

$$\mu^B = e^{\left(-\frac{r_m^2}{L_m^2} - \frac{r_g^2}{L_g^2} \right)},$$

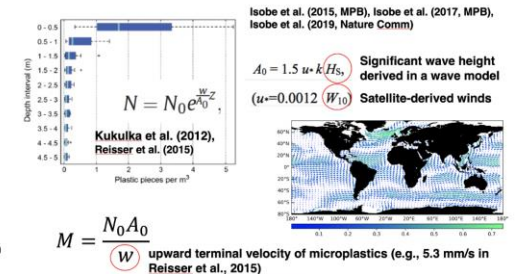


weight per unit area **LEVEL 3w**

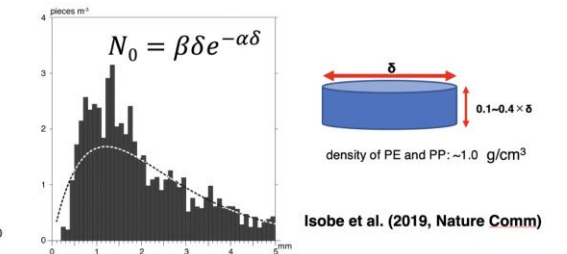
1000 km × 500 km



particle count per unit area **LEVEL 2p**

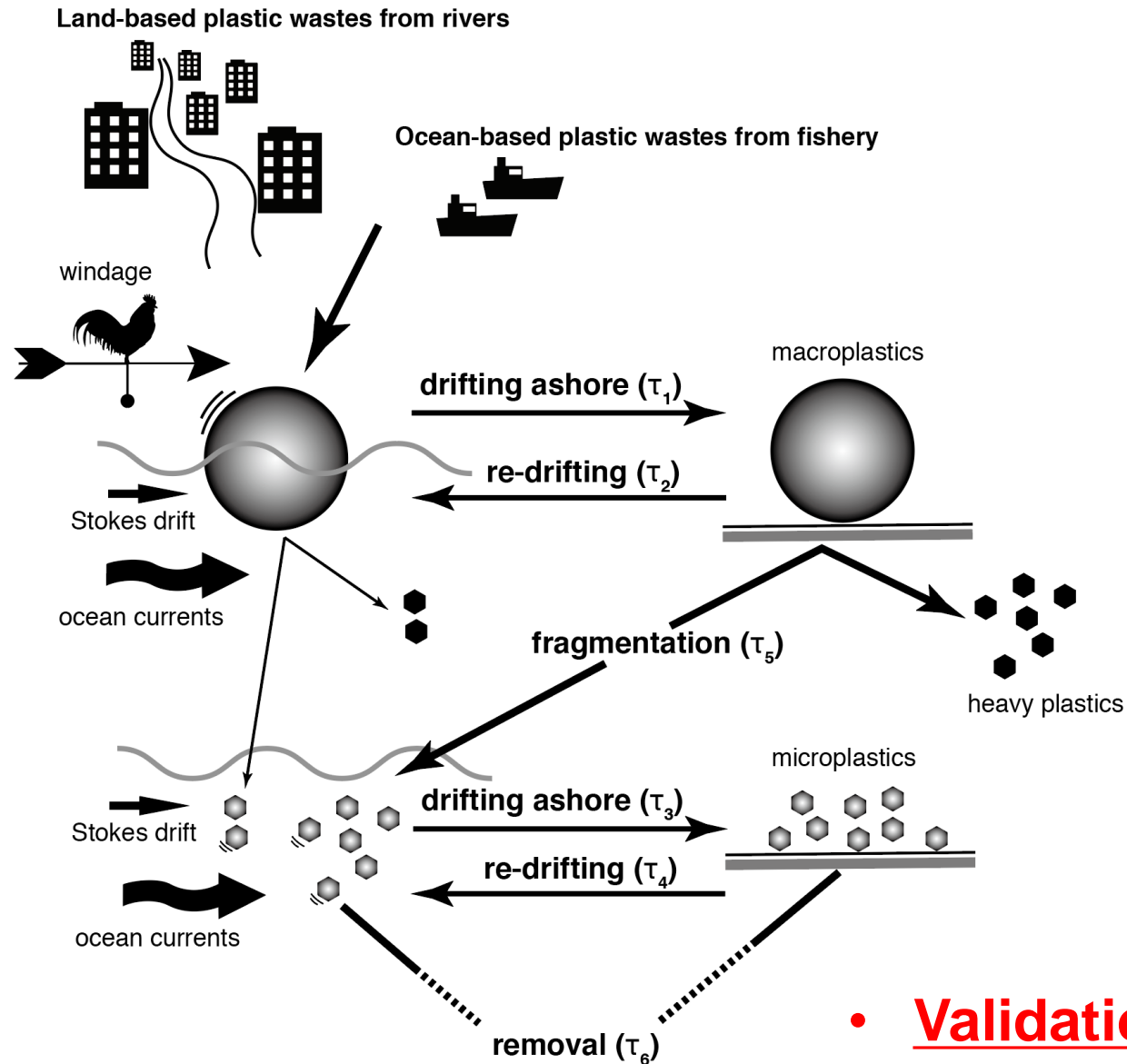


weight per unit area **LEVEL 2w**



- ✓ **Ecotoxicologists and/or environmental chemists** who set up laboratory-based