MARITTIMO - IT FR - MARITIME
TOSCANA - LIGURIA - SARDEGNA - CORSE

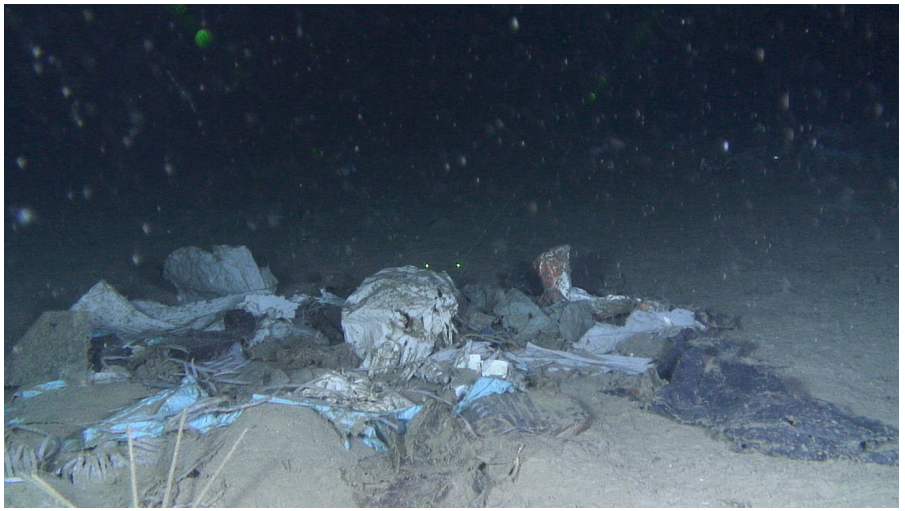
SYSTÈME INTÉGRÉ POUR LE MONITORAGE
ET LE CONTRÔLE DE L'ENVIRONNEMENT MARIN

SISTEMA INTEGRATO PER IL MONITORAGGIO
E IL CONTROLLO DELL'AMBIENTE MARINO

PROGRAMMA COFINANZIATO CON IL FONDO
EUROPEO DI SVILUPPO REGIONALE
PROGRAMME COFINANCE' PAR LE FONDS
EUROPEEN POUR LE DEVELOPPEMENT
REGIONAL

Marine litter, Observation/ modelling and MSFD

F. Galgani (IFEMER/LER/PAC)



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Marine Debris in the history

Twenty Thousand Leagues Under the Sea

by Jules Verne's, 1870

Chapter 12 - The Sargasso Sea, P.276:

Above us, huddled among the brown weeds, there floated objects originating from all over: tree trunks ripped from the Rocky Mountains or the Andes and sent floating down the Amazon or the Mississippi, numerous pieces of wreckage, remnants of keels or undersides, bulwarks staved in and so weighed down with seashells and barnacles, they couldn't rise to the surface of the ocean.

