INSTITUTO ESPAÑOL DE OCEANOGRAFÍA

27 Noviembre, Facultade de Ciencias Ambientais, Ourense

# Un mar de plástico

Dr. Jesús Gago
Coordinador IEO trabajos basuras marinas


OCEANS of PLASTICS

http://oceansofplastics.campusdomar.gal/

# Algunos ejemplos

Bulgaria : river pollution blocking Vacha Dam, April 2009.
Source : AFP PHOTO / DIMITAR DILKOFF

Galicia : vertedero de Bens, Septiembre 1996.
Source : El mundo / El ideal gallego

# Algunos datos

-10 Millones de toneladas de basura cada año acaban en el mar.

-300 millones de toneladas de plásticos producidos en 2016.

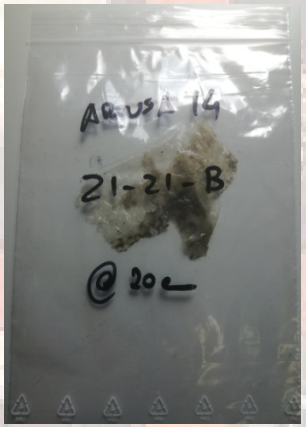
-268.940 toneladas de basura plástica flotando en los oceános.

-115 000 micropartículas/$km^2$ en el Mediterráneo.

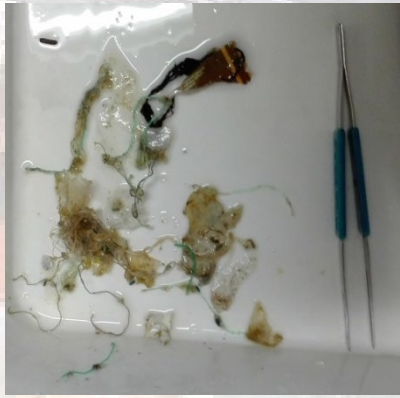
# ¿Dónde los encontramos?

En playas

En estómagos de peces




En sedimentos marinos



En agua superficial

# PLASTIC PARTICLES

SCIENCE
17 March 1972
Vol. 175, No. 4027
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

REPORTS

## Plastics on the Sargasso Sea Surface

Edward J. Carpenter[1], K. L. Smith Jr.[1]
+ See all authors and affiliations

Science 17 Mar 1972:
Vol. 175, Issue 4027, pp. 1240-1241
DOI: 10.1126/science.175.4027.1240


BREVIA

# Lost at Sea: Where Is All the Plastic?

Richard C. Thompson[1,*], Ylva Olsen[1], Richard P. Mitchell[1], Anthony Davis[1], Steven J. Rowland[1], Anthony W. G. John[2], Daniel McGonigle[3], Andrea E. Russell[3]

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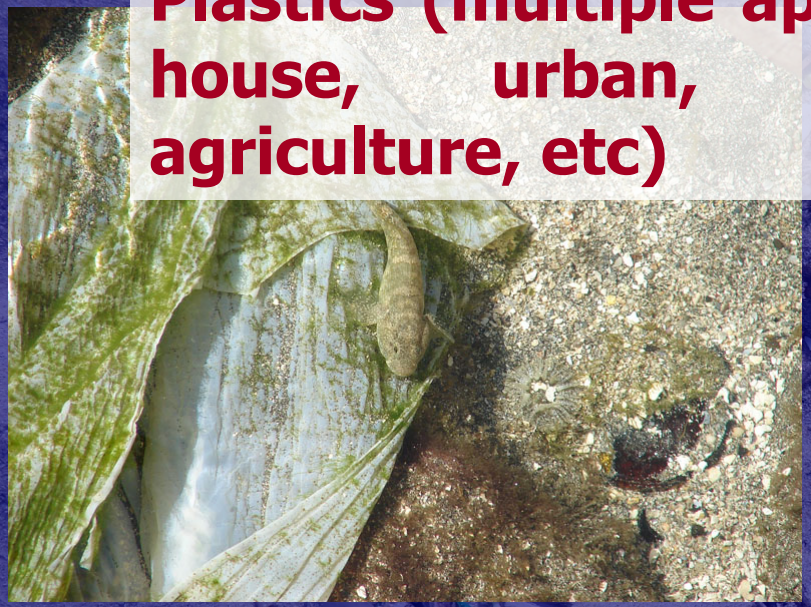
– Hide authors and affiliations

Science 07 May 2004:
Vol. 304, Issue 5672, pp. 838
DOI: 10.1126/science.1094559

# Marine ecosystems subjected to a massive input of synthetic chemicals (many anthropogenic activities: agriculture, industry, transport, urban and domestic applications, etc).

**Microplastics:** fragments of bigger ones and actual uses in cosmetic, domestic products, etc…

**Plastics (multiple applications: house, urban, industrial, agriculture, etc)**



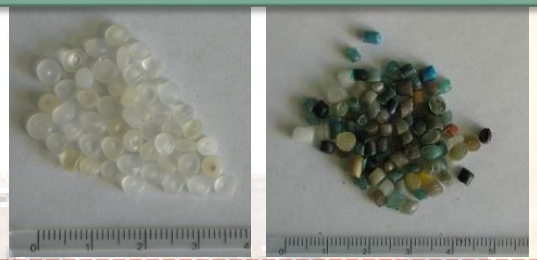
**Microplastics**

**Microspheres (cosmetics, adhesives, personal care products, etc)**

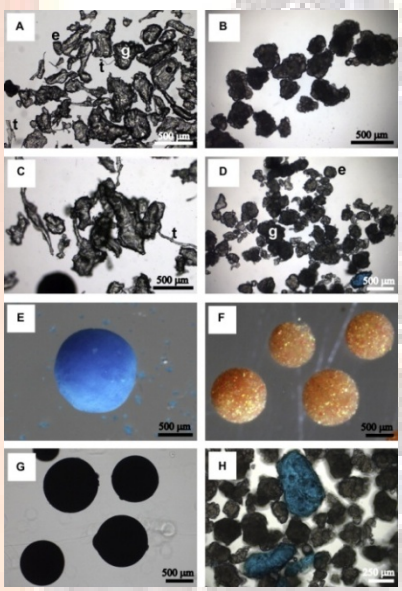
# Origen de los microplasticos

- **Microplasticos primarios**
  - Pre-produccion resin pellets
  - Plastic scrubbers en cosmeticos
  - Plastic abrasives en blasting
  - Otros nano- y micro-polimeros

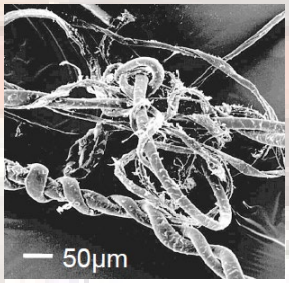
Resin pellets



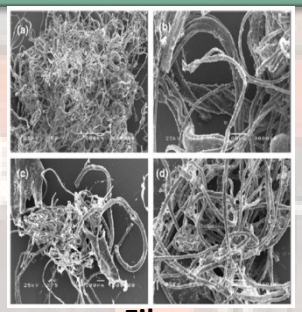
PE scrubs (Fendall and Sewell, 2009)



