

# A trial deployment of silicone-rubber passive sampler, and litter/plankton samplers attached to a -4H- FerryBox flow-through seawater system

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# Silicone rubber passive samplers



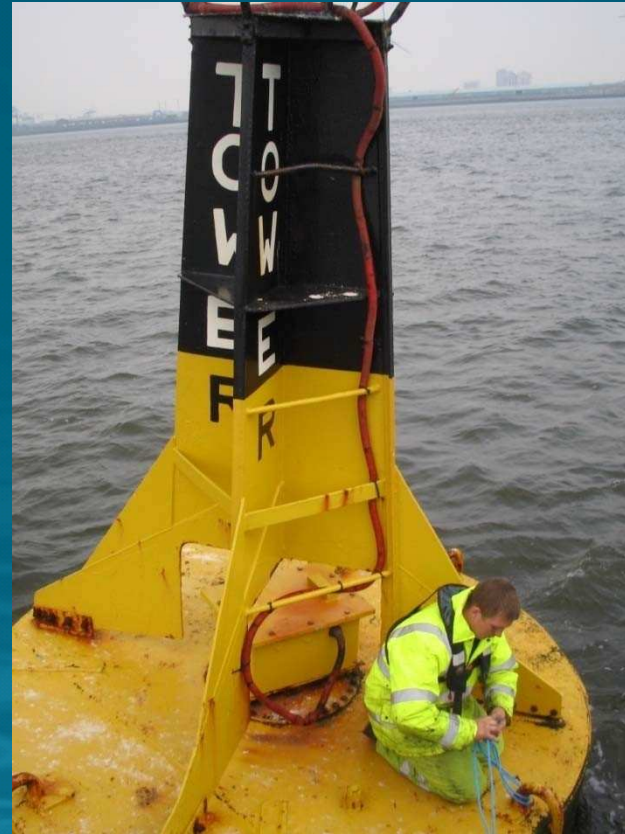
- Use has been reported in scientific literature for >10 years now



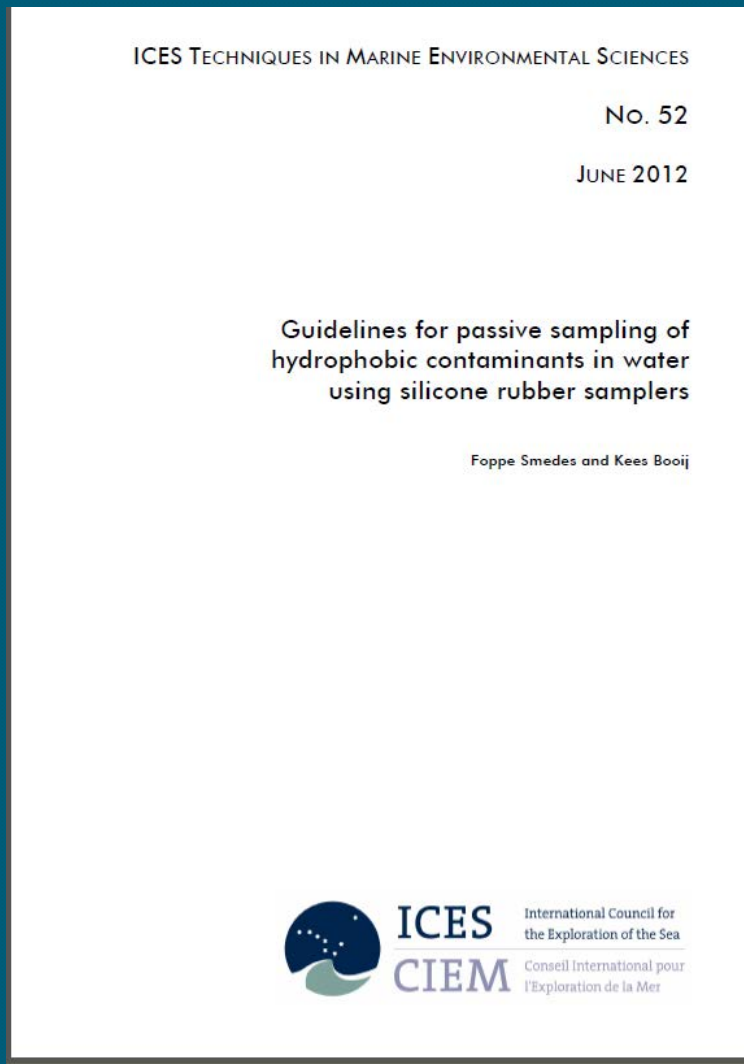
# Silicone rubber passive samplers



- Can be deployed by hanging off fixed buoys or other platforms

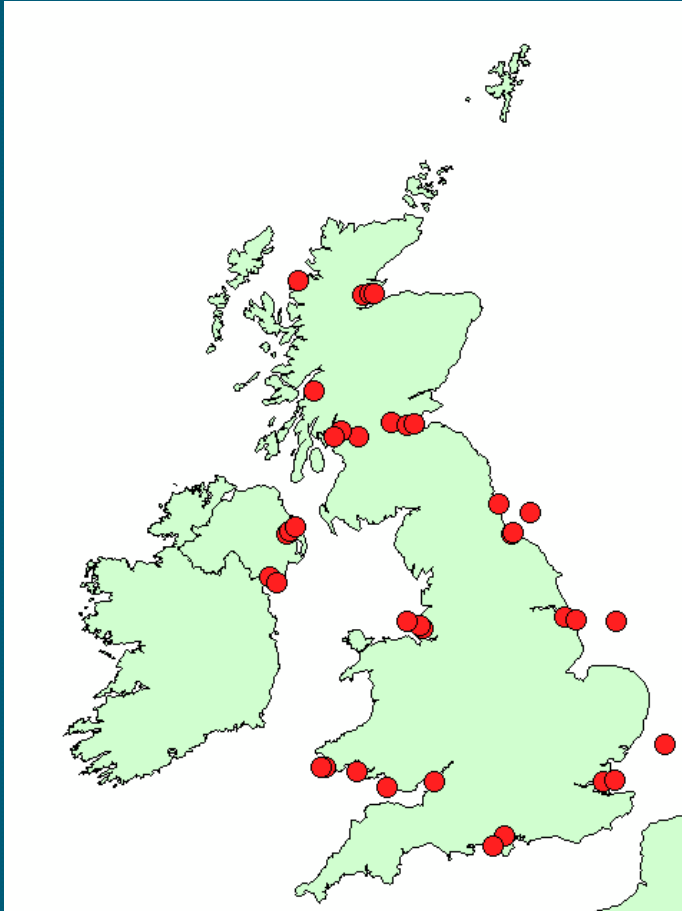


# Silicone rubber passive samplers



- Technique is very well characterised and ICES guidance document available
- Performance reference compounds (PRCs) are used to calculate sampling rates and hence (dissolved) water concentrations

# Project Plan



- 38 sites around UK
- In- and offshore
- 5 UK agencies
  - (Cefas, Marine Scotland, SEPA, EA, NIEA) with Deltares
- Multiple samplers (Silicon rubber, POCIS)
- Utilising smartbuoys