www.feedbooks.com/book/182.pdf

MARINE LITTER

-260 millions tons of plastic / Year

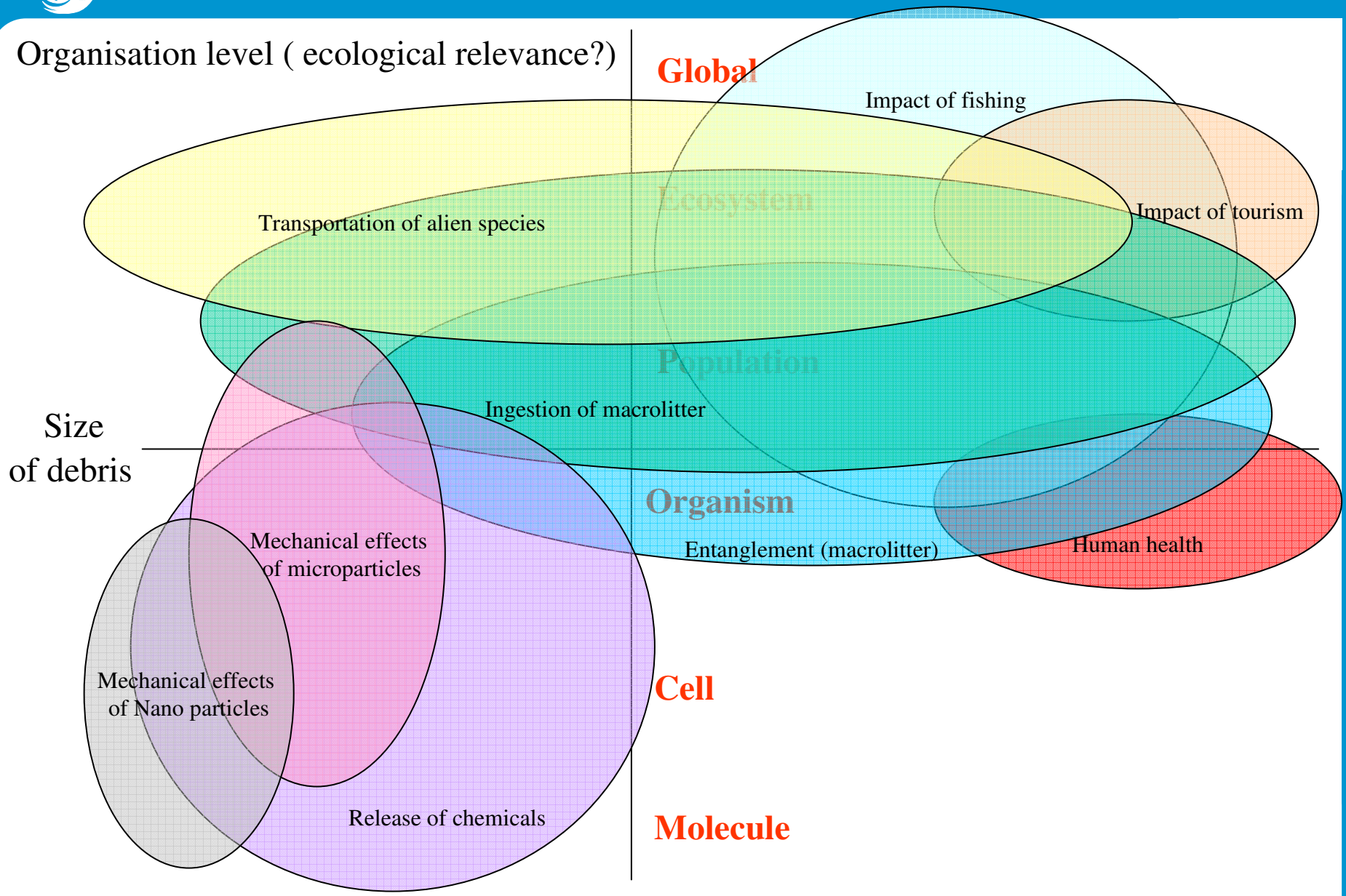
- 500 kg garbage/ year/ person in Europe

- 80% of the waste is land based

- 6 millions tons/ year from ships

- 90% are made of polymers

- 115 000 microplastics / km2 in the North west basin of the Mediterranean sea


Organisation level (ecological relevance?)
Global
Impact of fishing
Ecosystem
Transportation of alien species
Impact of tourism
Population
Ingestion of macrolitter
Size
of debris
Organism
Entanglement (macrolitter)
Human health
Mechanical effects
of microparticles
Mechanical effects
of Nano particles
Cell
Release of chemicals
Molecule

Marine Strategy Framework Directive

(MSFD, 2008/56/EC)

11 descriptors (56 indicators)

2012	Initial assessment by the Member States
2014	Monitoring
2016	Implementation of measures
2020	Good Environmental Status (GES)

Marine Strategy Framework Directive

Descriptor 10 (Marine litter) : " properties and quantities of marine litter should not cause harm to the coastal and marine environment."

A Task Group (TG10,2010) to Propose methodological standards

A technical group (GES-TG,2011-13) to support member states

overriding objective: measurable and significant decrease of the total amount of marine litter by 2020

-CRITERIA (INDICATORS) FOR THE EVALUATION OF THE ENVIRONMENTAL STATUS.