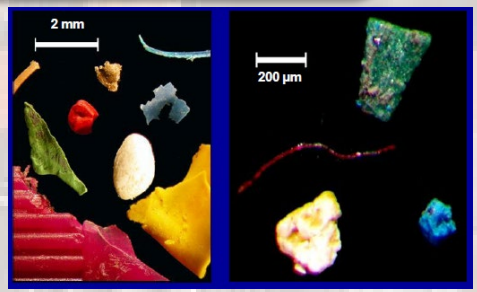

- **Microplasticos secundarios**
  - Fragmentos, fibras, elastomeros y recubrimientos de polimeros grandes



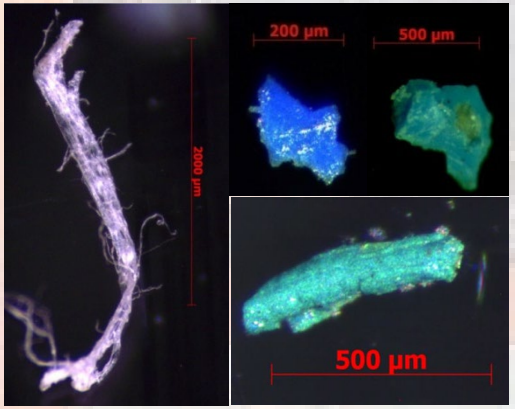

Fiber
(Thompson et al, 2004)



Fiber
(Murray and Cowie, 2011)




Sewage sludge
(Zubris & Richards, 2005)




Fragment

a global assessment

# Microplastics in the ocean

microplastic fragments from a beach near Busan, Republic of Korea © Peter Kershaw

Small pieces of plastic, commonly referred to as microplastics, were first described in the early 1970s and are widespread in the ocean.

## Sources, fate & effects

Larger items made of plastic, such as bags, rope and fishing nets, can have obvious direct impacts on marine life and society. But the effects of microplastics are more difficult to quantify.

Microplastic fragments from the western North Atlantic, collected using a towed plankton net © Giora Proskurowski, SEA

GESAMP
Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection

**7,600,000**
microplastics (2.5mm diameter)

**7.6 x $10^{21}$**
nanoplastics (250nm diameter)

EPS buoys and floating debris © J.H. Lee, OSEAN; EPS microplastics © Peter Kershaw


# OCEANS OF PLASTICS

## IMPACTO MACROPLÁSTICOS

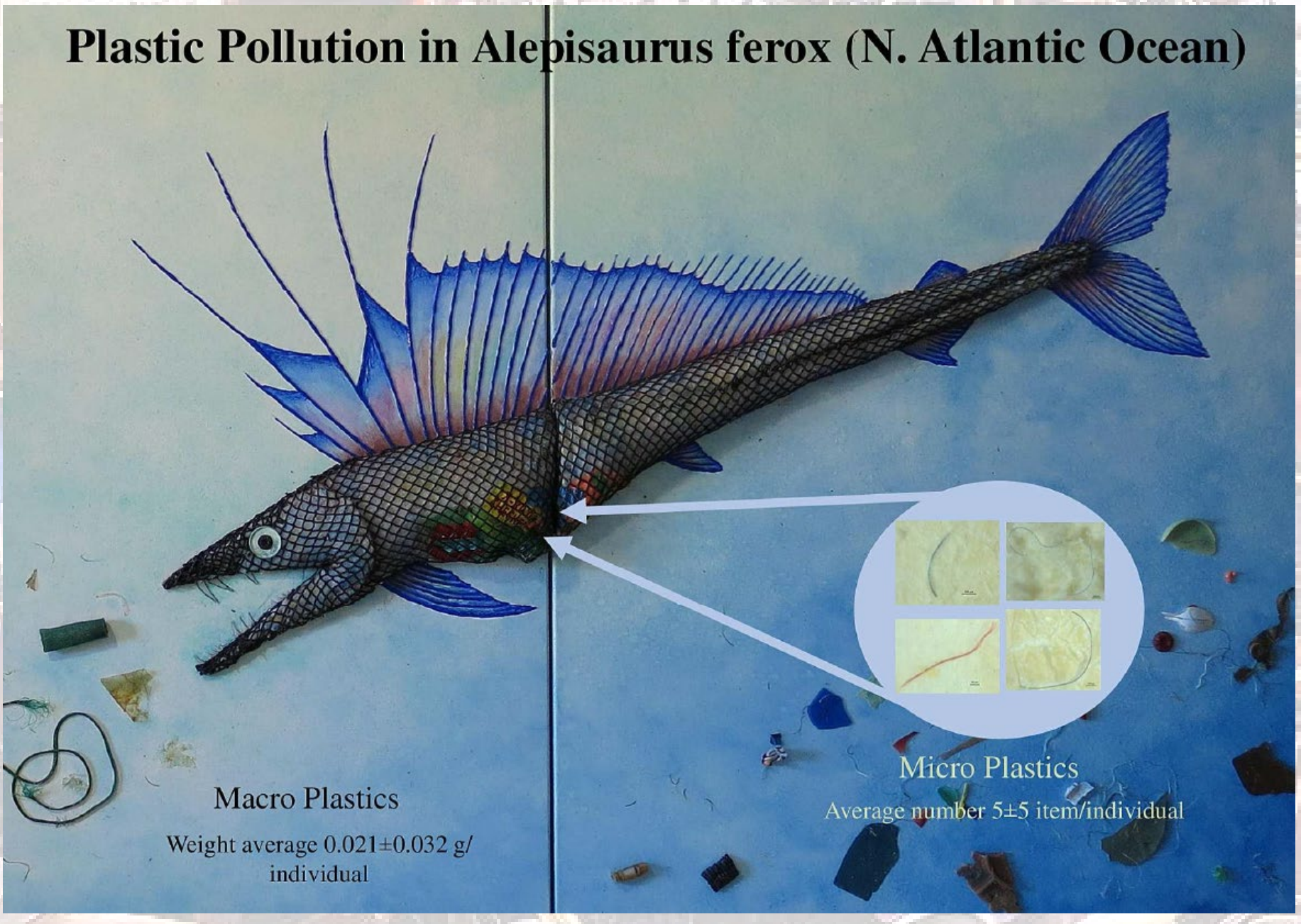
Los plásticos, cuando llegan al mar, tardan mucho en degradarse, o no se degradan. Debido a la mala gestión de estos residuos, unos **8 millones de toneladas de plásticos acaban en los mares y océanos cada año**.