# Important lessons learned

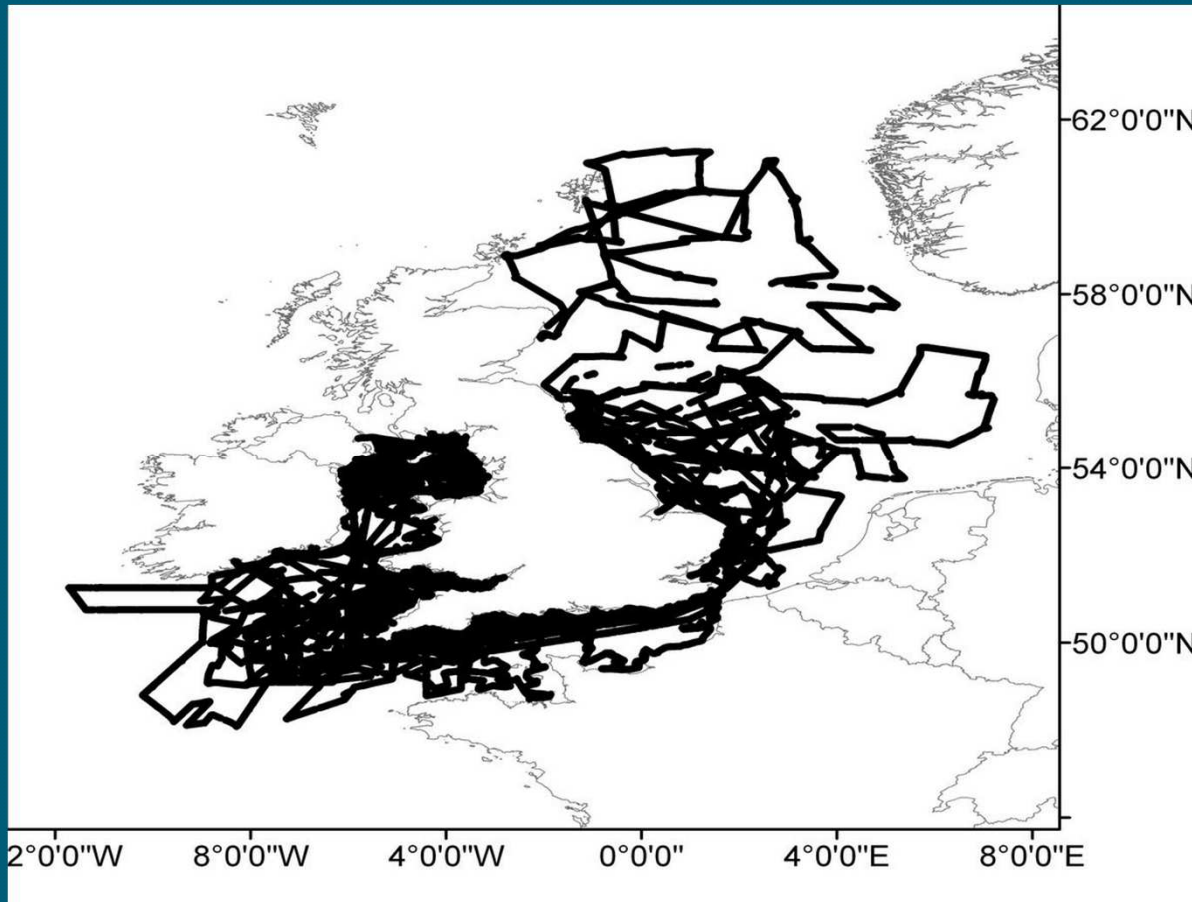
- Few offshore sites available
- Permission to deploy in certain areas not easily obtained
- Some samplers lost (also in previous programmes)
- Very long sampling programme
  - Supposed to be simultaneous deployment but ended up staggered over 8 months, due to problems arranging access

# Alternative deployment strategy?

- Cefas Endeavour is at sea in UK waters for >200 days per year
- FerryBox and pCO<sub>2</sub> systems onboard continuously measure levels of nutrients and other parameters on a seawater flow-through system



# RV Endeavour cruise track 2010



- Comprehensive cover of English and Welsh waters
- FerryBox operational since January 2009, pCO<sub>2</sub> analyser since 2011



# FerryBox on RV Cefas Endeavour

## -4H- FerryBox

Chlorophyll  
Turbidity  
Dissolved  
Oxygen  
Conductivity  
Salinity  
Temperature  
High accurate pH  
Hull mounted PRT  
Weather  
pCO<sub>2</sub>  
PAR