studies regarding "toxicity" of microplastics in realistic situations.
- ✓ **Physical Oceanographers** who set up numerical modeling approaches to reproduce and/or forecast the ocean microplastic abundance
- ✓ **Oceanographers and/or NPOs** who set up field surveys to collect microplastics efficiently
- ✓

How should we use AOMI database?

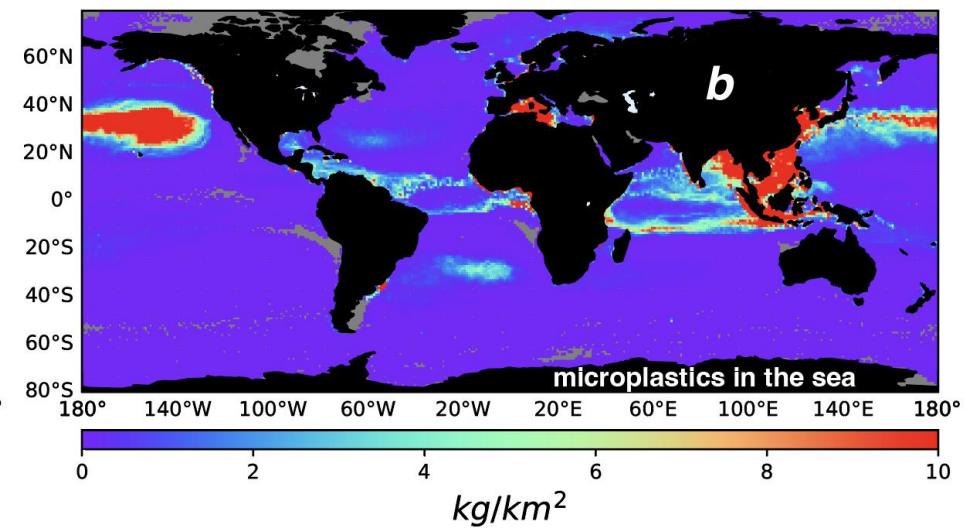
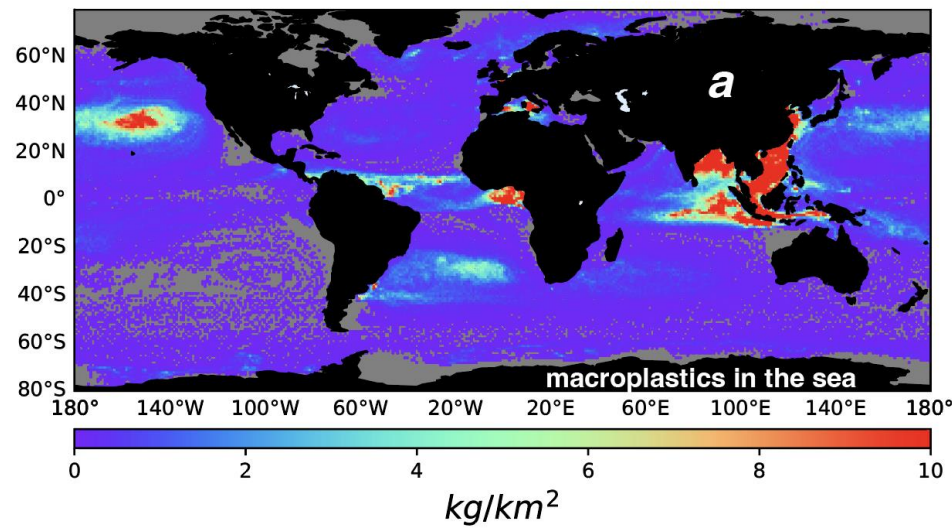