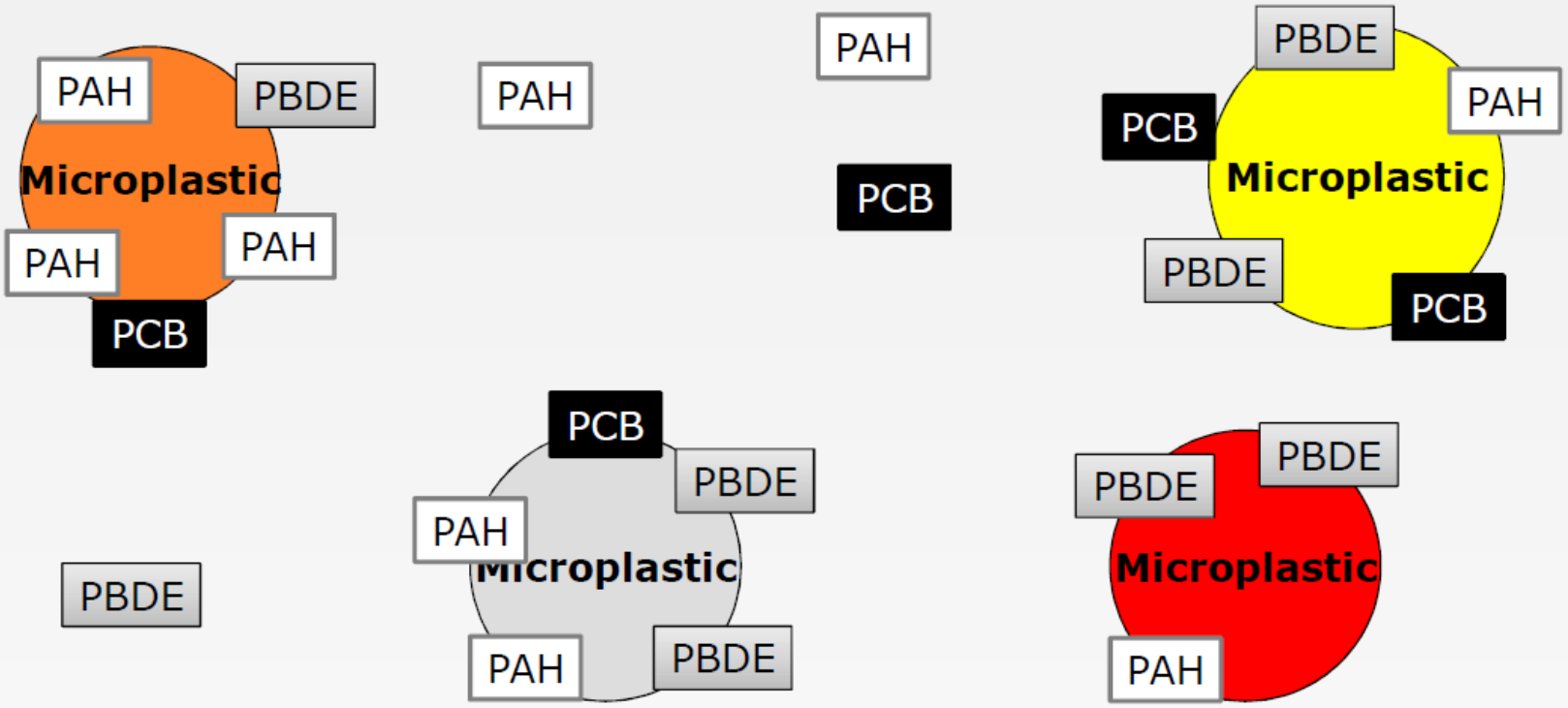
Llamamos **plásticos macroscópicos** a aquellos visibles y apreciables, con un tamaño **mayor a los 5 mm de diámetro**. El impacto que pueden producir sobre los organismos marinos es muy grave.

Los impactos principales son:

- **Enmalle**
- **Estrangulamiento**
- **Asfixia**
- **Ingestión**
- **Bioacumulación de sustancias químicas asociadas**
- **Transporte de especies invasoras**
- **Degradación de hábitats**
- **Impactos económicos**

CAMPUS DO MAR
GOBIERNO DE ESPAÑA MINISTERIO DE ECONOMÍA, INDUSTRIA Y COMPETITIVIDAD
FECYT FUNDACIÓN ESPAÑOLA PARA LA CIENCIA Y LA TECNOLOGÍA
Con la colaboración de la Fundación Española para la Ciencia y la Tecnología - Ministerio de Economía, Industria y Competitividad

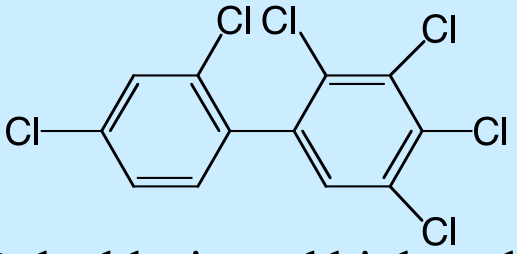

Plastic Pollution in Alepisaurus ferox (N. Atlantic Ocean)
Macro Plastics
Weight average 0.021±0.032 g/ individual
Micro Plastics
Average number 5±5 item/individual



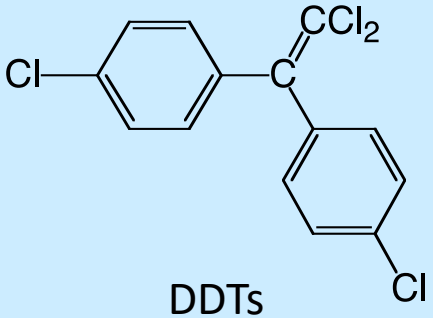

Microplastics act as vectors for pollutants to marine animals

# Los Plasticos transportan dos tipos de sustancias en el mar

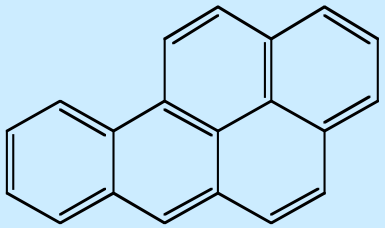
## Sustancias adsorbidas del agua de mar




Polychlorinated biphenyl (PCBs)

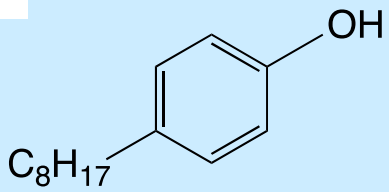



DDTs

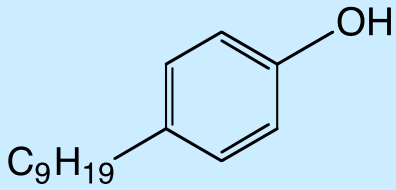


Polycyclic aromatic hydrocarbons (PAHs)