# Cefas Ferrybox passive sampler

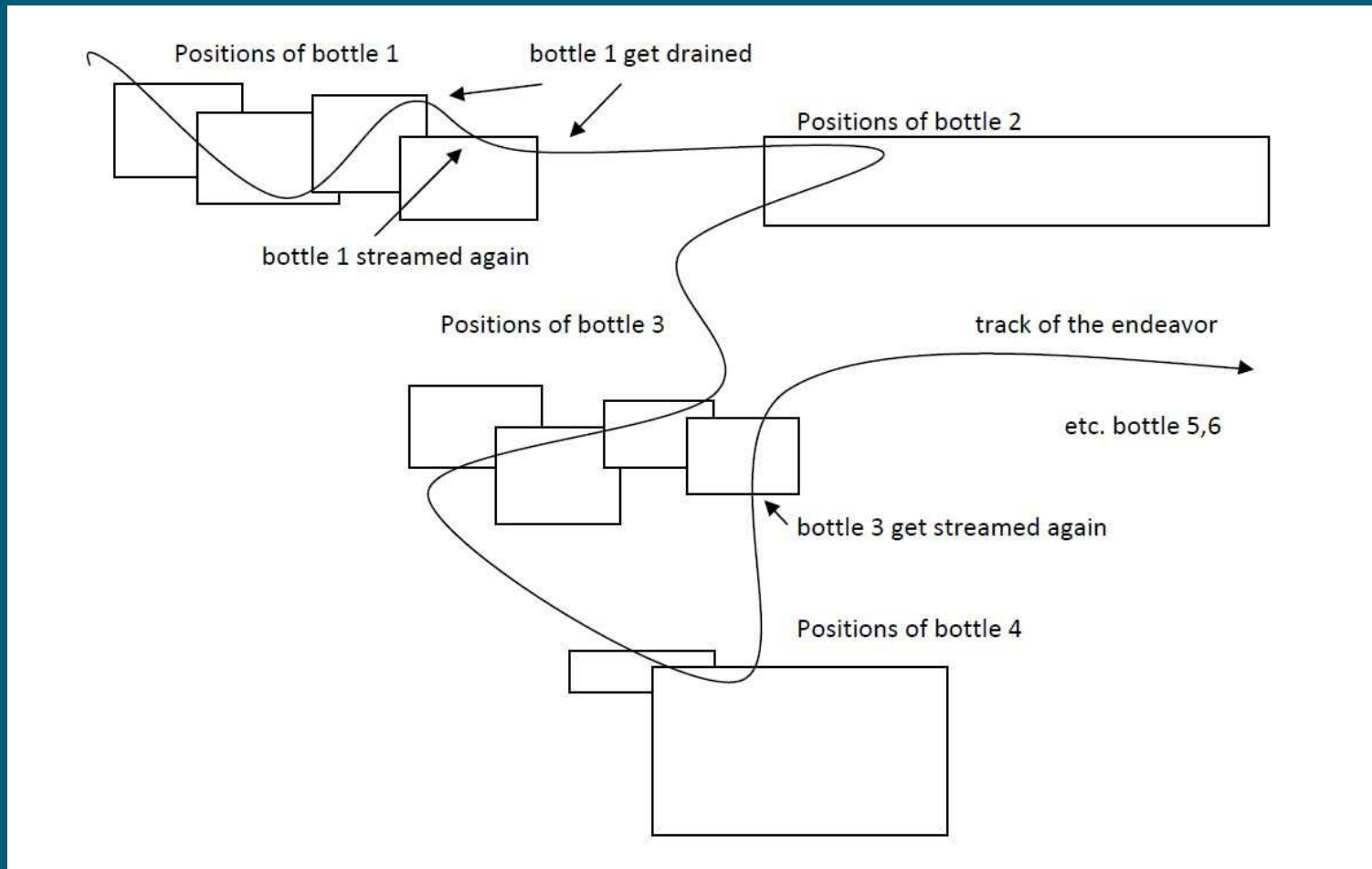


# Software control of sampler

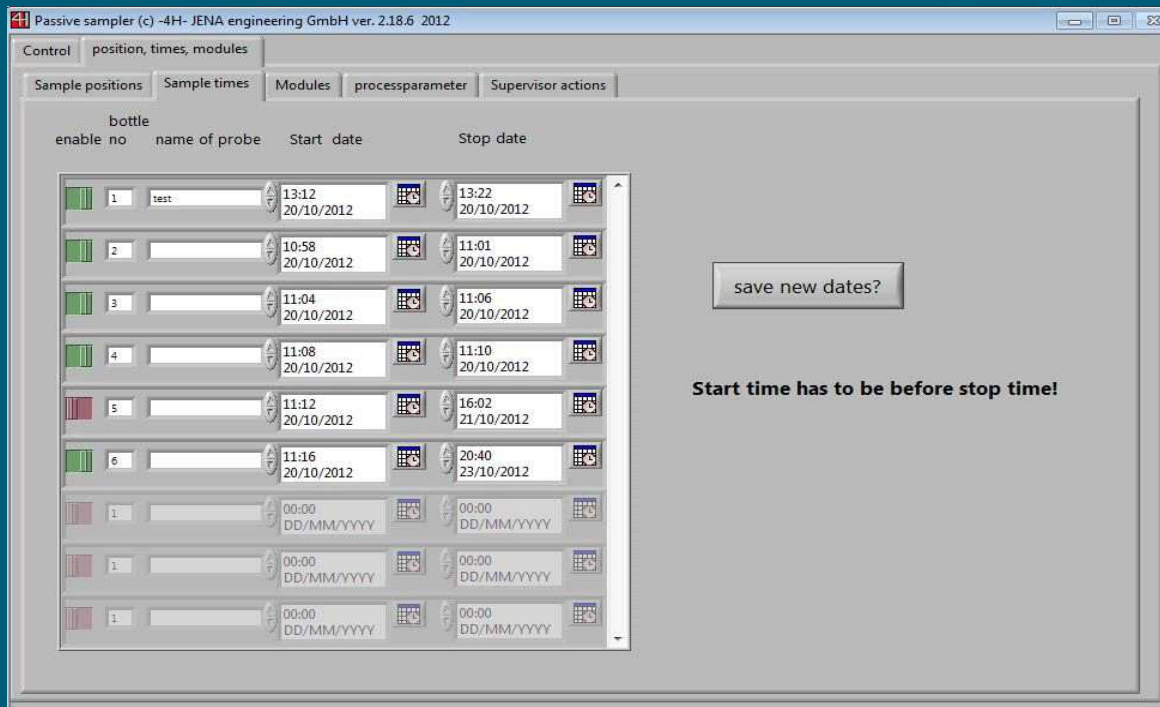


- Fully automated system
- Traps can be filled separately or trap 6 can be filled at same time as any others
- Sampling can be based on geographical region or time

# Sampling by geographical region



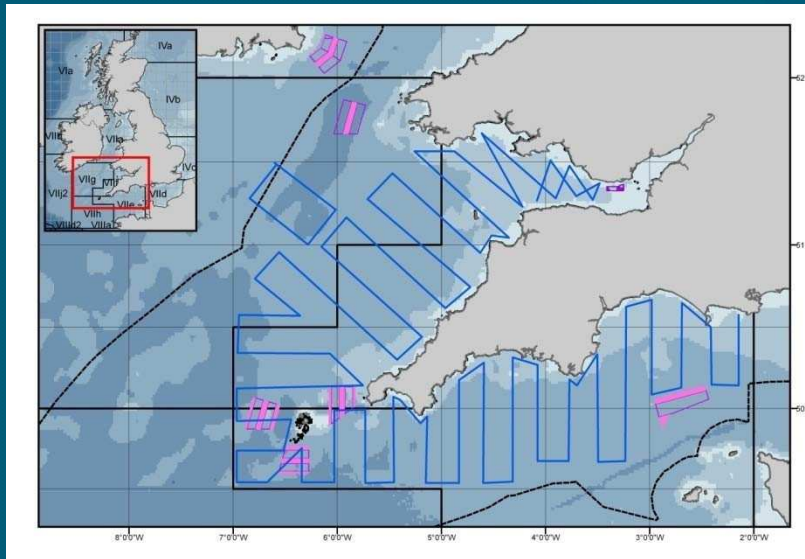
# Sampling by time period



- Sample using start and end times as control parameters
- Again, multiple time periods can be assigned to the same trap (if know when going close to shore for e.g. crew change)

# Cruise details

- Cefas Endeavour cruise  
Cend18/12 (23rd of  
October-9th of November  
2012)



- A multidisciplinary pelagic survey of the Western Channel and Celtic Sea waters to estimate the biomass and gain insight into the population structure of the small pelagic fish community

# Problems during deployment

- System installation was carried out on 2 day cruise immediately before Cend 18/12 and was not completely optimised
- In order to avoid disturbances to FerryBox and pCO<sub>2</sub> analyser data collection, system was temporarily installed to a different sea water line
- The end of this sea water line was also used by staff in the lab for fish sample processing and mistakenly got turned off twice at the end of shifts

# Deployment statistics

	trap1	trap2	trap3	trap4	trap5	trap6
Start date	23/10/2012	24/10/2012	29/10/2012	06/11/2012	08/11/2012	23/10/2012
End date	24/10/2012	28/10/2012	06/11/2012	08/11/2012	09/11/2012	09/11/2012
Total volume (in L)	13398	54589	112798	24952	12669	218414
Average flow rate (in L/min)	9.33	9.48	9.79	9.81	9.81	9.69
Sampling duration (in days)	1.00	4.00	8.00	1.75	0.90	15.64