framework of a 2D model

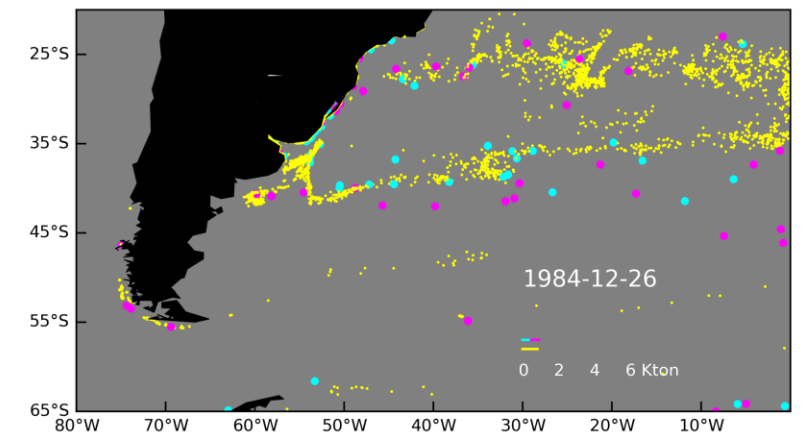
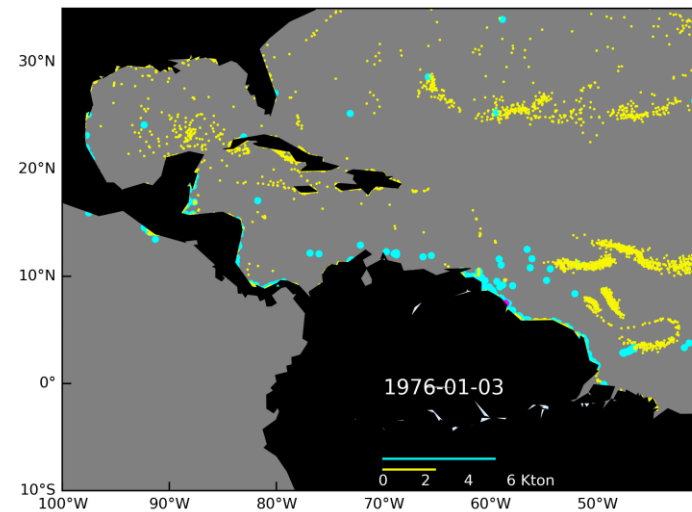
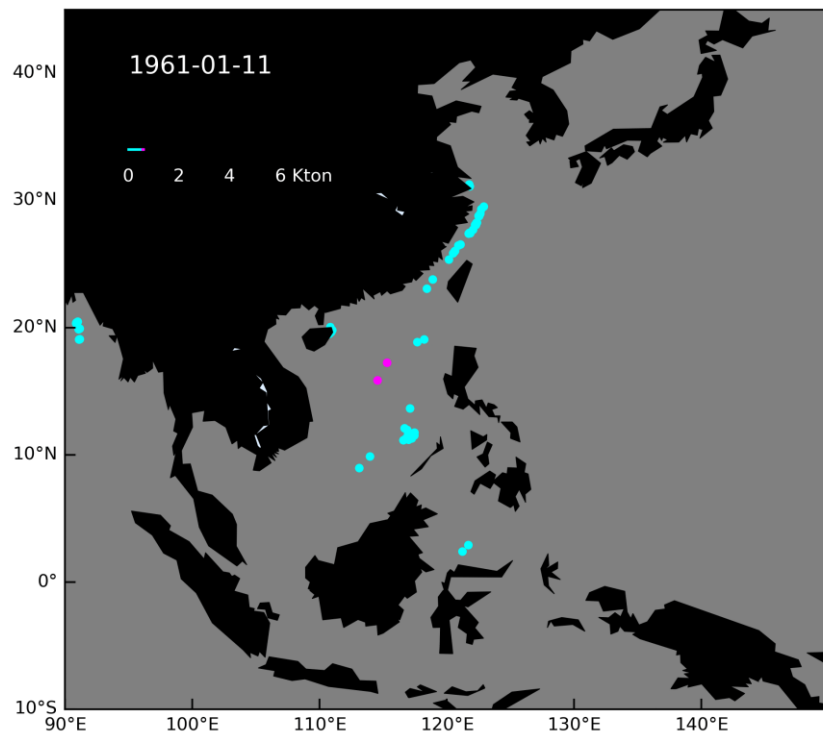
Ocean plastics are categorized to