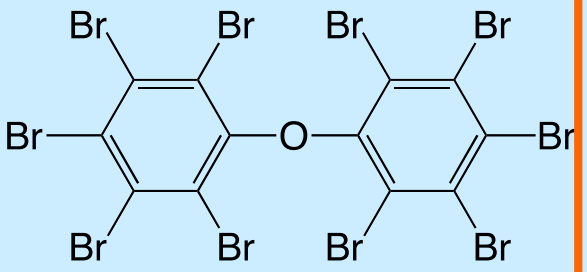
## Aditivos químicos



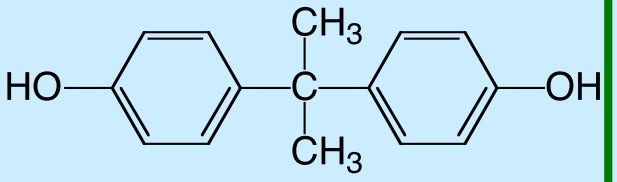

Octylphenol




Nonylphenol



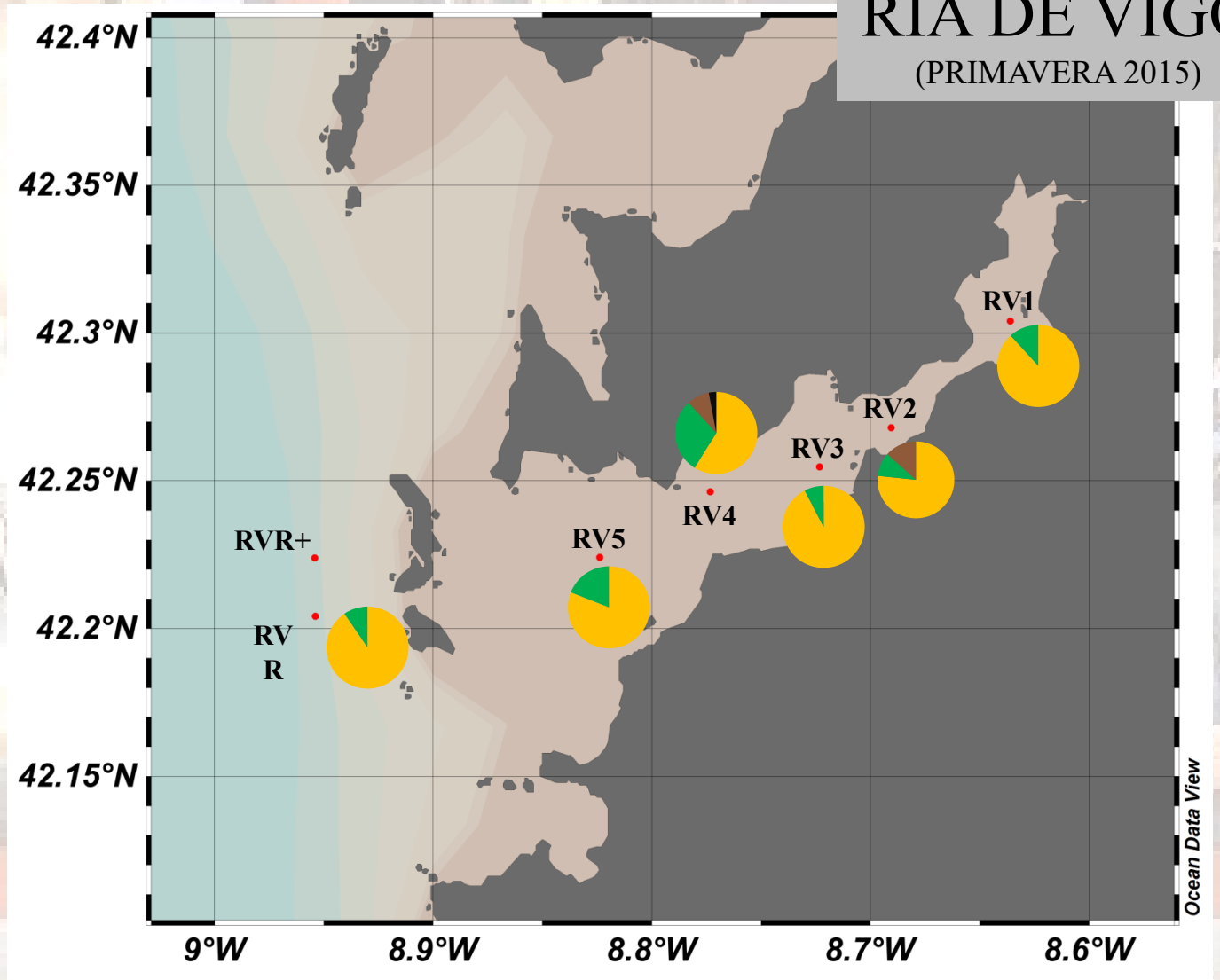

Polybrominated diphenyl ethers (PBDEs)




Bisphenol A

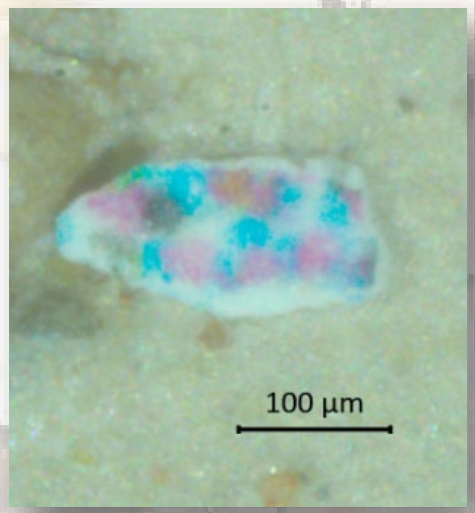
# RÍA DE VIGO

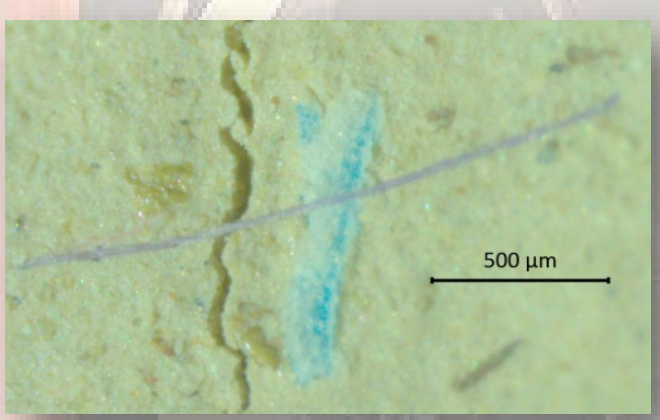
(PRIMAVERA 2015)