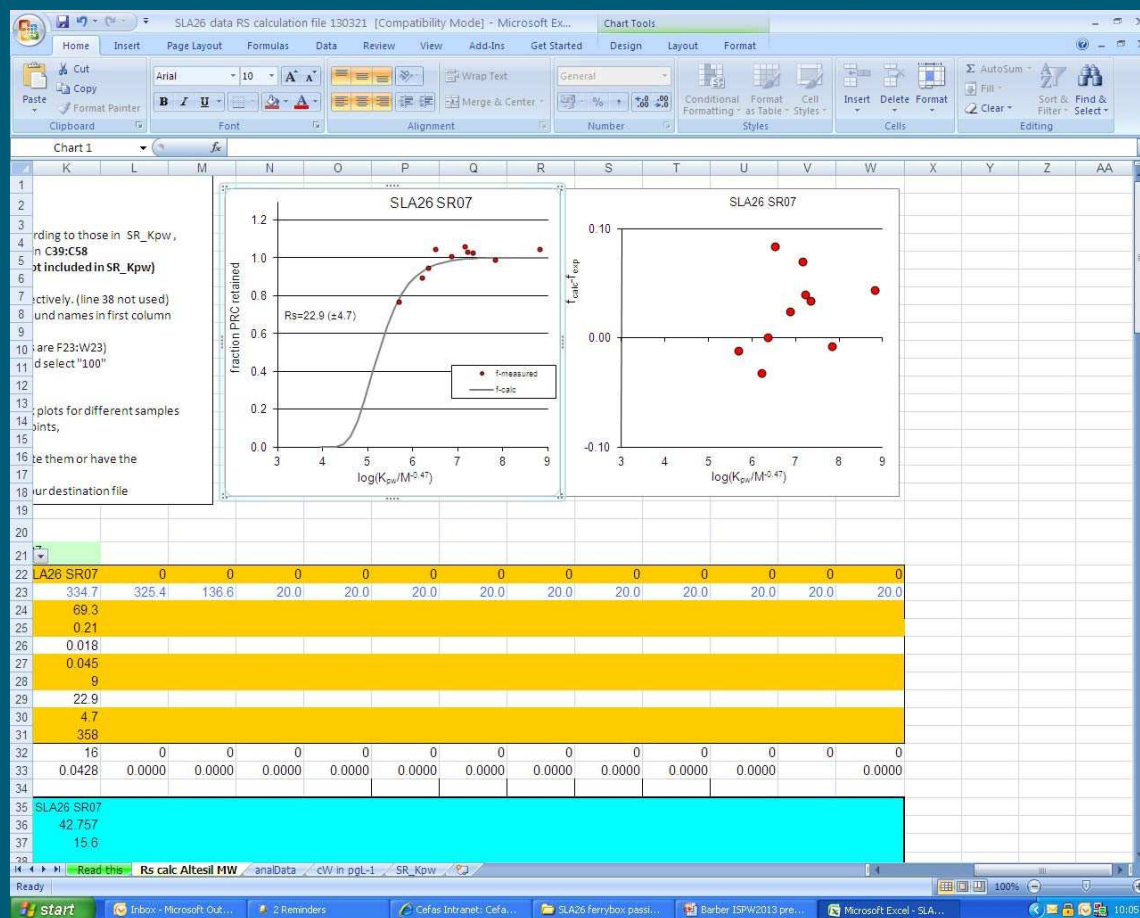
- Information collected by software controlling sampler



# Analytical details

- Samples split into 2 sub-samples for extraction and C8 clean-up and were then recombined afterwards
- Whole sample gravimetrically split into 2, with half going to PAH analysis and half going to organohalogen and PRC analysis
- Alumina clean up of PAH fraction prior to GC-MS analysis
- Alumina clean-up and silica fractionation of organohalogen fraction prior to GC-EI-MS (PCBs, PRCs and OCs) and GC-CI-MS (PBDEs) analysis

# How long is needed to measure PRC loss?



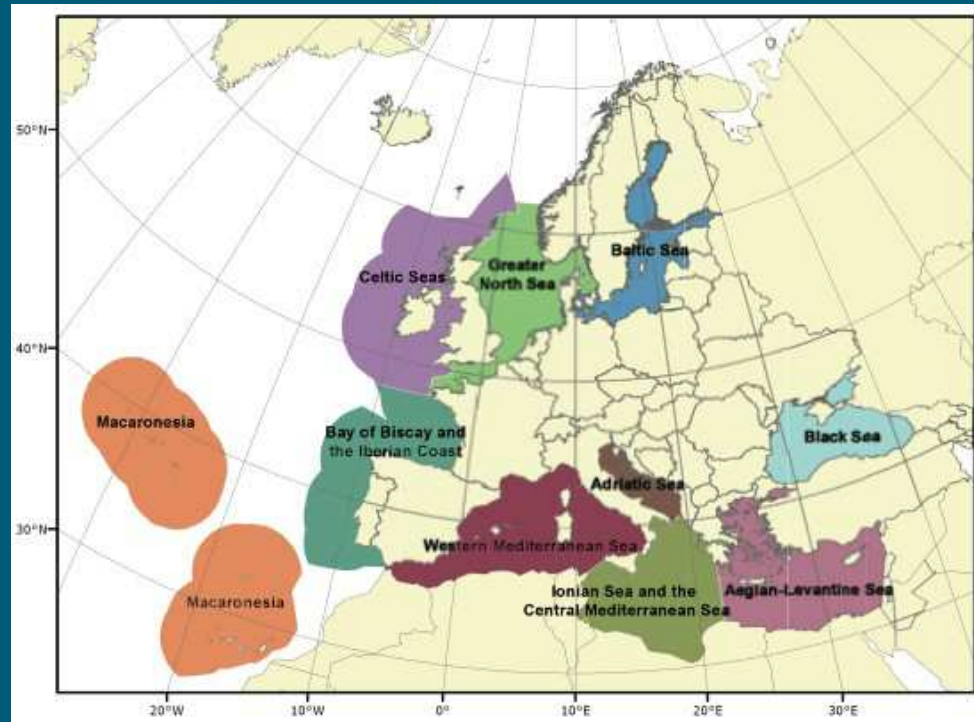
- Good fit to equation for PRC compounds for 8 and 16 days exposure
- Sampling rates ~20 L/day, similar to offshore deployed samplers

# Results: water concentrations

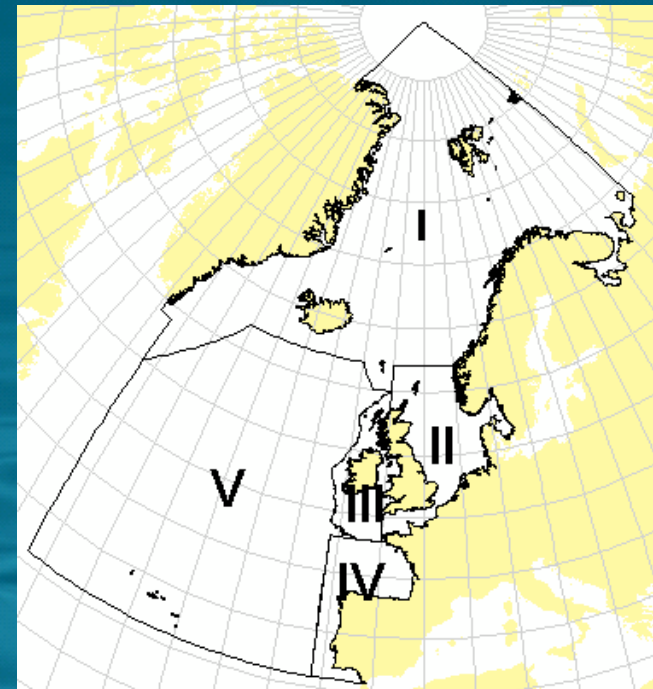
	Exposure length (in days)	
	8	16
	Water concentration in pg/L	
HCB	6.9	6.9
$\Sigma$ CBs	85	88
$\Sigma$ BDEs	64	31
$\Sigma$ PAHs	12829	10733
Phenanthrene	604	594
Benzo[a]pyrene	39	29