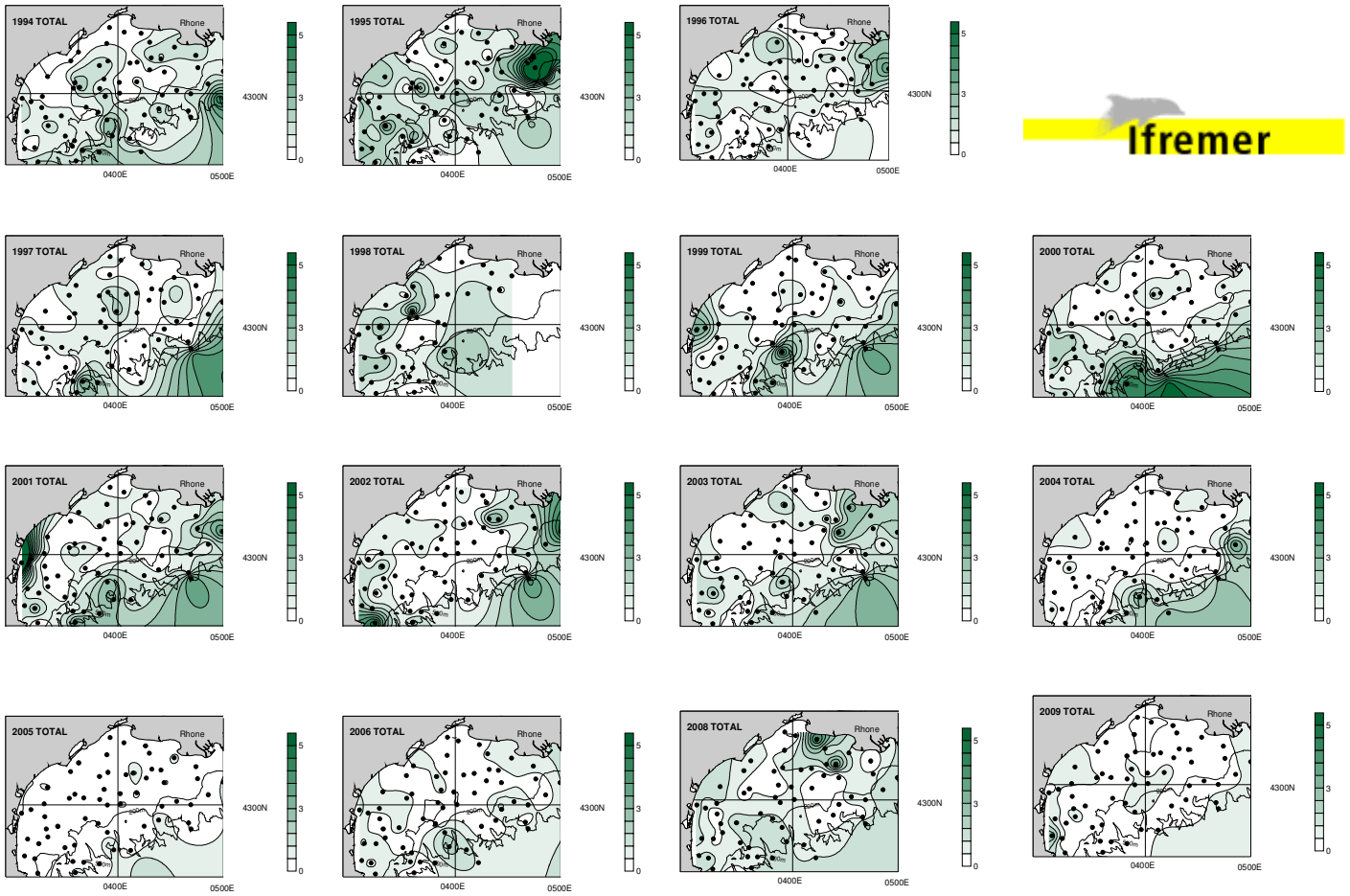
10.1.1 Amount, source and composition of litter washed ashore and/or deposited on coastlines