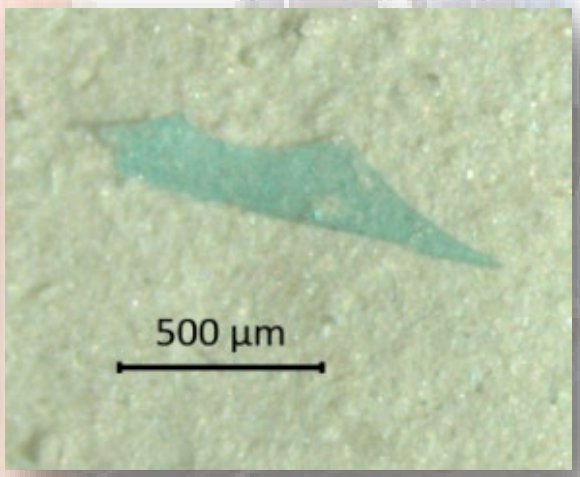


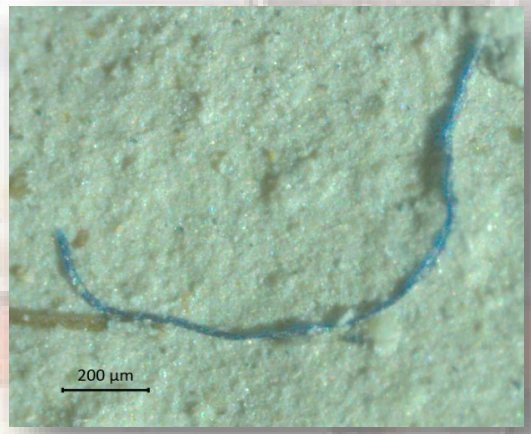

Fibra Fragmento Pellet Film

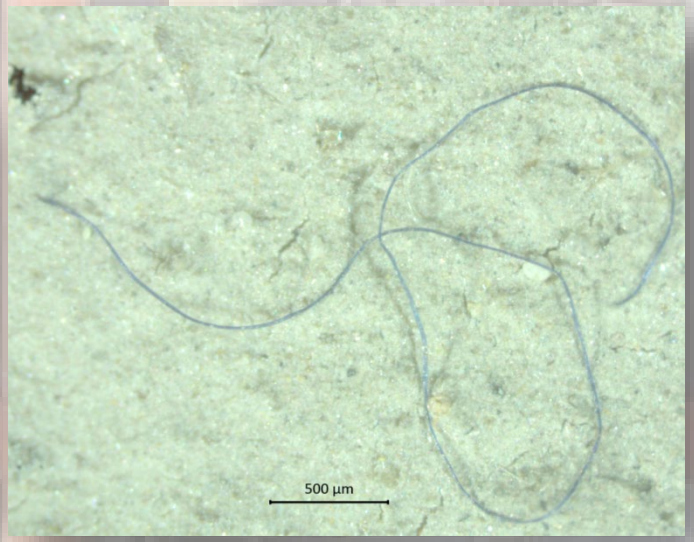
# MPs ría de Vigo (proyecto IMPACTA)

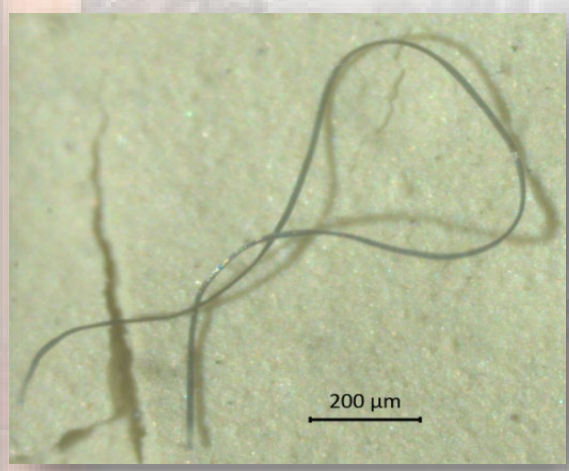


# CleanAtlantic

## Tackling marine litter in the Atlantic Area

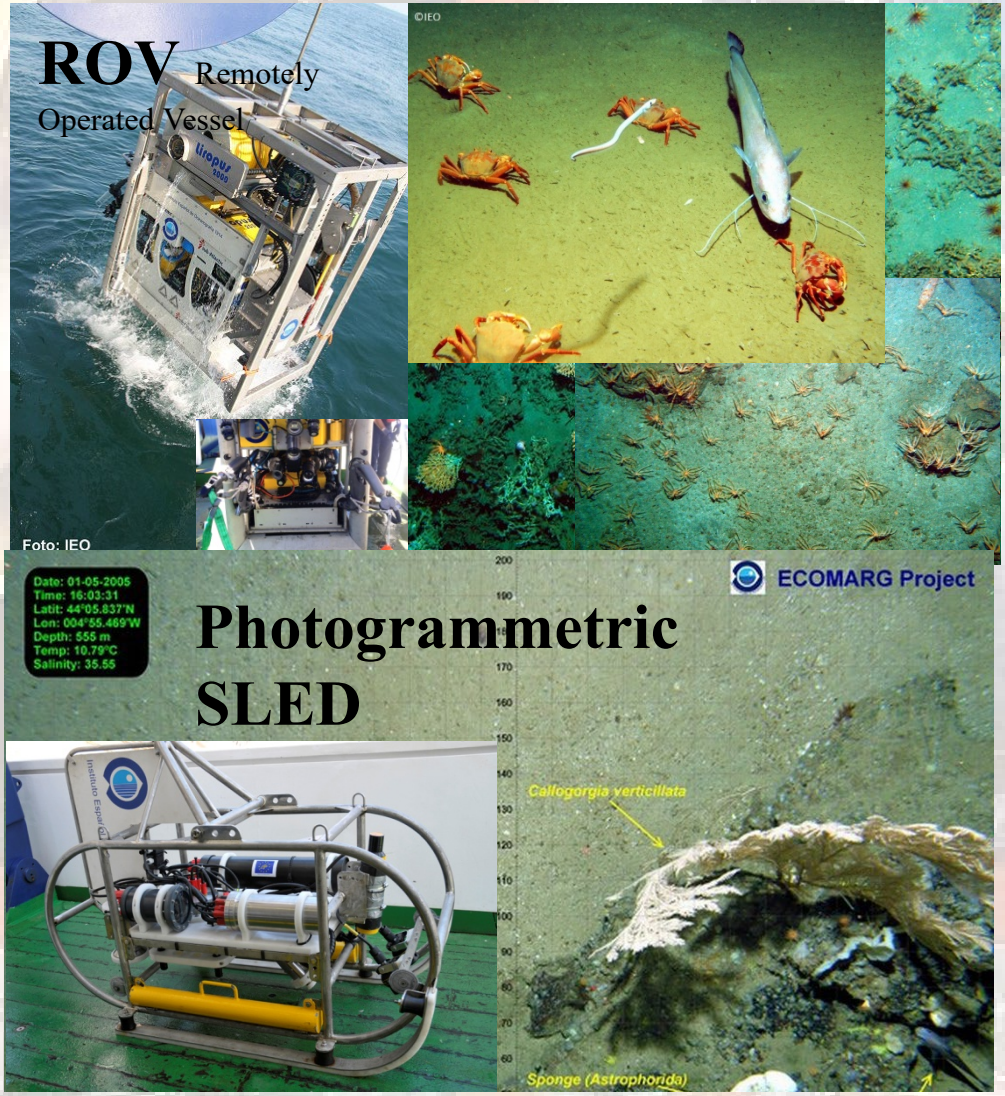
## CLEANATLANTIC: Nuevos métodos y tecnologías de monitorización de basuras marinas

Dr J. Gago-IEO

GOBIERNO DE ESPAÑA
MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD
IEO
Interreg
Atlantic Area
European Regional Development Fund