- (dissolved) water concentration data can be calculated for the 8 and 16 day exposures, equivalent to the area of the Celtic Sea and the Celtic Sea plus English Channel areas

# Good enough for regional measurements? Yes!



OSPAR regions



MSFD sub-regions (draft as on 18 July 2012) from:

[http://www.projectpisces.eu/guide/the\\_msfd\\_and\\_the\\_ecosystem\\_approach/](http://www.projectpisces.eu/guide/the_msfd_and_the_ecosystem_approach/)

# Marine Litter



# Facts & Figures

## What is Marine Litter:

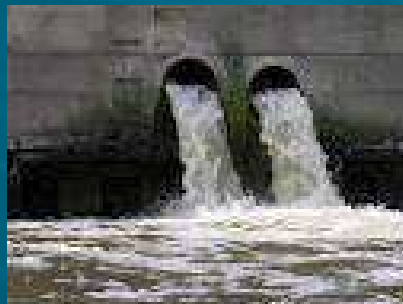
Any man-made object discarded, disposed of, or abandoned that enters the coastal or marine environment. It may enter directly from a ship, or indirectly when washed out to sea via rivers, streams and storm drains.

## Types of Marine Litter:

Ranges from common domestic material (bags, cups, bottles, balloons) to industrial products (strapping bands, plastic sheeting, hard hats, resin pellets) to lost or discarded fishing gear (nets, buoys, traps, lines).

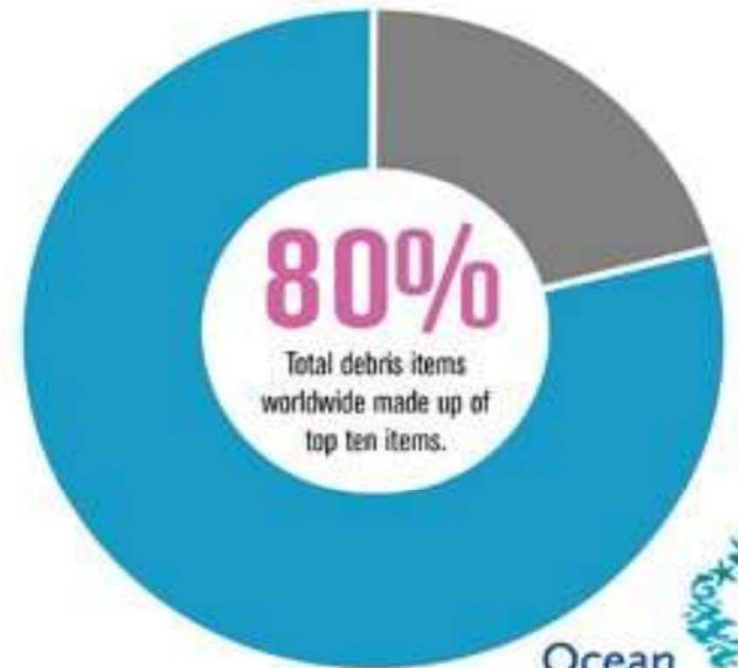
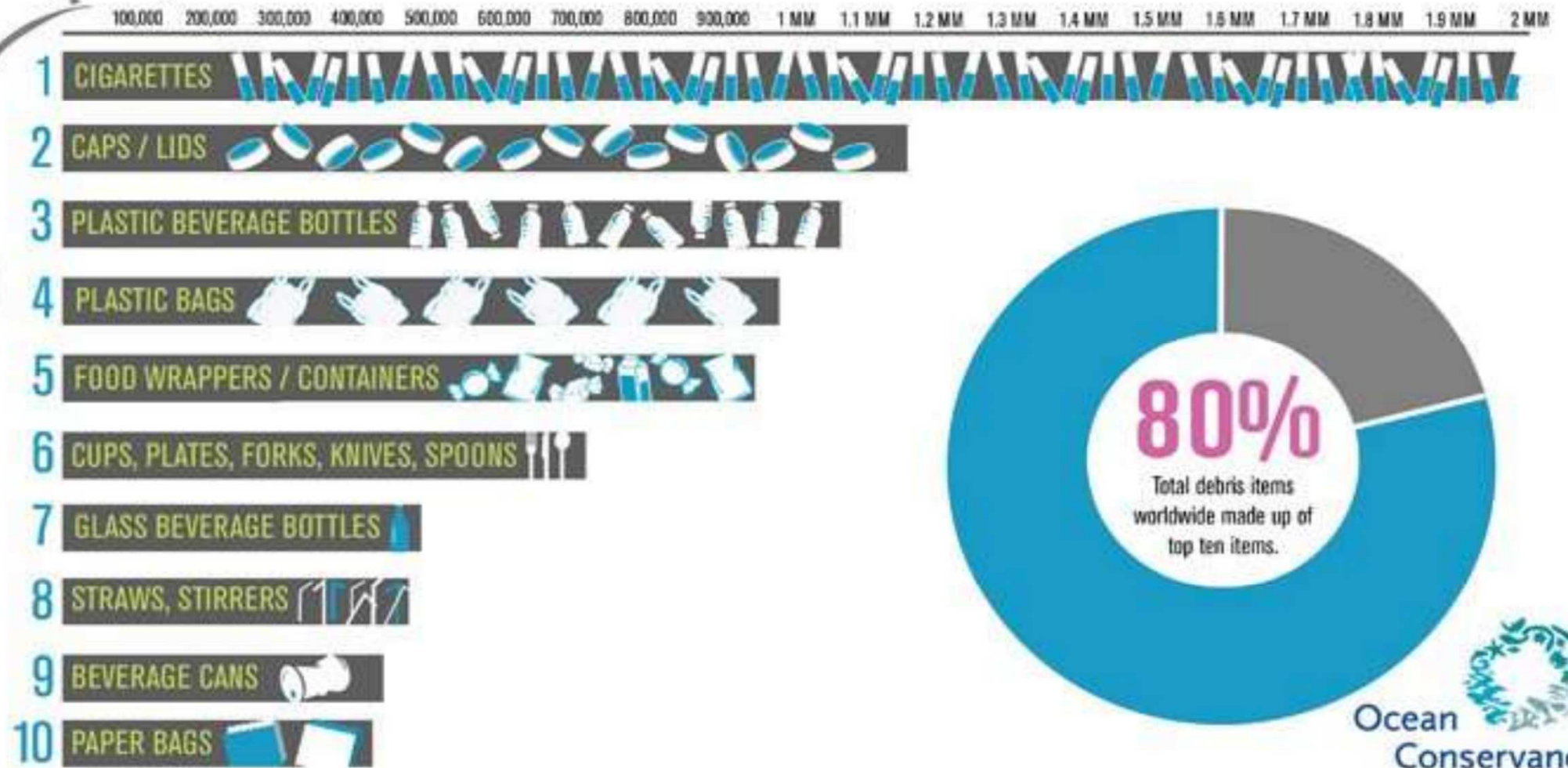
## Where does it come from:

- **Ocean-based Sources:** Fishing Vessels, Cargo Ships, Stationary Platforms, Fish Farming Installations, Pleasure Crafts and Other Vessels
- **Land-based Sources:** Littering, Dumping, Poor Waste Management Practices, Untreated Sewage and Storm Water Discharges, Riverine Inputs, Industrial Facilities, Tourism, Extreme Natural Events



# TOP TEN ITEMS FOUND

Ocean Conservancy's International Coastal Cleanup 2012



Ocean Conservancy  
oceanconservancy.org/2012data



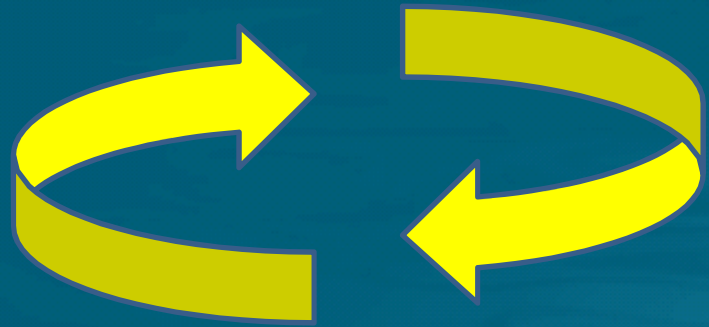
MARINE CONSERVATION SOCIETY (UK)  
[www.mcsuk.org](http://www.mcsuk.org)





