Science Day – 2018

Scientific Groups Meeting for London Convention and Protocol (LC/SG 41 & LP/SG 12)

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28 años 1989-2017

Research centre for toxic compounds in the environment

UNIVERSITÀ DI SIENA 1240

Microplastics in the marine environment – Global overview – The Mollusks case study - and Identification of International Regulations for the Aquaculture sector

Dr. Karla Pozo

Valparaiso, Chile 3rd May 2018

Microplastics is a multidisciplinary global issue

- In recent years, there has been a critical environmental concern about "microplastics" (plastic fragments smaller than 5 mm).
- Due to their small size, microplastics are considered bioavailable for organisms throughout the food webs.

Fragments….

RESEARCH ARTICLE

Plastic Pollution in the World's Oceans: More than 5 Trillion Plastic Pieces Weighing over 250,000 Tons Afloat at Sea

Marcus Eriksen[1]*, Laurent C. M. Lebreton[2], Henry S. Carson[3,4], Martin Thiel[5,6,7], Charles J. Moore[8], Jose C. Borerro[9], Francois Galgani[10], Peter G. Ryan[11], Julia Reisser[12]

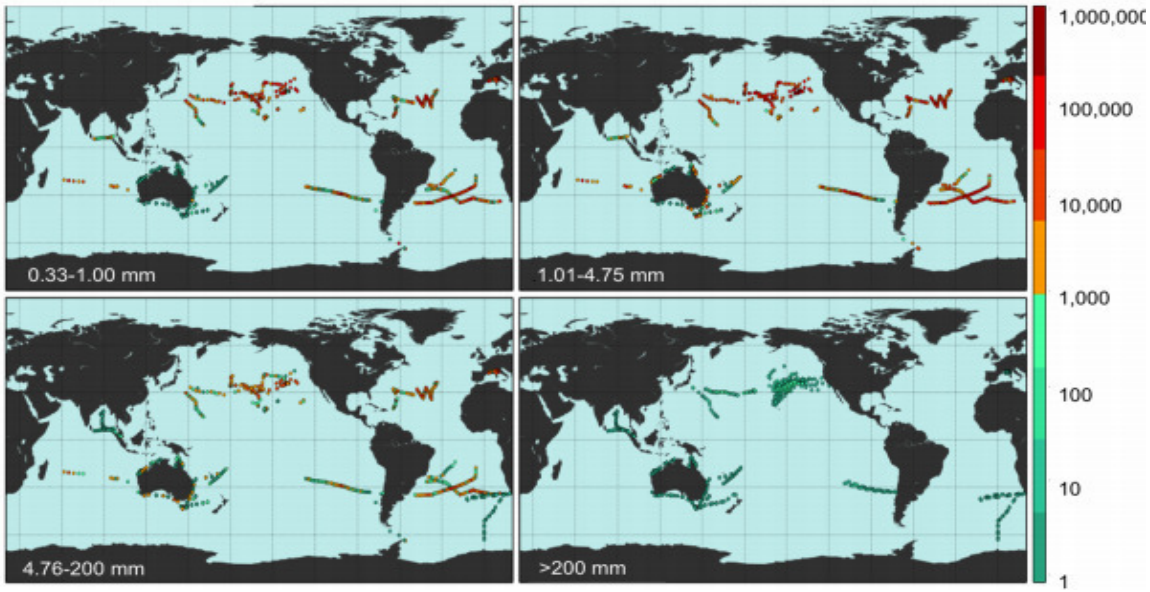
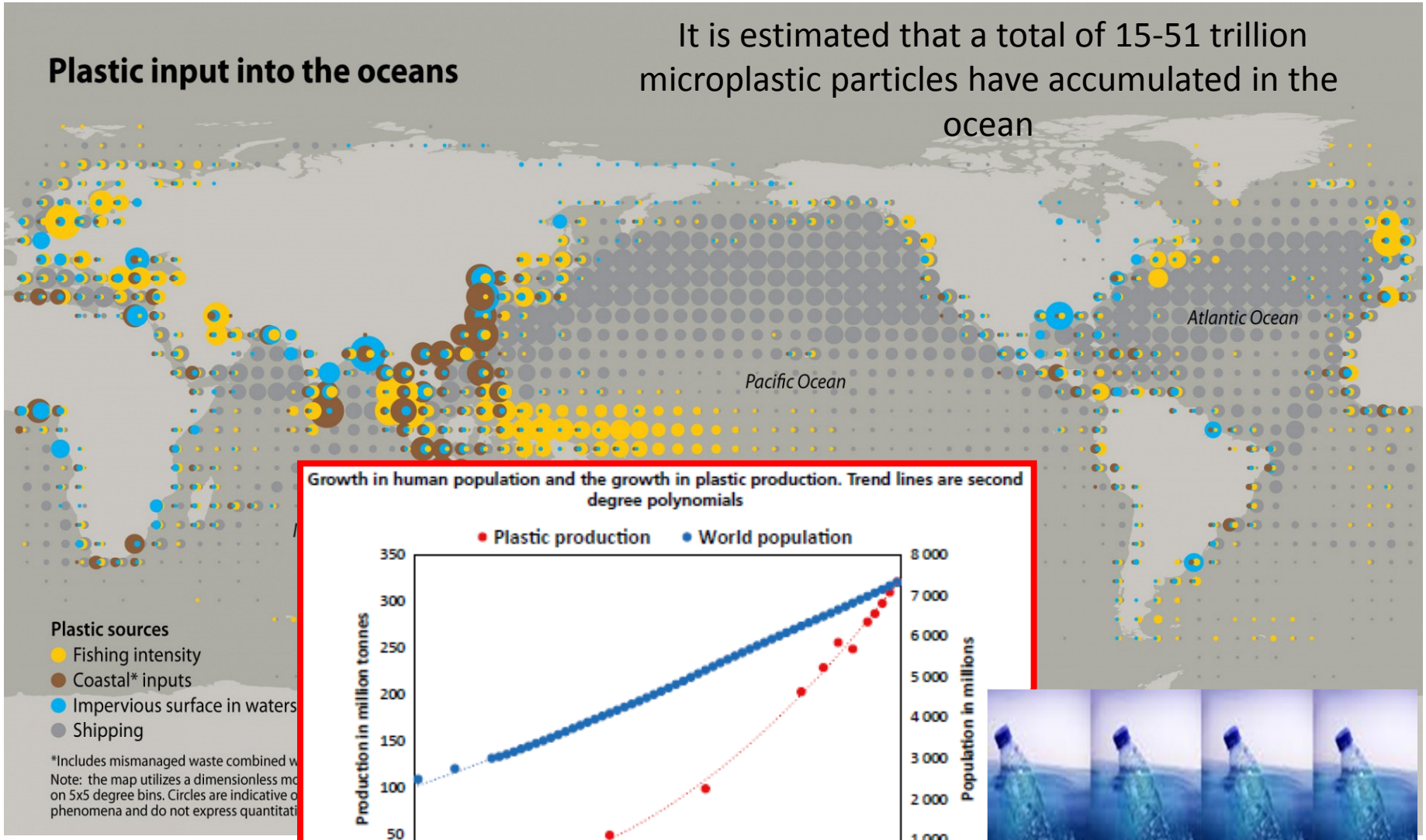