## ROV and Photogrammametric SLED

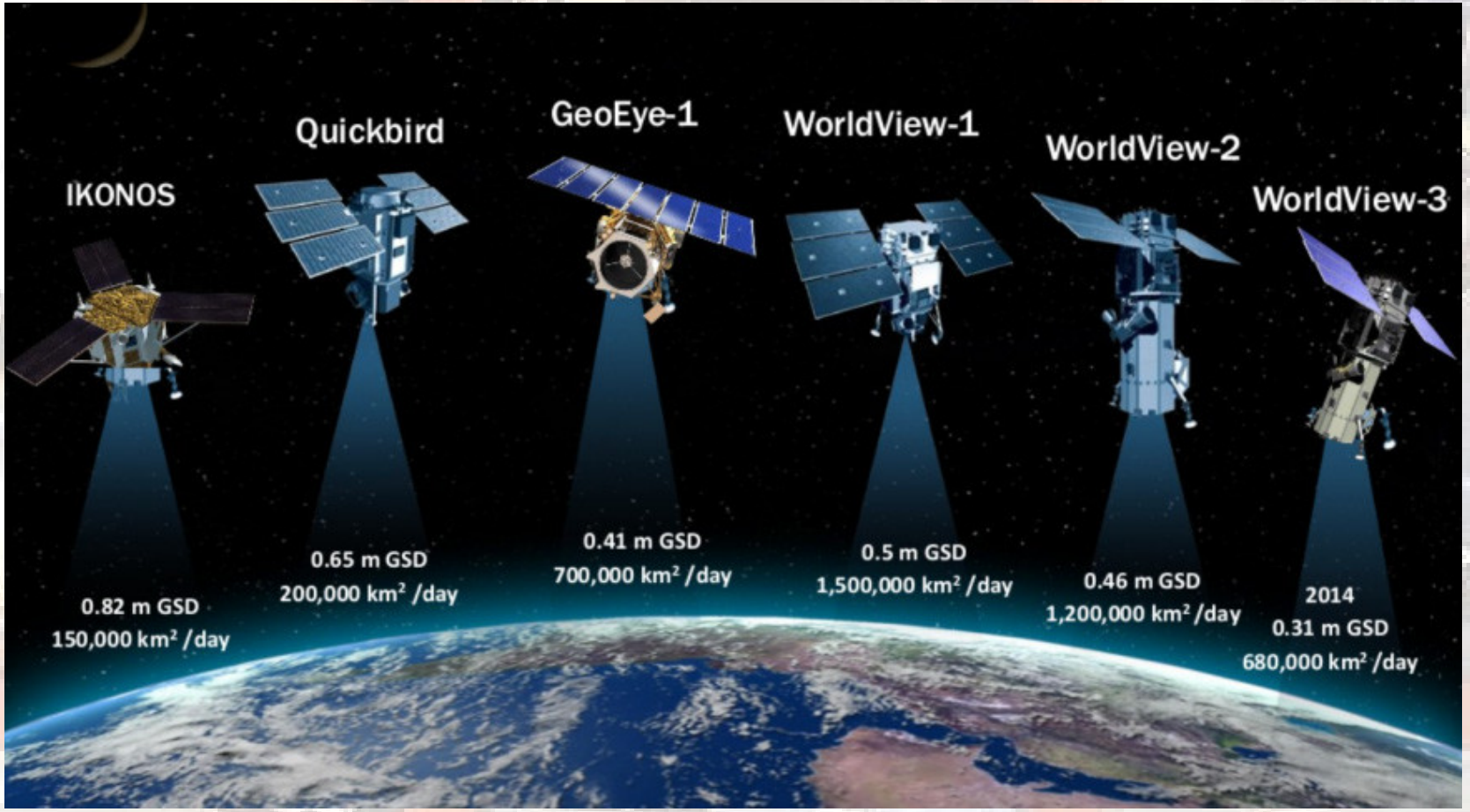
- To revisit the databases to monitoring sea bed litter.
- Data processing and analysis.
- Comparison with other sea bed litter sampling methods.



**Satellites**

- CEFAS: Assessing the feasibility of open-source (Sentinel 1 and 2, possibly high-resolution data from SSGP) and commercial (WorldView-3) satellite data in automated identification of polymers in coastal areas and sea surface.
- Plan:
  - Identifying areas where plastic litter/litter covers at least 10x10m and that could be identified on satellite data (experiment set up in Mytilene- Greece; static areas- landfills-> Eden domes; Thilafushi in Maldives).
  - Analysis: Testing spectral signatures of different cover types- comparing them to the spectral signatures of plastic litter.

**Satellites (commercial satellite DigitalBlobe)**

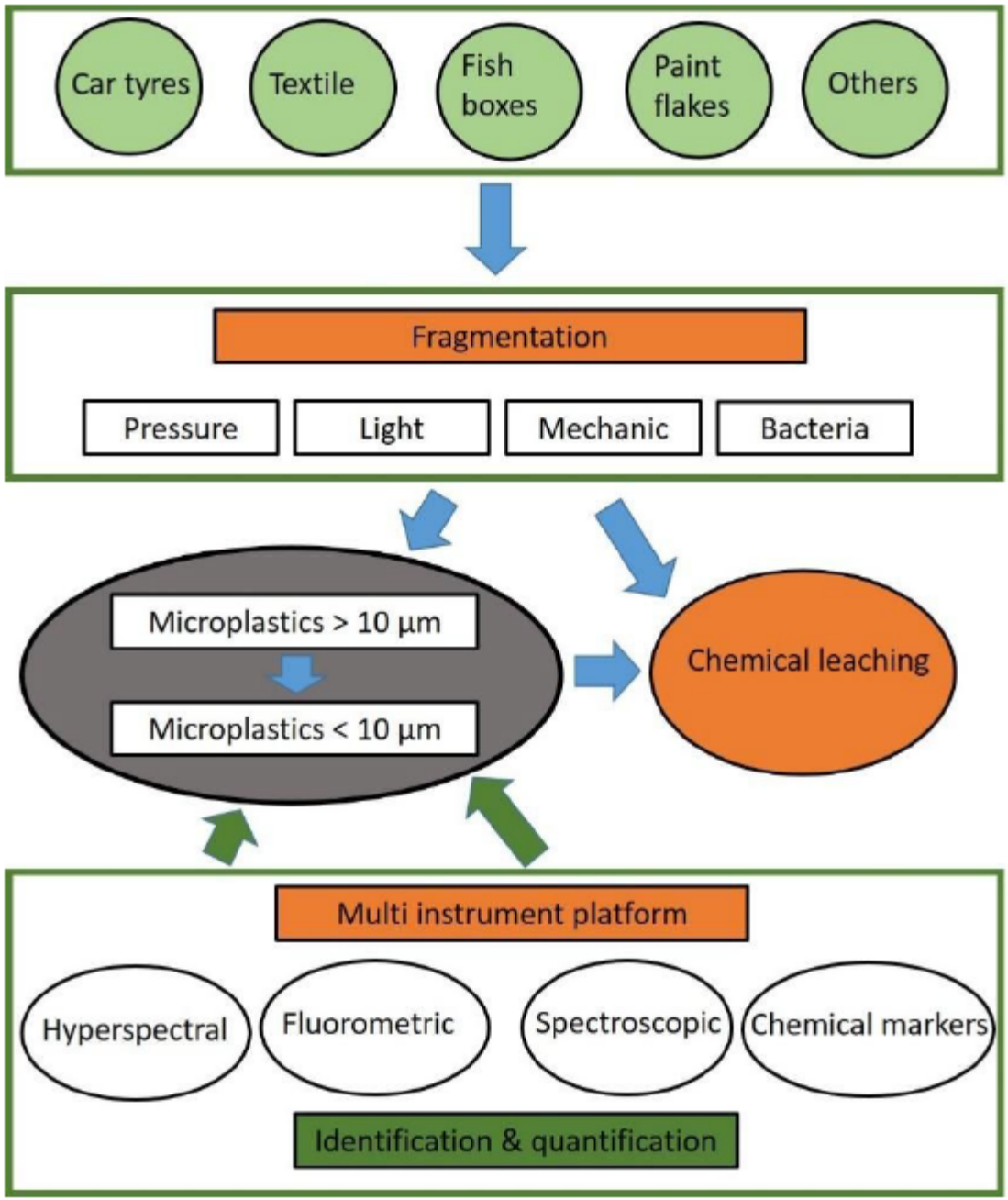


**Lineas prioritarias de investigación**,

-Desarrollo y optimización de metodologías.