**BEACH**

**WATER**



**BENTHIC**

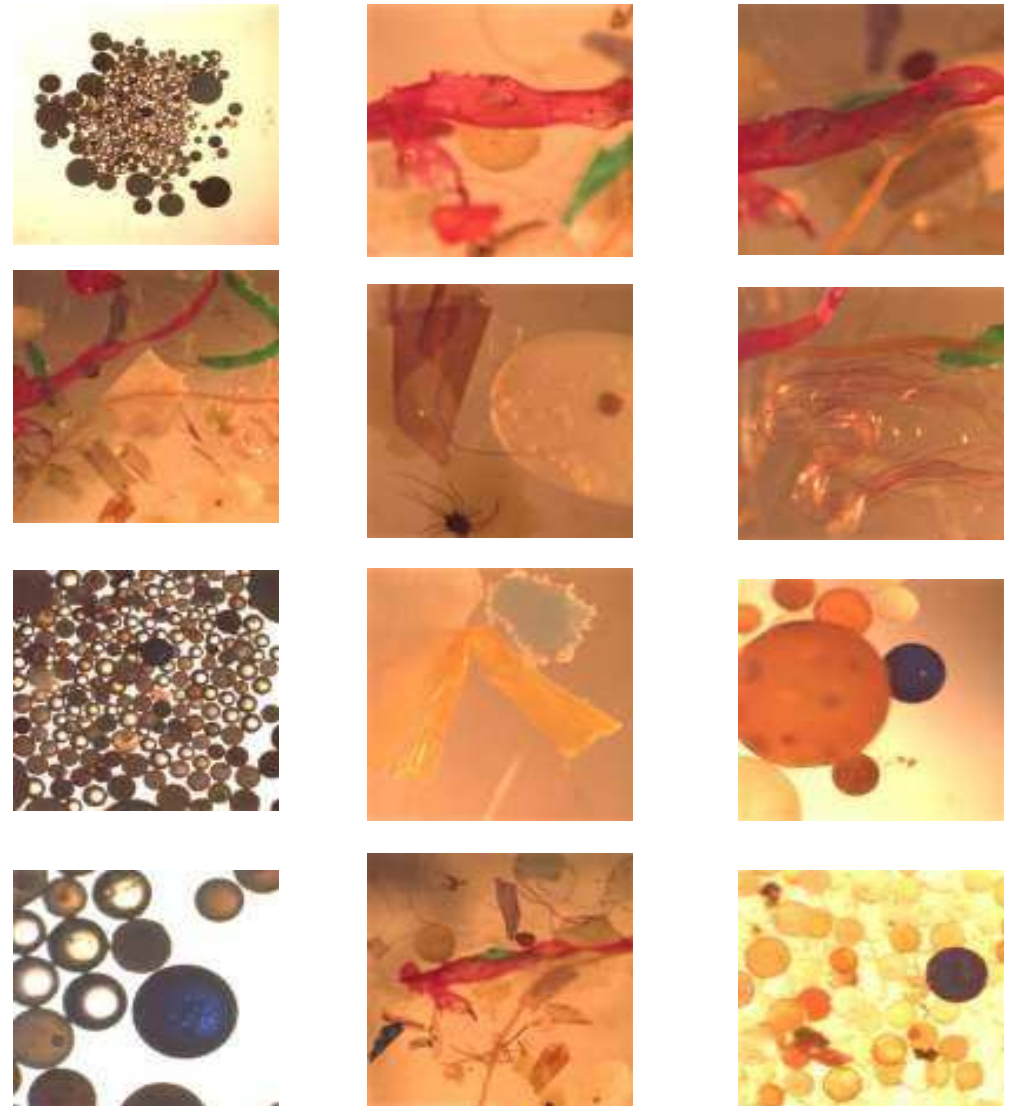




# MACRO

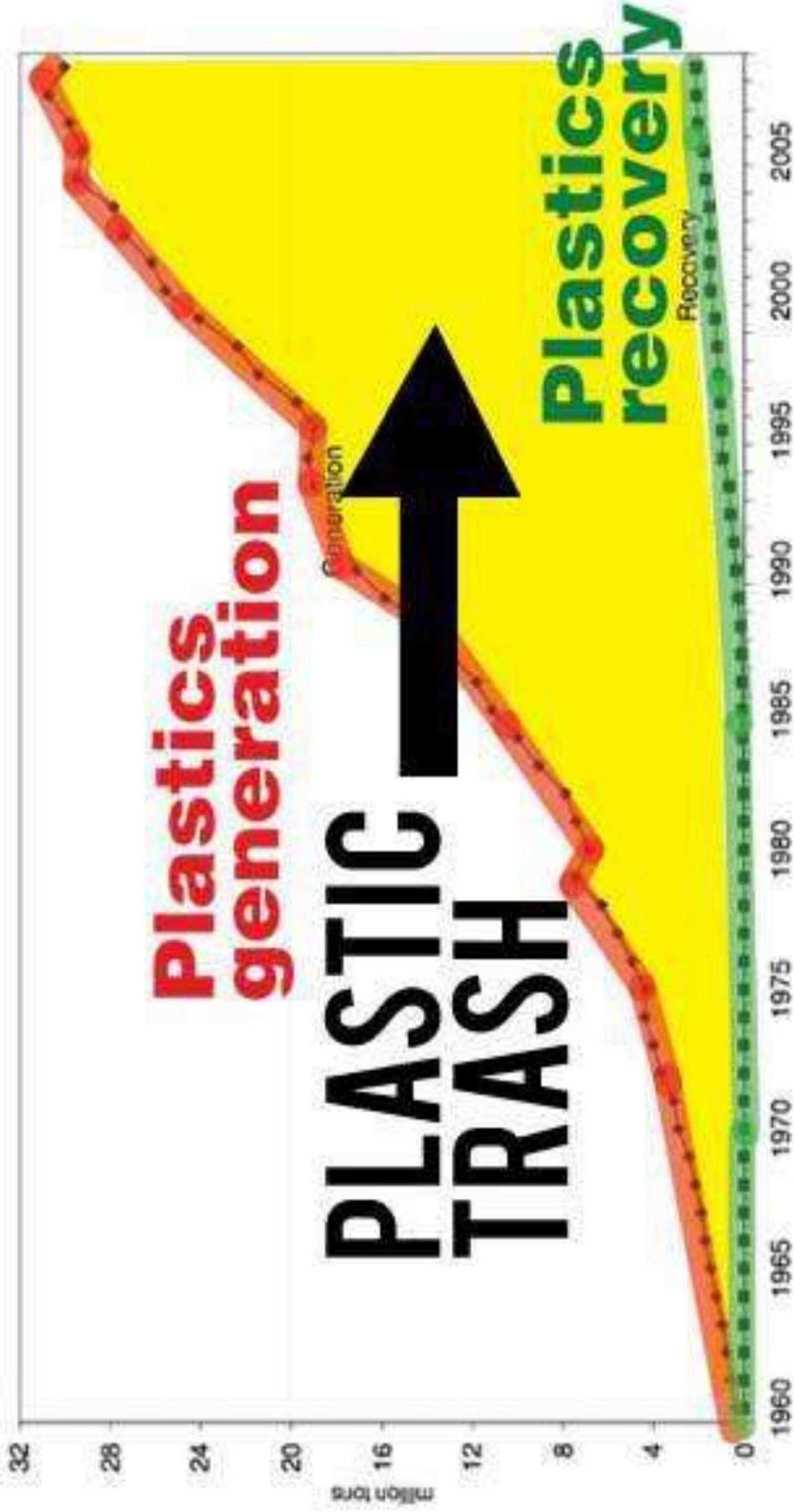


# MICRO



Chemical leaching & sorbance!

Figure 9. Plastics generation and recovery, 1960 to 2008



Source: CalRecycle

# PLASTIC:



➤ Alexander Parkes , 1862, the first man-made plastic, Great International Exhibition in London

➤ Worldwide *plastic production* 280 million tonnes (2011)

➤ 100kg plastic per person/year in Europe



Manilla, Philippines. Photo: Francis R. Malasig



Krichim, Bulgaria . Photo: Dimitar Dilhoff



© SWNS

UK Beach, Devon. Photo Source: SWNS



North America. Photo Source: photobucket



Newport Channel, Los Angeles, USA. Photo Source: Coastal wiki





Philippines. Photo Source: NSW Volunteers

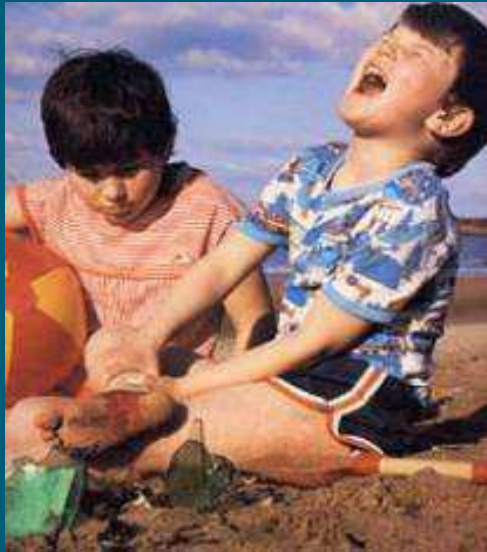
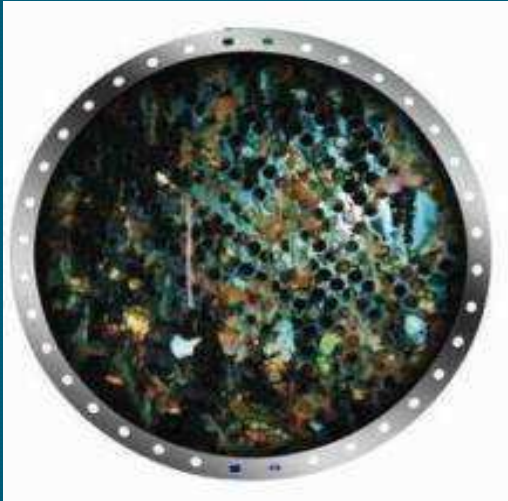


**Mediterranean. Photo Source: Bouteilles à la mer org.**



Southbank, London, UK. Photo Source: Surfers Against Sewage

# Socio-Economic Impacts





# Monitoring & Research



Just because you can't see it, doesn't mean it isn't there



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[www.awbnet.org](http://www.awbnet.org)

# Microplastic Monitoring and Method development

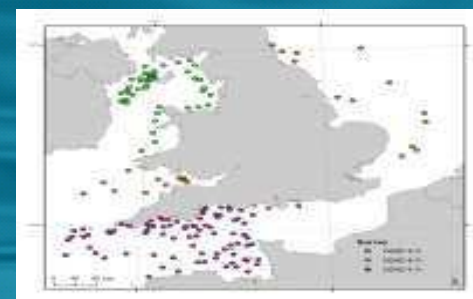
1



2



3



- 3 different methods tested
  - Filtration - 200 $\mu$ m
  - Surface fishing net - 1cm
  - High speed manta trawl – 333 $\mu$ m

# Microplastic Monitoring and Method Development



# Manta Trawl Case Study

3 surveys 2011

151 locations around the UK

Total collected items: 3599 items



COLOR & TYPE

4.749 – 2.800mm

2.790 – 1.000mm

0.999- 0.710mm

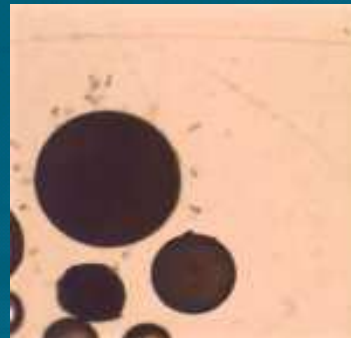
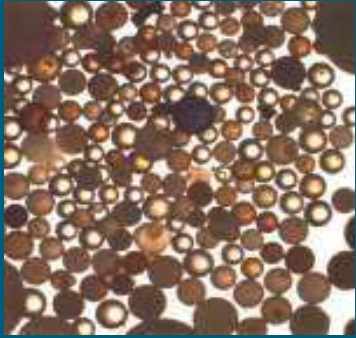
0.709 – 0.500mm