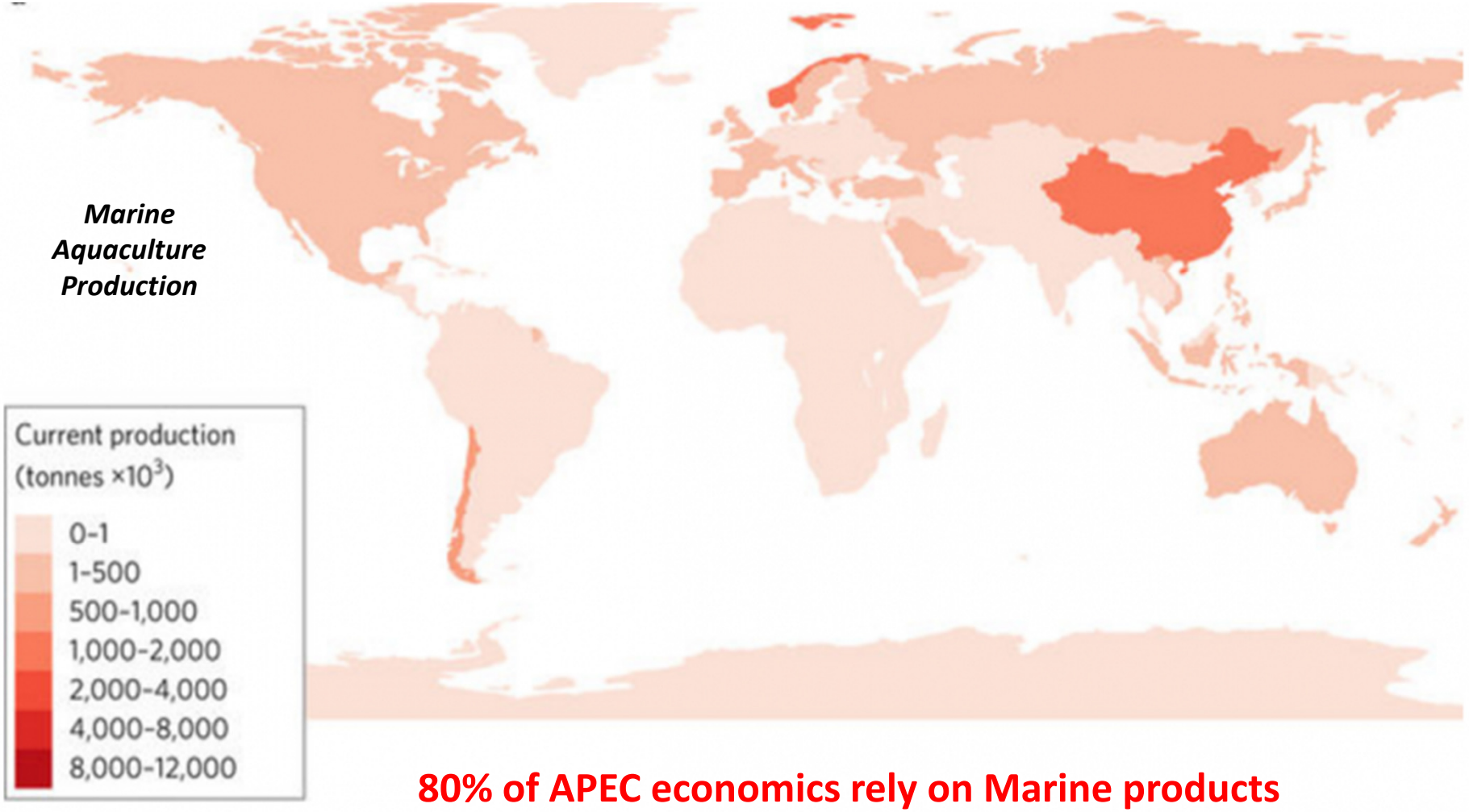
Figure 1. Field locations where count density was measured. Count density (pieces km^{-2}; see colorbar) of marine plastic debris measured at 1571 stations from 680 net tows and 891 visual survey transects for each of four plastic size classes (0.33–1.00 mm, 1.01–4.75 mm, 4.76–200 mm, and >200 mm).

Microplastics is a multidisciplinary global issue



Why do we need to investigate micro and nanoplastics in APEC economies?

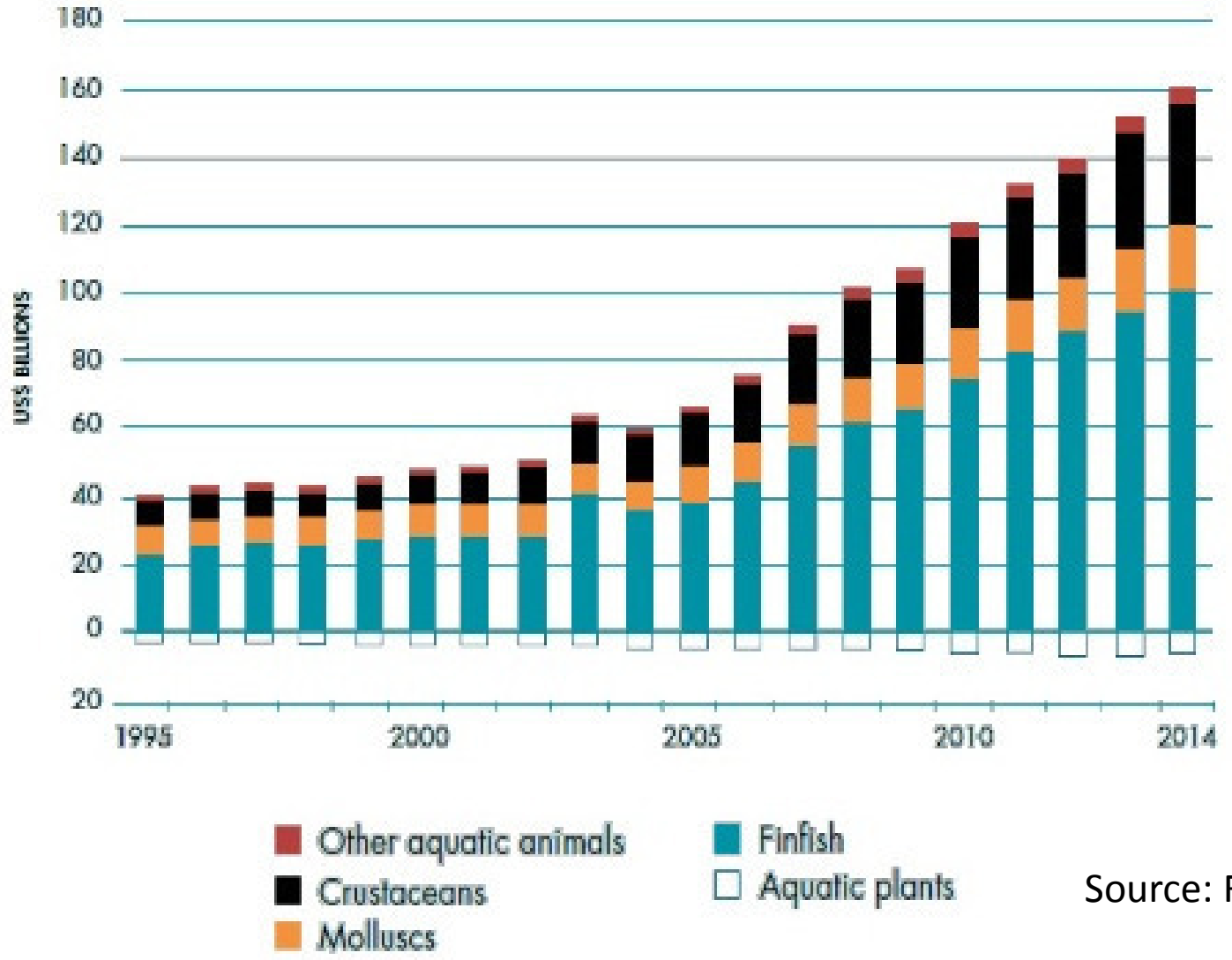
Asia-Pacific Economic Cooperation (APEC) is a forum for 21 Pacific Rim member economies that promotes free trade throughout the **Asia-Pacific** region.



80% of APEC economics rely on Marine products

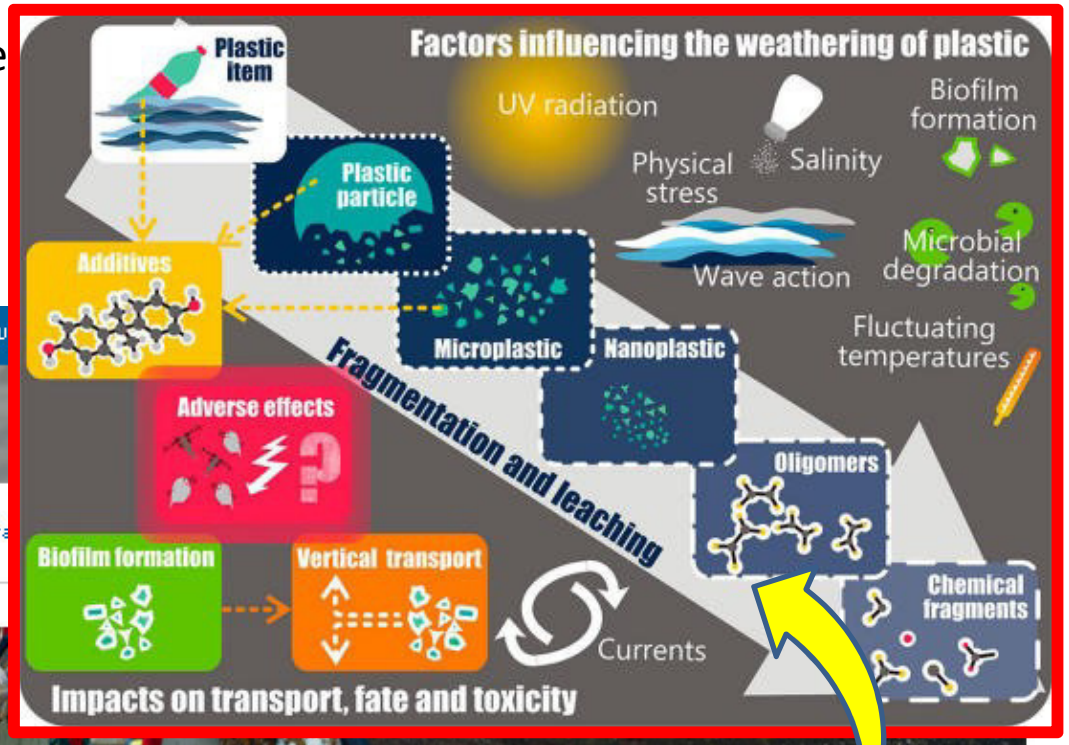
Why do we need to investigate micro and nanoplastics in APEC economies?