-Modelado; cuantificación e impacto.

-Ecotoxicología.


Car tyres
Textile
Fish boxes
Paint flakes
Others
Fragmentation
Pressure
Light
Mechanic
Bacteria
Microplastics > 10 µm
Microplastics < 10 µm
Chemical leaching
Multi instrument platform
Hyperspectral
Fluorometric
Spectroscopic
Chemical markers
Identification & quantification

# Calibration of a marine floating litter transport model

Diego Pereiro[a], Carlos Souto[a] and Jesús Gago[b]

[a]Department of Applied Physics, Universidade de Vigo, Vigo, Spain; [b]Instituto Español de Oceanografía (IEO), Vigo, Spain

**ABSTRACT**

Predicting the transport of marine floating litter requires a detailed understanding of the processes involved in the dispersion of floating materials in the ocean. The restraining effect of a near-coastal boundary or shallow bottom topography may affect the drift response to local wind forcing. The aim of this work is to develop a particle-tracking model for the north-west Iberian waters that allows for spatial variations in the effect of winds on the transport of marine floating litter. Observational data from 23 drifters were used, in conjunction with wind and ocean current data from atmospheric and ocean models. The drifter locations were grouped into three separate zones based on the bathymetry and the orientation of the coastline. Response matrices for each of these areas were computed using a 2-D vector regression approach. The maximum drift response to local wind forcing is alongshore in inner shelf waters, whereas an isotropic drift response to winds is observed in outer shelf waters. The wind drag coefficient ranges from $0.5 \times 10^{-2}$ to $1.2 \times 10^{-2}$, depending both on the wind direction and the drifter position.

**ARTICLE HISTORY**
Received 3 November 2017
Accepted 23 April 2018

**KEYWORDS**
Marine floating litter; particle-tracking model; wind drag coefficient; north-west Iberia

# Dynamics of floating marine debris in the northern Iberian waters: A model approach

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[a] *Universidade de Vigo, Campus Universitario As Lagoas, Marcosende, s/n, 36310, Vigo, Spain*
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ARTICLE INFO

*Keywords:*
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Floating marine debris
Marine litter
North-West Iberia
ROMS

ABSTRACT

Floating marine debris is distributed worldwide through the oceans and poses a serious threat to marine ecosystems. Field data and model results show high concentrations of floating debris in the Bay of Biscay. In this work, the Regional Ocean Modelling System (ROMS), in conjunction with a particle-tracking model, has been used to study the distribution of floating debris in the northern Iberian waters.

Longer residence times were observed in the south-eastern Bay of Biscay, where the concentration of floating debris would be, on average, 2.1 times higher than in the north-western Iberian coastal waters, and 3.6 times higher when considering only the winter months. The analysis also suggests the existence of a seasonal influx of floating debris into the south-eastern Bay of Biscay, which would be greater during the winter. Both results - long residence time and influx of floating debris - support the hypothesis that the Bay of Biscay can be regarded as an accumulation zone of floating debris.

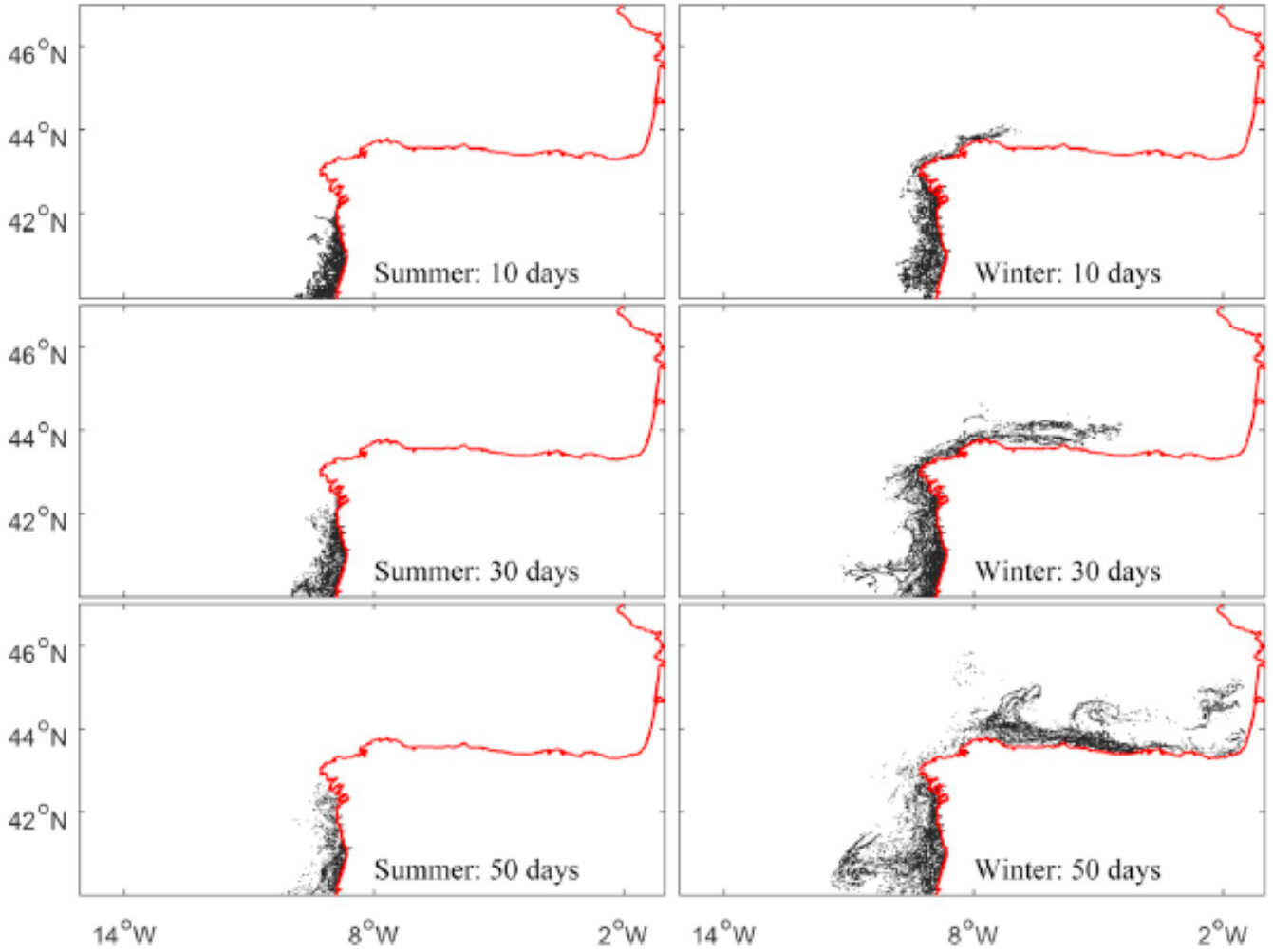
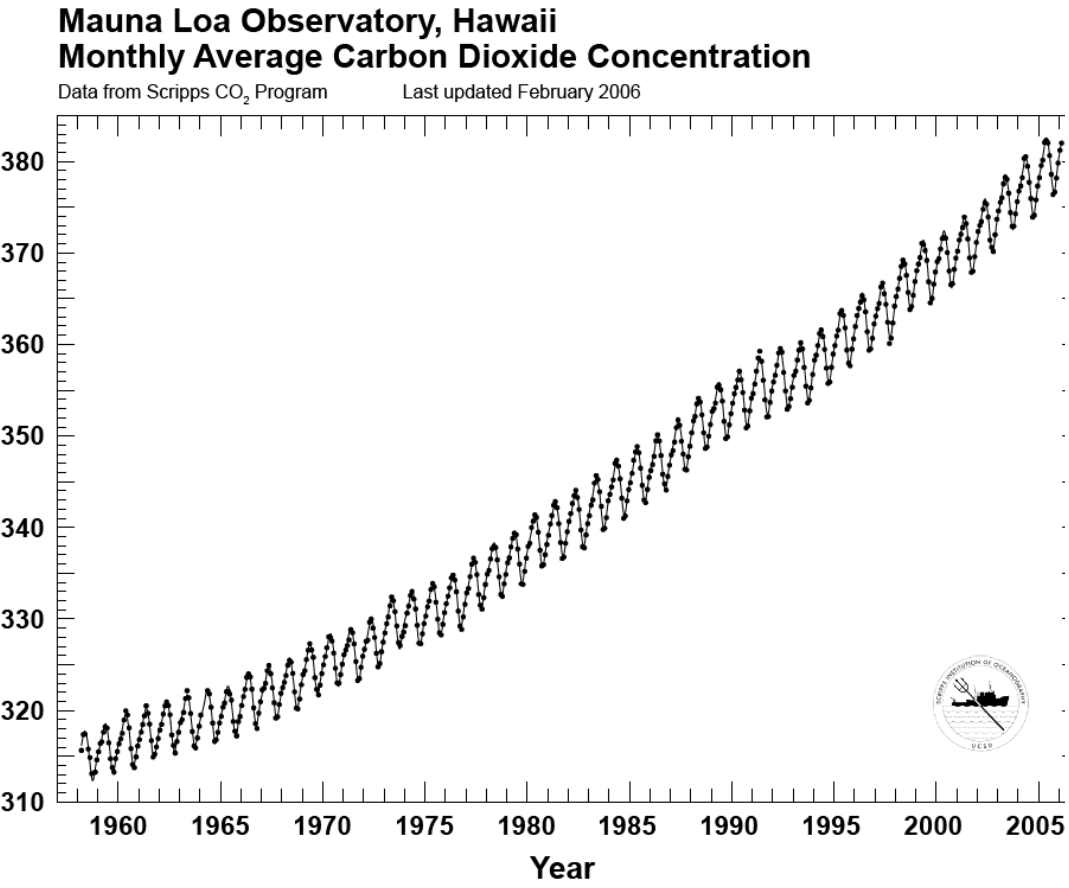