0.499 – 0.355mm





# HIGH SPEED MANTA TRAWL RESULTS



Highest catch: 283 items

- 128 fragments
- 28 pellets
- 28 pieces of lines
- 50 thin films
- 49 foamy items



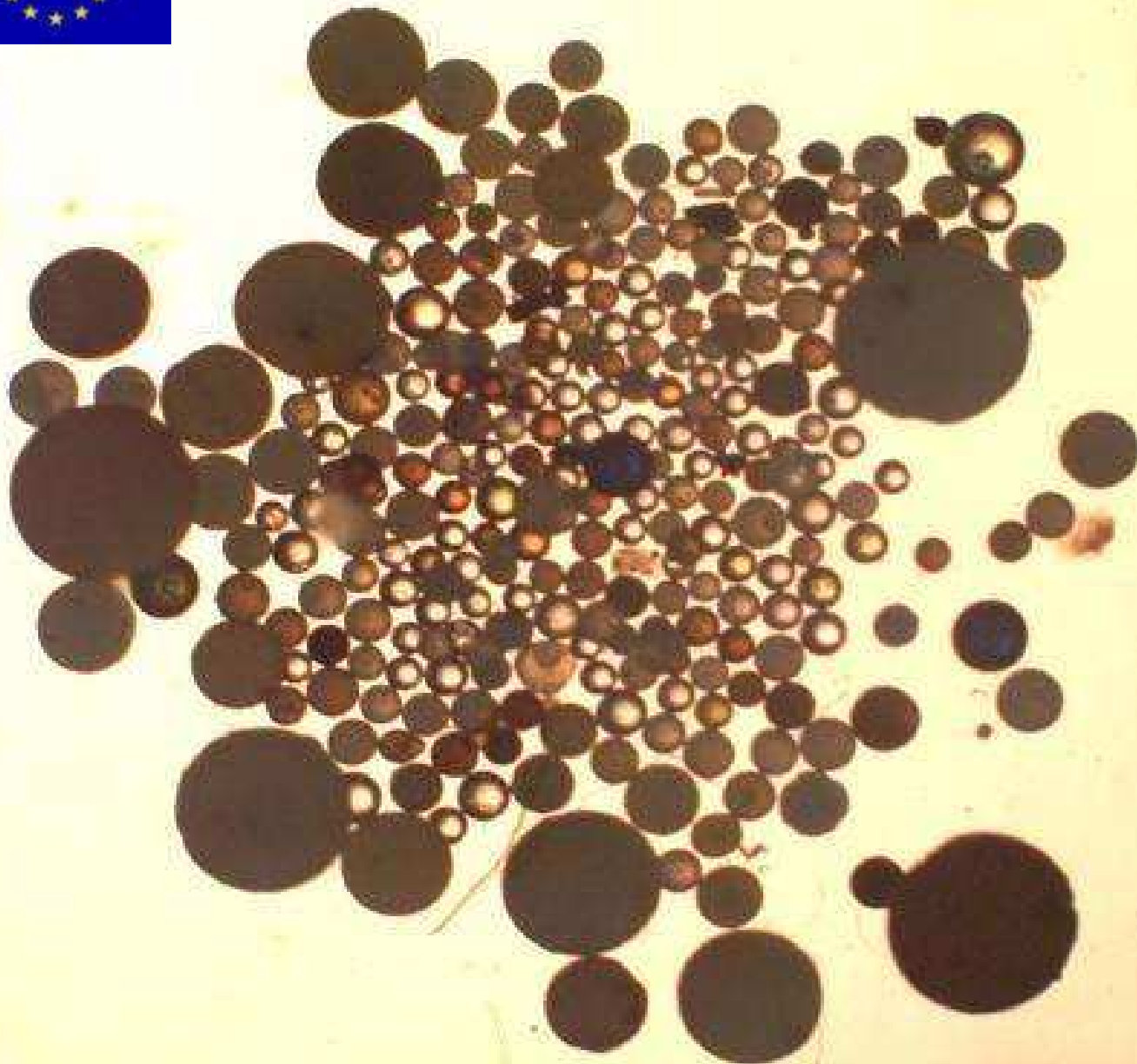
Mean	19237 items/km <sup>2</sup>
Median	<b>11881 items/km<sup>2</sup></b>
Max	156624 items/km <sup>2</sup>

# Monitoring strategy 2014/2015

## Microplastic during autumn/winter

## Plankton during spring/summer





# R&D



3 Pilot  
Projects



# The Marine Strategy Framework Directive



Initial assessment of UK seas

Monitoring programme established

Programme of measures implemented




Directive transposed

GES defined, including targets and indicators

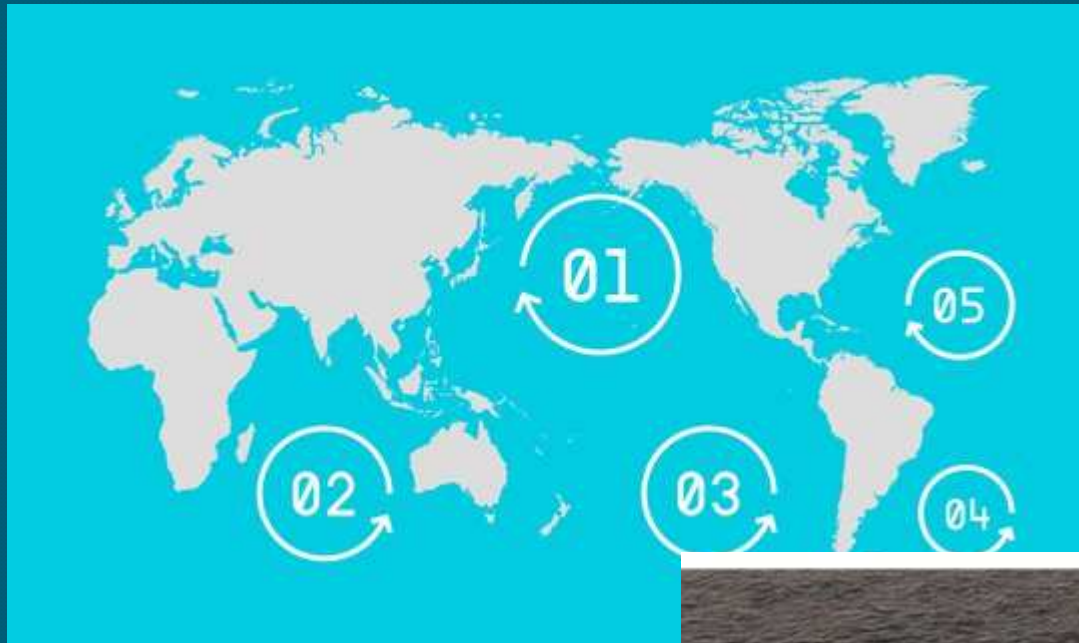
GES achieved for UK seas





The only way to manage the marine litter pollution issue is by limiting the input—changing ways and behaviours that cause marine litter to enter the environment.

**Reduce, Reuse, Recycle, collect**



# Any questions or comments?



Please contact me for CEFAS email addresses  
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Thank you very much  
for your attention