World Aquacuture Production Value



Source: FAO, 2016

APEC released on May 10th in 2016 the news: APEC combats Marine debris to secure ecosystems trade



Asia-Pacific Economic Cooperation

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Issued by the APEC Oceans and Fisheries Working Group

Home > News > News Releases > 2016 > APEC Combats Marine Debris to Secure Ecosystems, Tra

NEWS

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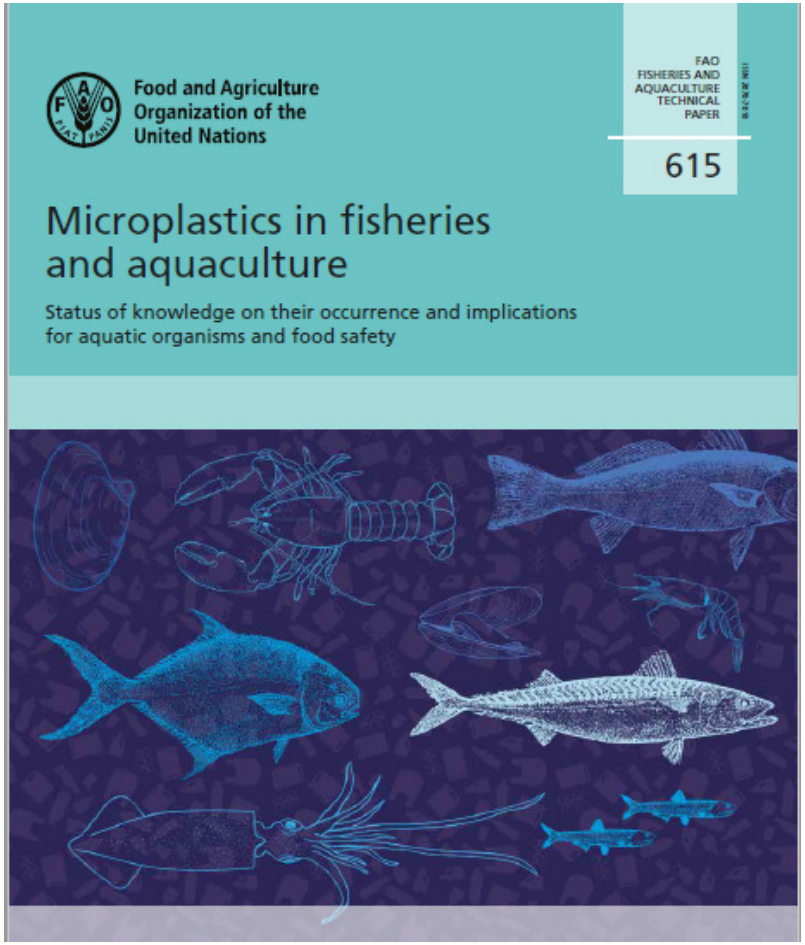
Next steps!!!!!
Micro
⇩
Nanoplastics

Oceans and fisheries officials from the 21 APEC member economies are mounting an expansive effort to fight the costly accumulation of man-made debris in the Asia-Pacific's oceans and waterways. The aim is to enhance the sustainability of marine ecosystems critical to livelihoods and food security in the world's most populous region.

2 years of strategy!

International regulation framework/recomendations



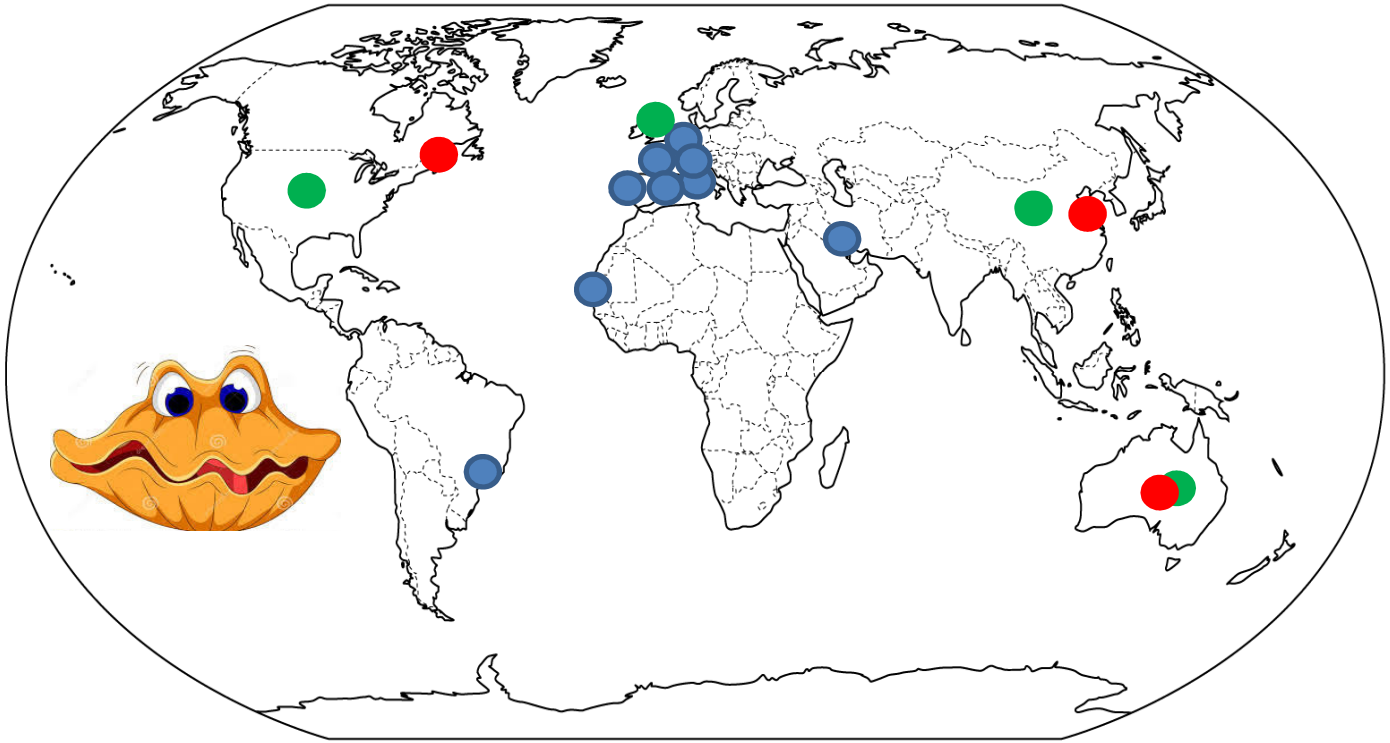
In humans the risk of microplastic ingestion is reduced by the removal of the gastrointestinal tract in most species of seafood consumed.

However, most species of bivalves and several species of small fish are consumed whole, which may lead to microplastic exposure (FAO, 2017).