- ✓ **Ocean macroplastics emitted from rivers (Lebreton et al., 2017) and fishery (20% of riverine plastic debris)**
- ✓ Macroplastics washed ashore on beaches
- ✓ Ocean microplastics fragmentized from macroplastics
- ✓ Heavy plastics
- ✓ Microplastics washed ashore on beaches
- ✓ Microplastics removed from the upper oceans

- **Validation of numerical model approach**



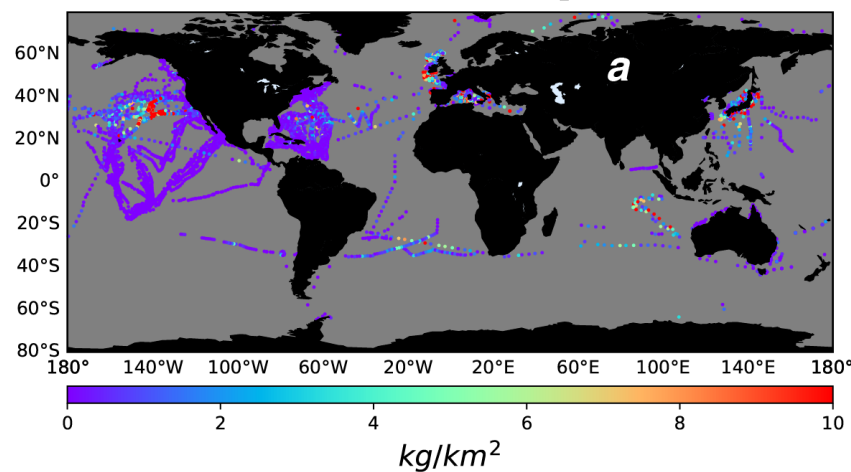
fragmentation **3 years** removal **3 years**