**Fig. 6.** Dispersion of numerical drifters released close to the Minho River estuary during summer (left) and winter (right). Dark grid cells have been reached by at least one numerical drifter. White color shows unaffected areas.

# Los microplásticos en el oceáno, un indicador de cambio global?



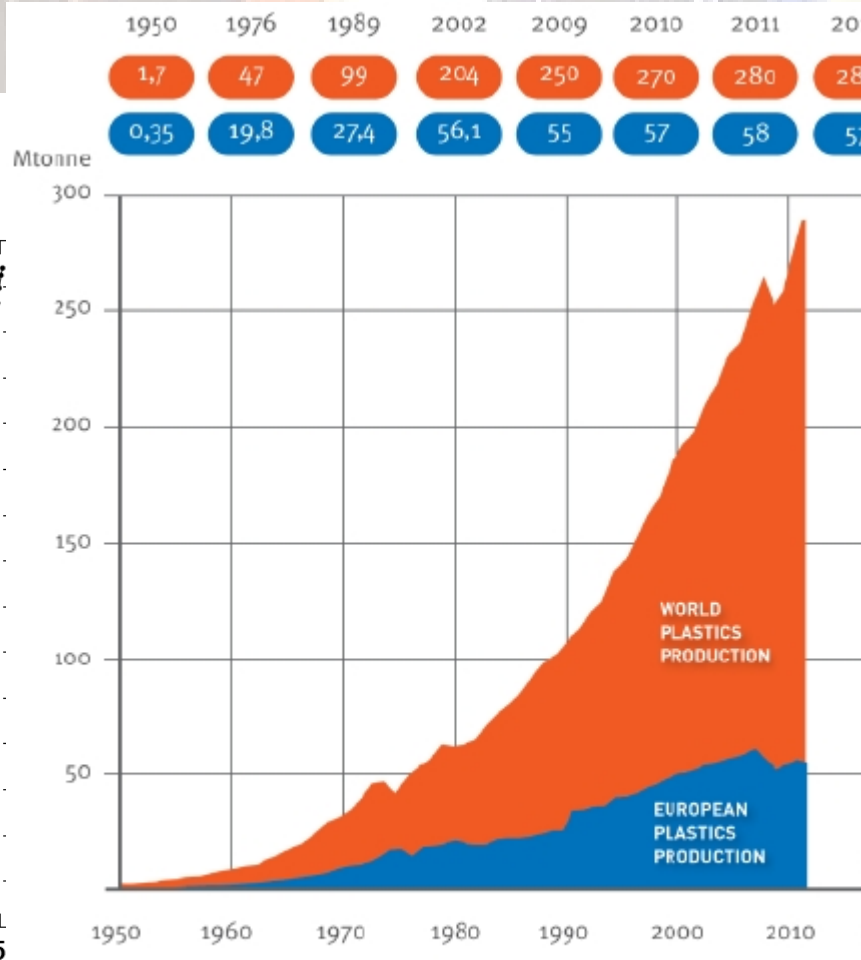




Figure 2: World plastics production 1950-2012

Includes thermoplastics, polyurethanes, thermosets, elastomers, adhesives, coatings and sealants and PP-fibers. Not included PET-, PA- and polyacryl-fibe

Source: PlasticsEurope (PEMRG) / Consultic

## Un indicador de cambio global

Anthropoceno → Plastiesfera.

# El problema de los plásticos en los oceános; ¿Soluciones?

1. Problema industrial: economía circular y legislación. (Ej. Reciclaje redes, prohibición de MPs,)

2. Acciones de divulgación y educación ambiental. (Ej. Acciones en limpieza de playas)

3. Del 3R al 5R (Rediseñar y Recuperar energeticamente).


100 años en Vig
una vida en el ma
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# ¡MUCHAS GRACIAS!