Global survey of studies for Micro and nanoplastics in Bivalves

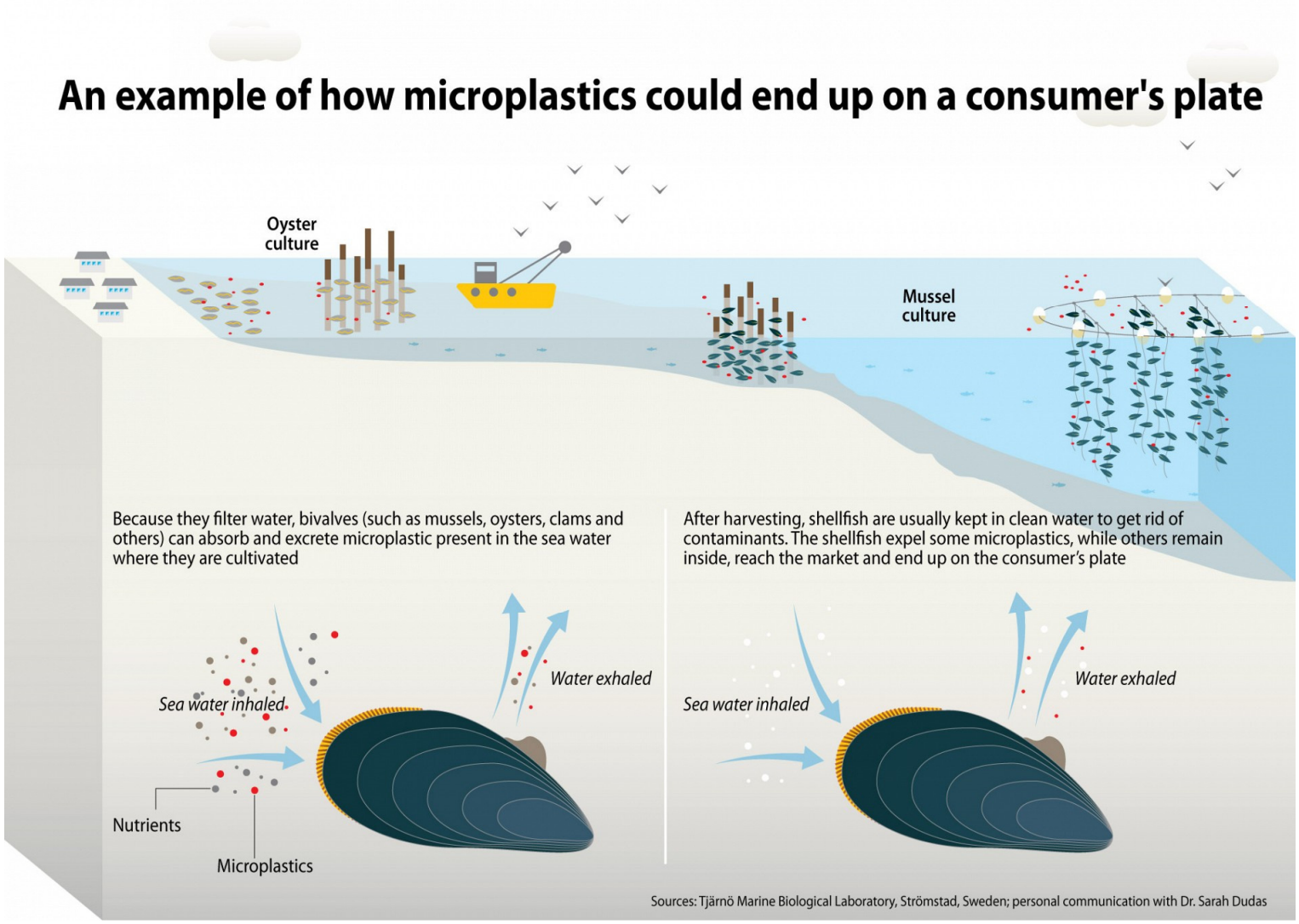
There is a lack of information in the APEC economies related to presence of micro and nanoplastics in the acquaculture sector.

In particular in Bivalves for human consumption…



APEC economies non-APEC economies Laboratory studies

Microplastic from ….. consumption



https://www.aquarium.co.za/blog/entry/plastic-free-july-the-facts-about-ocean-plastics

Environmental Pollution 207 (2015) 190–195

Contents lists available at ScienceDirect

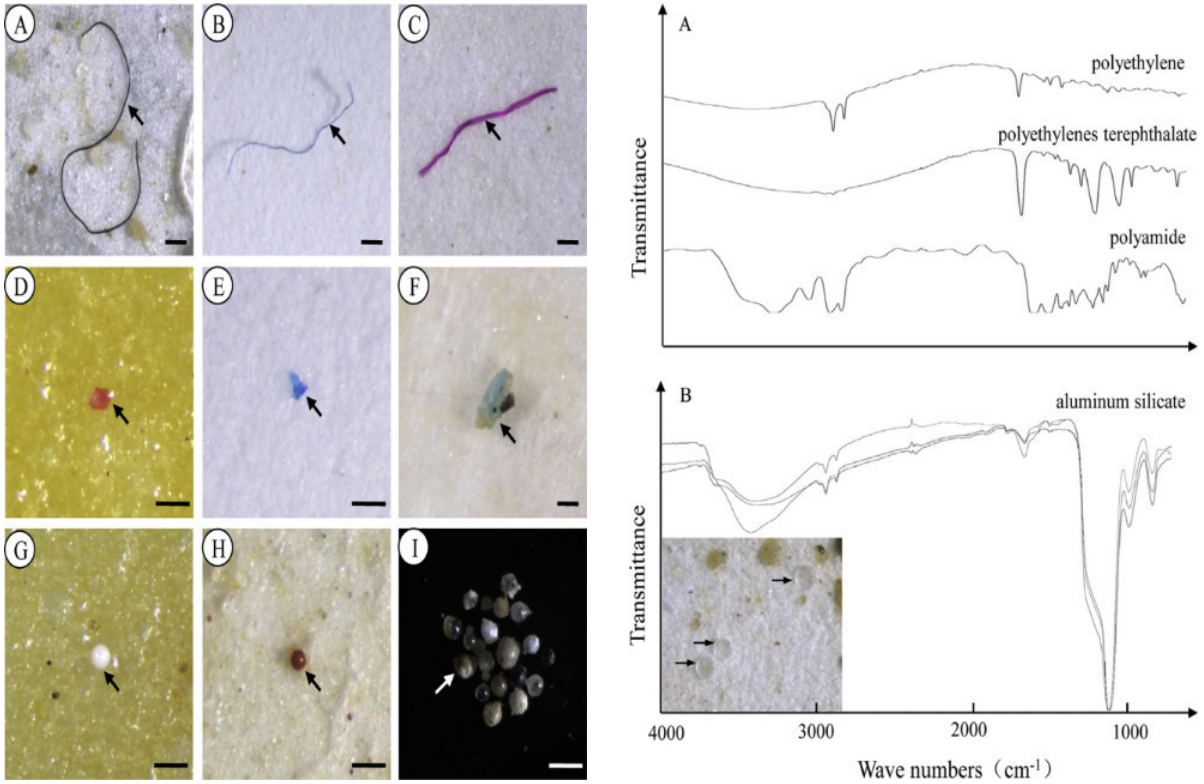
Environmental Pollution

journal homepage: www.elsevier.com/locate/envpol

Microplastics in commercial bivalves from China

Jiana Li [a], Dongqi Yang [a], Lan Li [b], Khalida Jabeen [a], Huahong Shi [a, *]

[a] State Key Laboratory of Estuarine and Coastal Research, East China Normal University, Shanghai 200062, China
[b] Research Center for Analysis and Measurement, Donghua University, Shanghai 201620, China



Identification of microplastics with micro-Fourier Transformed Infrared Spectroscope (m-FT-IR).

- Microplastic pollution in 9 commercial bivalves from a fishery market in China.
- Multiple types of microplastics, including fibers, fragments and pellets, occurred in the tissue of all bivalves.
- The number of total microplastics varied from **2.1 to 10.5 items/g** and from **4.3 to 57.2 items/individual** for bivalves.

The Antarctic Polar Front, large plastic debris named macroplastics (> 1 cm) have been reported in the Southern Ocean since the 1980s and, more recently, south of the Antarctic Convergence (South Georgia Islands). Currently, there is a lack of information concerning smaller debris as micro- (< 5 mm) and nanoplastics (< 1 µm) resulting from weathering and fragmentation processes.