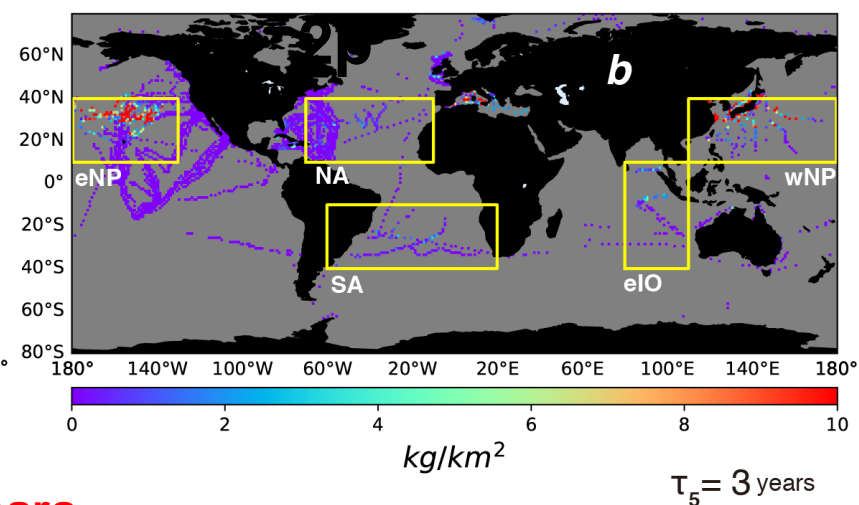
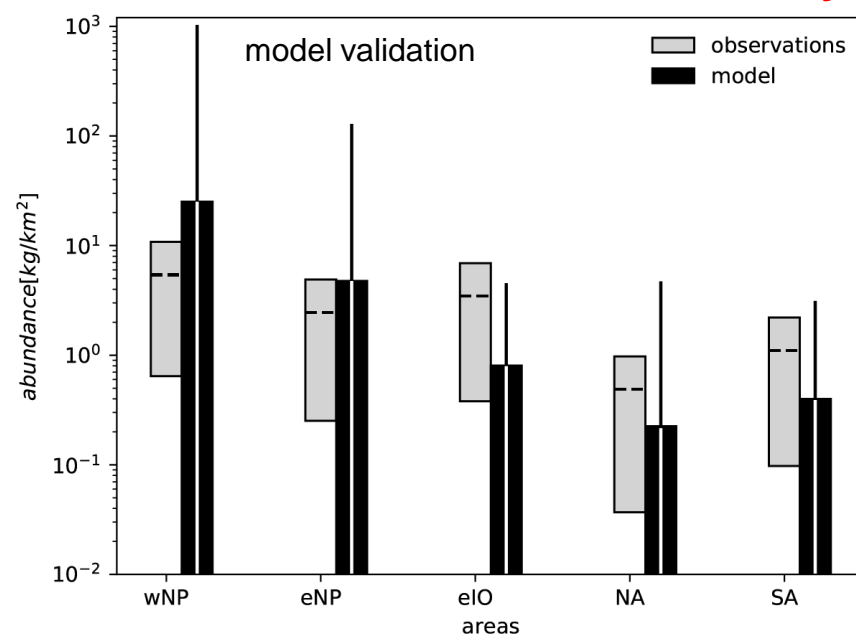
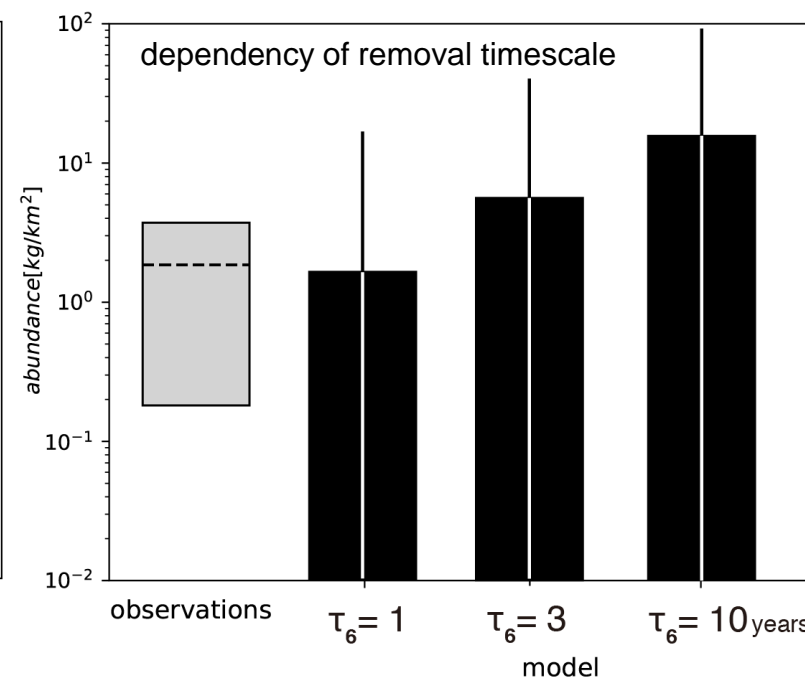
(Isobe & Iwasaki, 2022, STOTEN)

(blue: plastic debris, red: fisheries plastic debris, yellow: microplastics)