SCIENTIFIC REPORTS

OPEN

Episodic records of jellyfish ingestion of plastic items reveal a novel pathway for trophic transference of marine litter

Received: 24 October 2017
Accepted: 22 March 2018
Published online: 17 April 2018

A. Macali[1], A. Semenov[2], V. Venuti[3], V. Crupi[3], F. D'Amico[4], B. Rossi[4], I. Corsi[5] &

Ecotoxicology and Environmental Safety 145 (2017) 557–563

Contents lists available at ScienceDirect

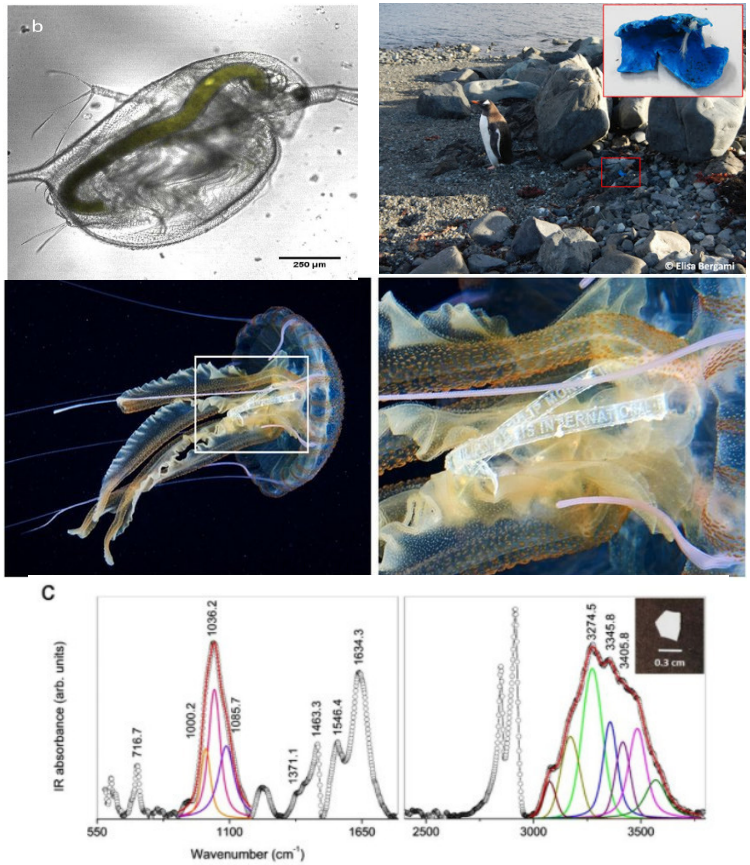
Ecotoxicology and Environmental Safety

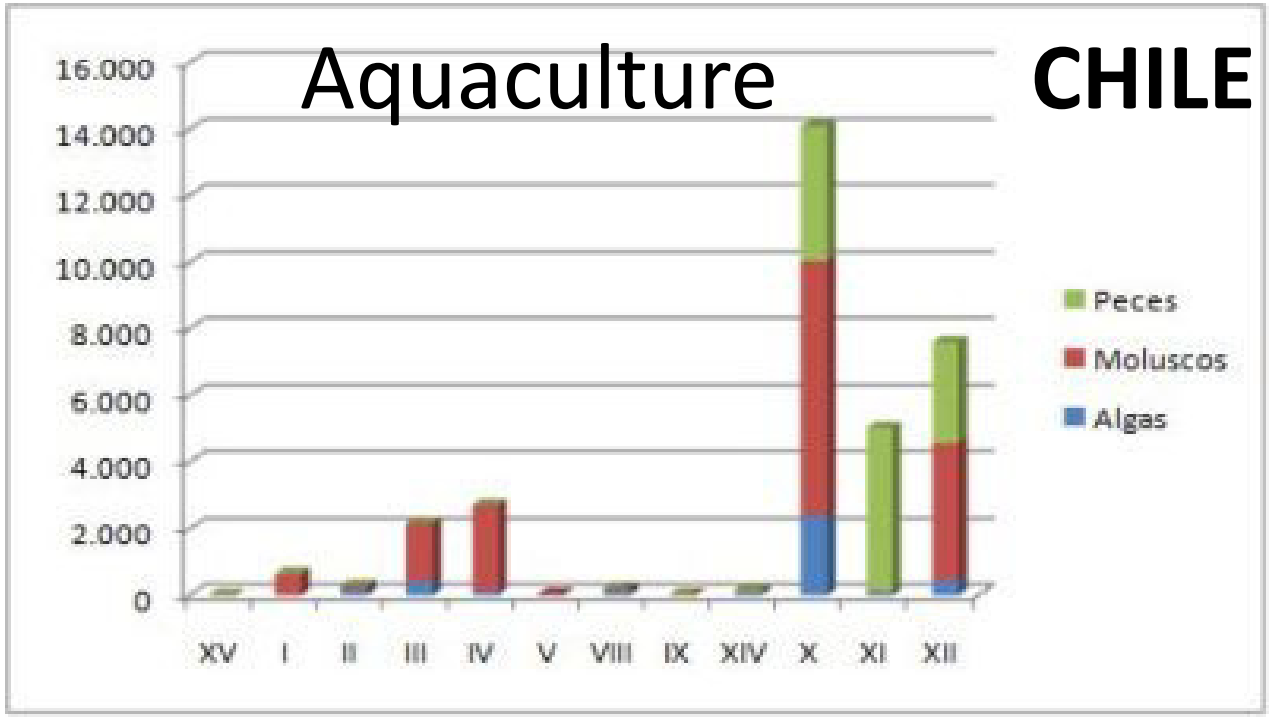
journal homepage: www.elsevier.com/locate/ecoenv

Comparative ecotoxicity of polystyrene nanoparticles in natural seawater and reconstituted seawater using the rotifer *Brachionus plicatilis*

L. Manfra[a,b,*], A. Rotini[c], E. Bergami[d], G. Grassi[d], C. Faleri[e], I. Corsi[d]

[a] Institute for Environmental Protection and Research (ISPRA) Rome, Italy
[b] Department of Biology and Evolution of Marine Organisms, Stazione Zoologica Anton Dohrn Naples, Italy
[c] Department of Biology, University Tor Vergata, Rome, Italy
[d] Department of Physical, Earth and Environmental Sciences, University of Siena, Italy
[e] Department of Life Sciences, University of Siena, Italy

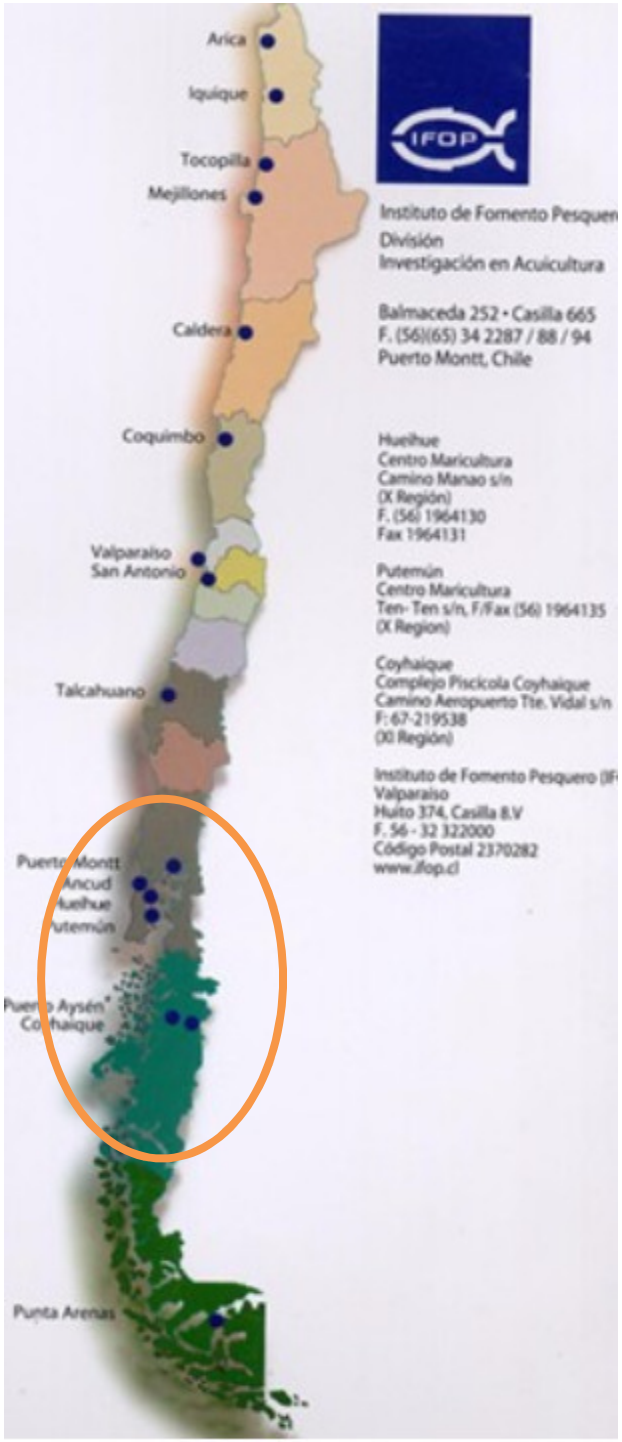




- Chile is the eighth country with the highest sales in the aquaculture sector worldwide and represents 1.6% of total production.

- In the regions of Los Lagos and Aysén, **97%** of the country's aquaculture centers are concentrated, which develop 10 species.

- Salmon is the protagonist because represents 70% of national sales in the sector.

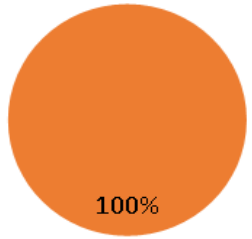


Fondecyt proyect (2016-2018): **Characterization of plastic debris and microplastics in the Concepción bay in biotic and abiotic matrices, Biobio Region.**

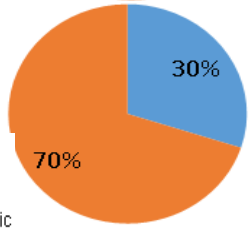
CHILE

Ocean Fishes

Trachurus murphy

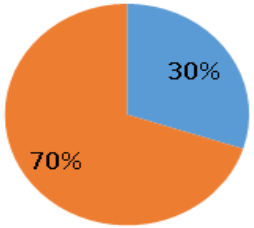


Sardinops sagax

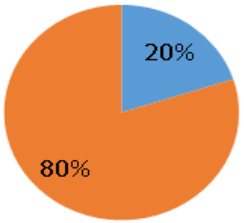


Coastal fishes

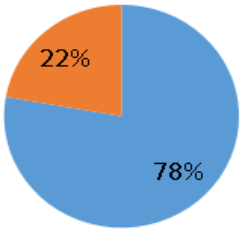
Eleginops maclovinus

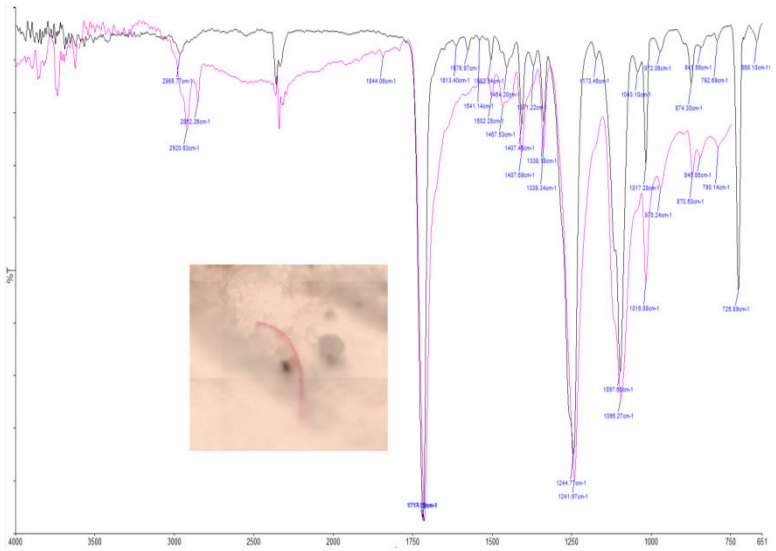


Aplodactylus punct

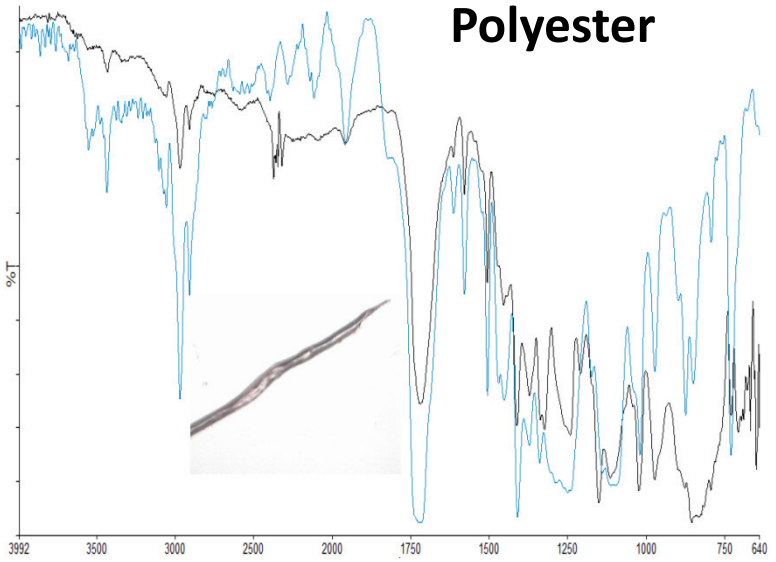


Basilichthys austro





Polyester



Micro- and Nanoplastic laboratory - USS

Faculty of Ingeneering and Technology (USS)