Level 2p



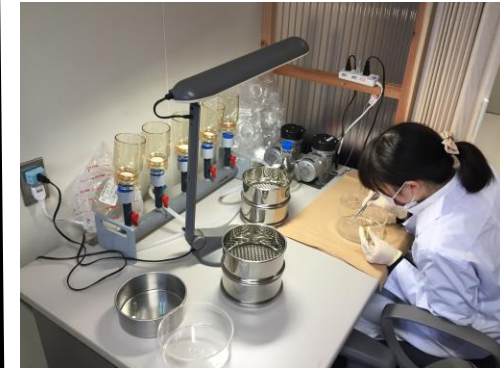
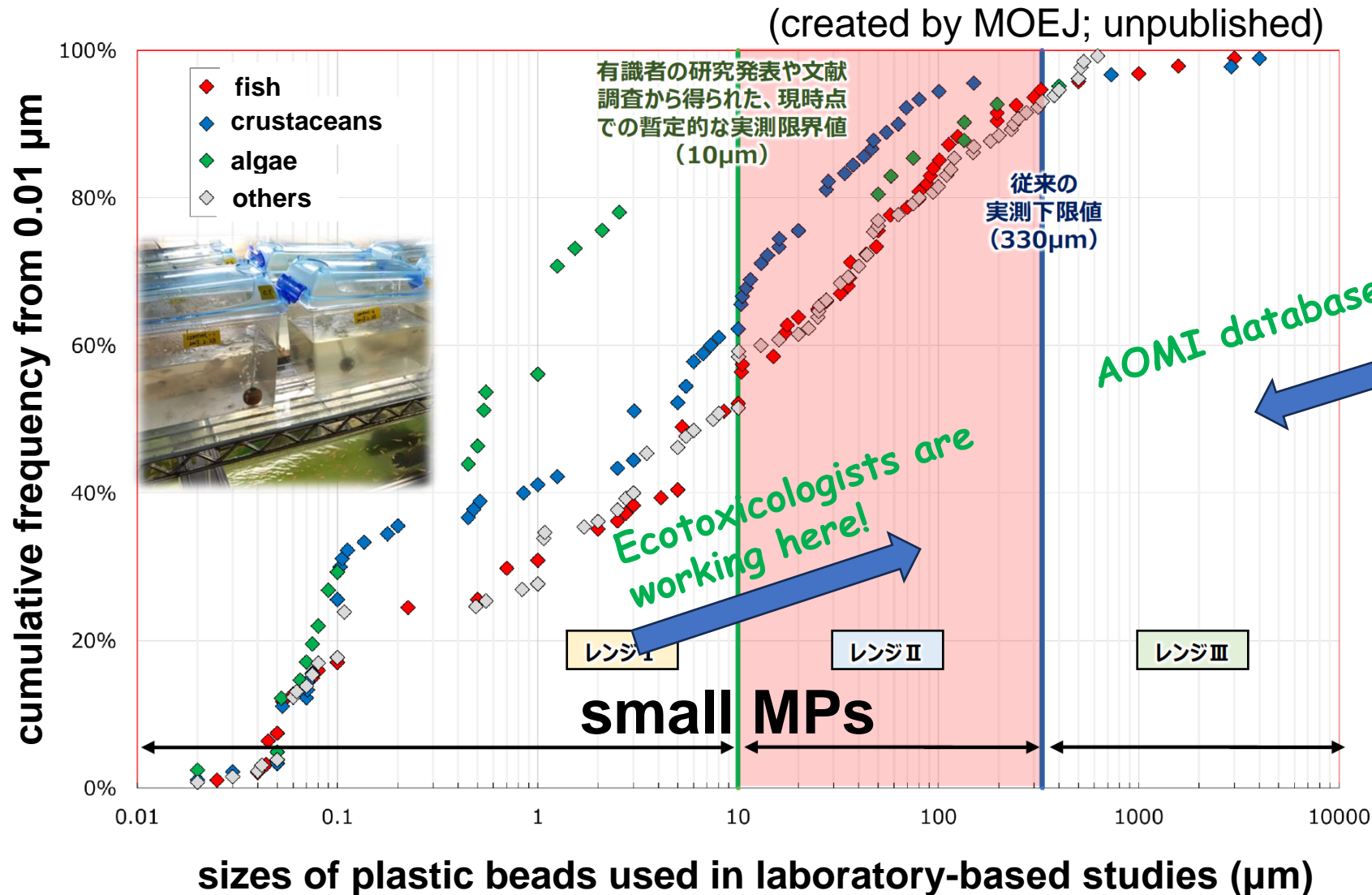
Model

 $\tau_5 = 3 \text{ years}$ fragmentation **3 years** removal **3 years****c****d**

Design of eco-toxicological experiments

However, there is a large gap between microplastic sizes in laboratory experiments and field surveys

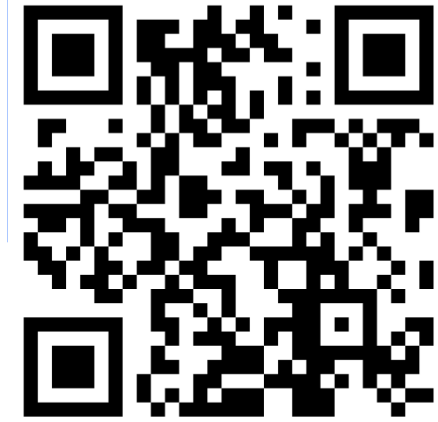
> 0.3 mm



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