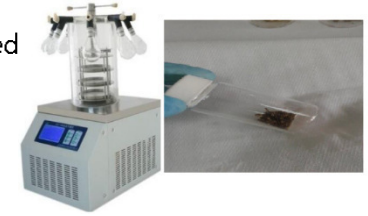
Biotic samples analysis

Gastrointestinal tissue

Step 1

Lyophilized

Step 2

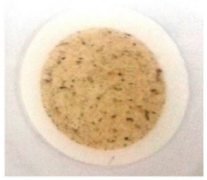


Enzymatic digestion with proteinase-k

Step 3

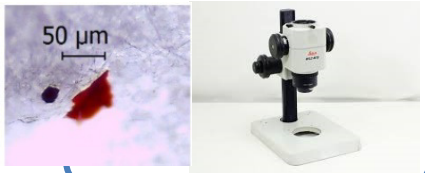
Step 4

Filter

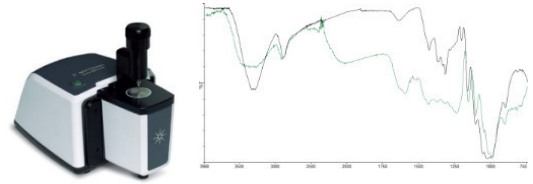


Microscope Analysis

Step 5



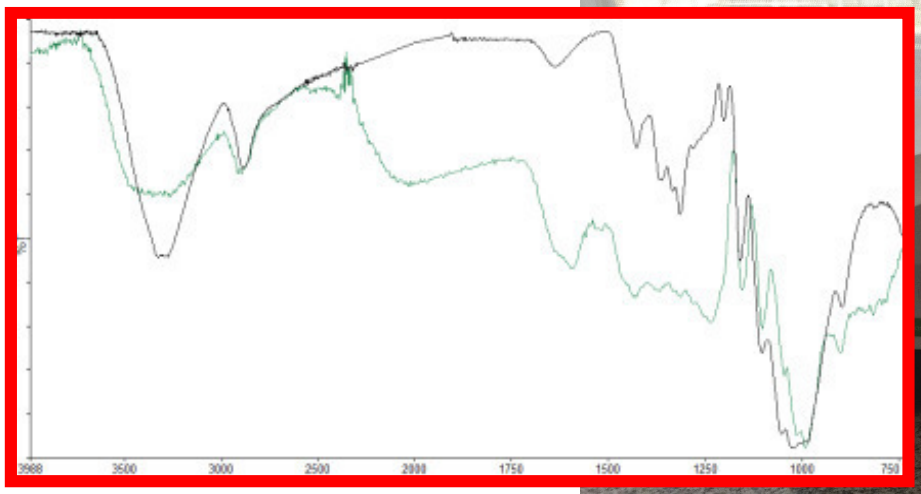
High resolution optical microscope

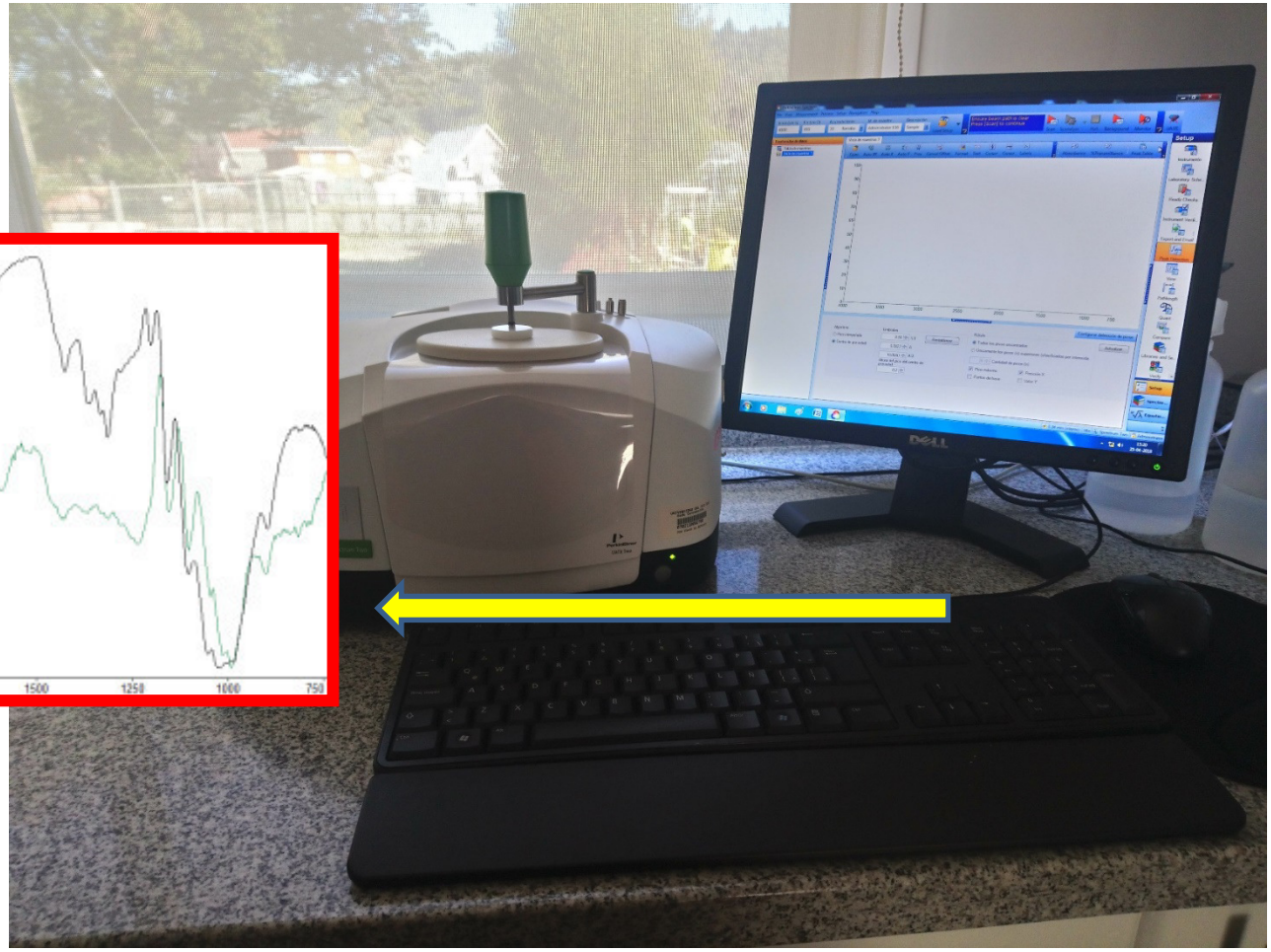


FT-IR ATR

FTIR (CIPA) – Analysis

Centro de Investigación de Polímeros Avanzados (Regional Government Project)





- Plastics

Pilot project for the analysis of microplastics in bivalves in Biobio region in central of Chile

SERNAPESCA
Ministerio de Economía, Fomento y Turismo
Gobierno de Chile

Servicio Nacional de Pesca
y Acuicultura

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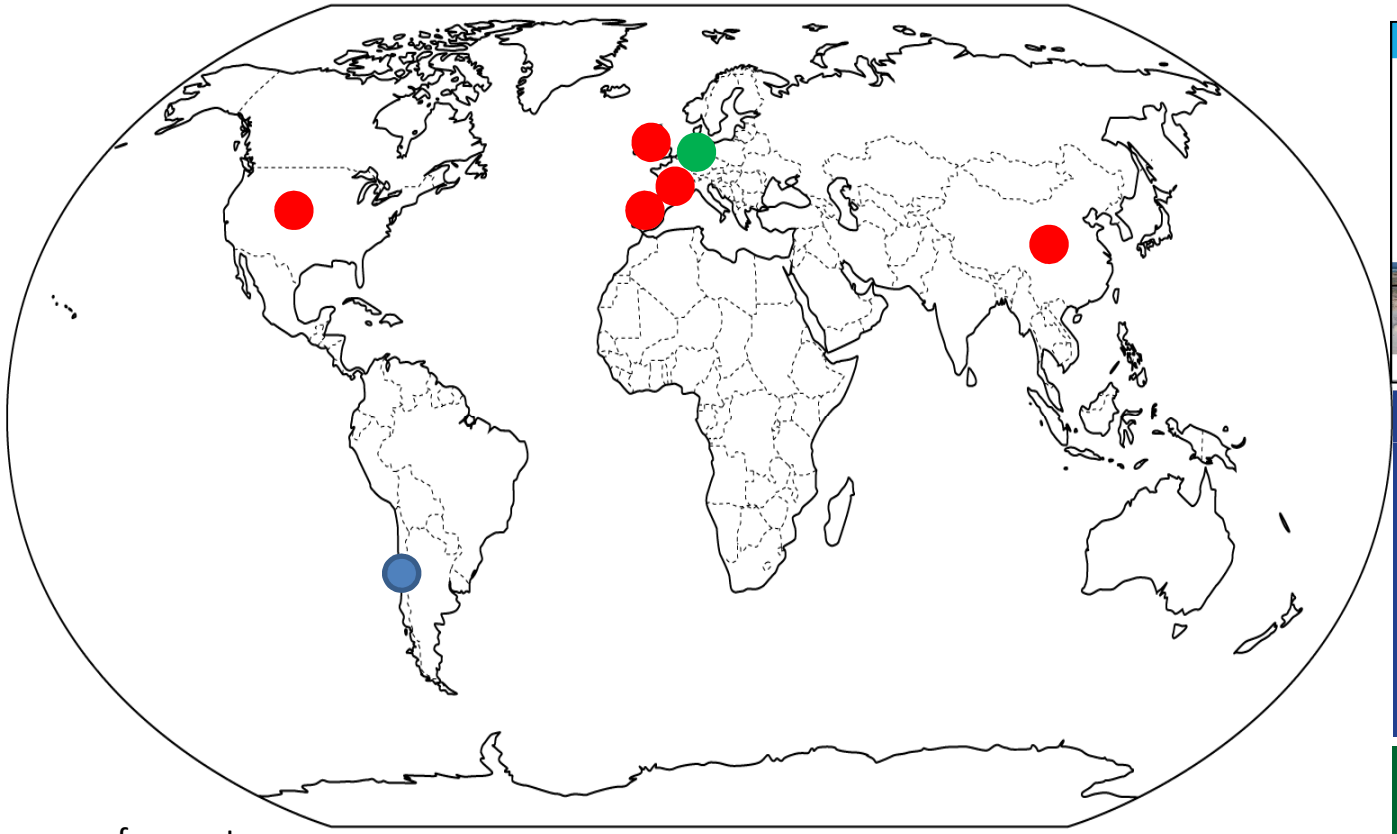
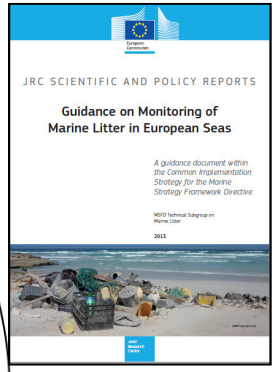
International regulations and recomendations

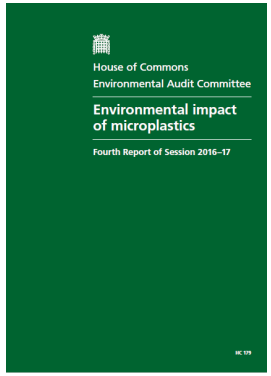


Law Law Project Report

GESAM: Joing group of experts on the scientific aspects of marine environmental protection

UNEP: United nations environmental program





International recomendations as proposed by:

Action-orientated recommendations:

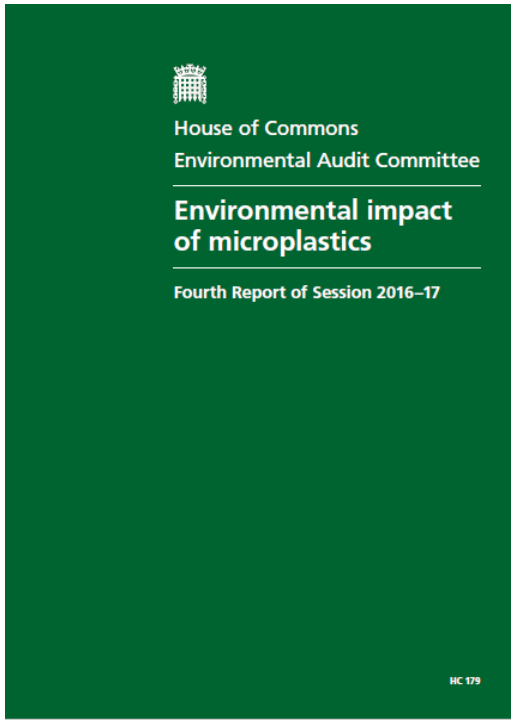
- Identify the main sources and categories of plastics and microplastics entering the ocean.

- Utilize end-of-plastic as a valuable resource rather than a waste product.

Recommendations for improving a future assessment:

- Include particles in the nano-size range.
- Evaluate the potential significance of plastics and microplastics as a vector for organisms.
- Address the chemical risk posed by ingested microplastics in greater detail.

The guidance document should support EU Member States in **implementing harmonized monitoring programmes for marine litter**. Dealing with a topic under development through research efforts and by fast growing experience this guidance should be regarded as a living document and be reviewed regularly.



Microbeads are a transnational source of pollution and there are advantages to dealing with it on an international basis. The Government has been considering a national ban and working towards an EU ban.

European Food Safety Authority

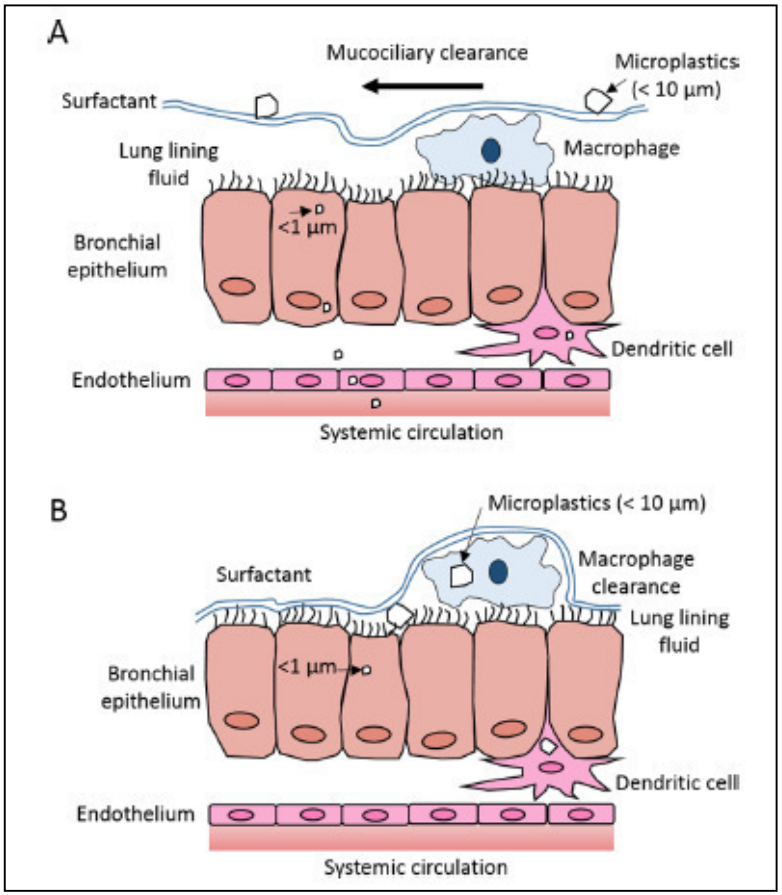
- EFSA has taken a first step towards a future assessment of the potential risks to consumers from microplastics and nanoplastics in food, especially seafood.
- EFSA to take stock of scientific developments in this area, identify data and knowledge gaps and recommend future research priorities to address them.
- EFSA 2016 also completed work on the presence of microplastics and nanoplastics in food, with a particular focus on seafood.
- EFSA estimated that a portion of mussels (225g) could contain 7 micrograms of microplastic.

How big are they?
EFSA defines microplastics as ranging in size from 0.1 to 5000 micrometres (µm), or 5 millimetres to give an idea. Nanoplastics measure from 0.001 to 0.1 µm (i.e. 1 to 100 nanometres).

What future scientific work is needed?

- The Panel's recommendations research should generate data on the occurrence of microplastics and especially nanoplastics in food, their fate in the gastrointestinal tract, and their toxicity.

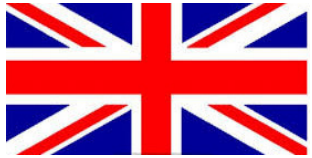
- Knowledge on the toxicity of nanoplastics is particularly needed because these particles may penetrate all kinds of tissues and eventually end up in cells. The Statement also proposes standardized analytical methods to help with monitoring.



Wright and Kelly, 2017; Chae et al., 2017

Ministry of Health, Welfare and Sports of Netherland

- The Ministry of Health, Welfare and Sports of Netherland conducted in 2015 a report towards a **definition of microplastics** in order to achieve a definition of microplastics to provide **building blocks to support a discussion on this topic**, as well as a definition to provide legal clarity and allows monitoring in microplastic contamination and transparent evaluation of the effects of policy measures.



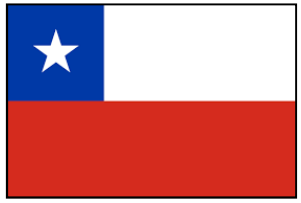
United Kingdom

- A ban on the manufacture of cosmetics and personal care products containing plastic microbeads comes into effect in the UK today.
- The ban was due to be implemented on January 1rst, according to a notification of the draft Regulation to the World Trade Organization (WTO) in July.
- Exfoliating scrubs, shower gels and toothpaste are among the products

Microbeads are a transnational source of pollution and there are advantages to dealing with it on an international basis.

The Government has been considering a national ban and working towards an EU ban.

House of Commons,
Environmental Audit Committee



Chile

- In Chile, the motion regulating the use of disposable single-use plastics was approved unanimously, which discourages the use of plastic bags in coastal communities and empowers the rest of the municipalities to imitate the initiative.

The project must now be analyzed by the Chamber and progress has been made in that the start-up will be gradual, to avoid problems in the communes.

Acknowledgments

FONDECYT Project 1161673 (PI: Karla Pozo)

THANKS FOR YOUR ATTENTION

RECETOX, Research Centre for Toxic Compounds in the Environment, Masaryk University, Brno, Czech Republic

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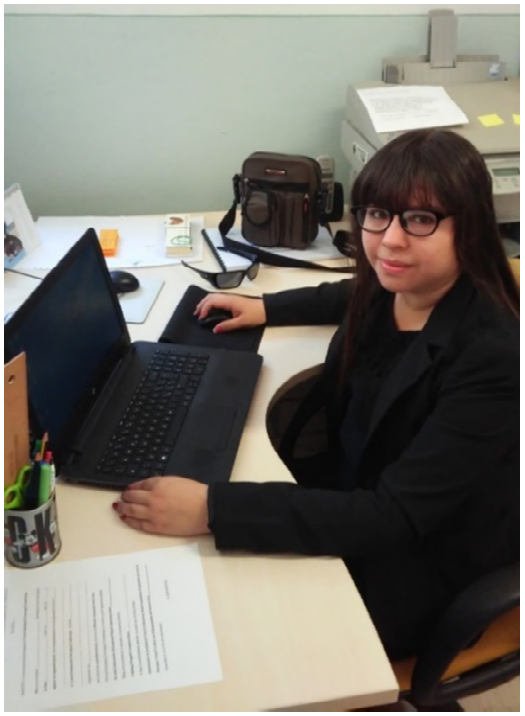

Biomaterials, and Innovation
(Best practices)

Research group:

- **Victoria Gómez Aburto (PhD student)**
- **Mariett Torres (Msc.)**
- **Luciano vera (Msc.)**
- **William Urbina (Msc.)**

Faculty of Ingeneering and Technology (USS)