10.1.2 Amount and composition of litter at sea (surface/ sea floor)

10.1.3 Amount, distribution and composition of microparticles

10.2.1 Amount and composition of litter ingested by marine animals

Example of monitoring:
Gulf of Lion, litter on the sea bed, 1994 -2009



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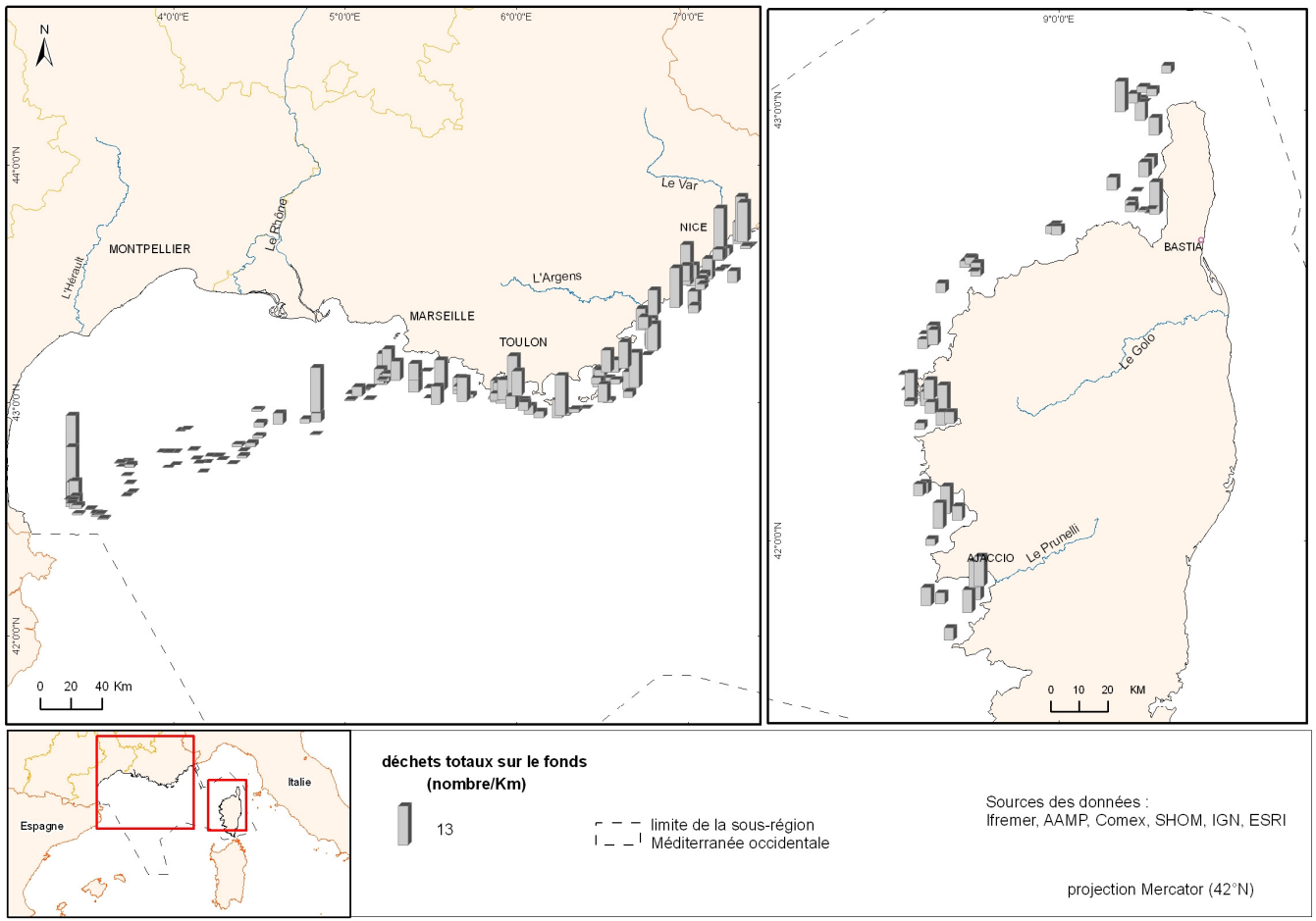
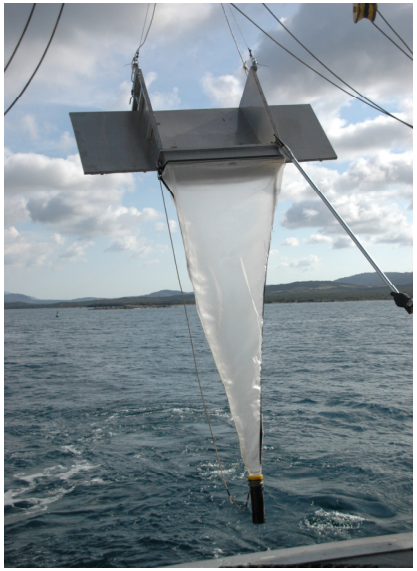
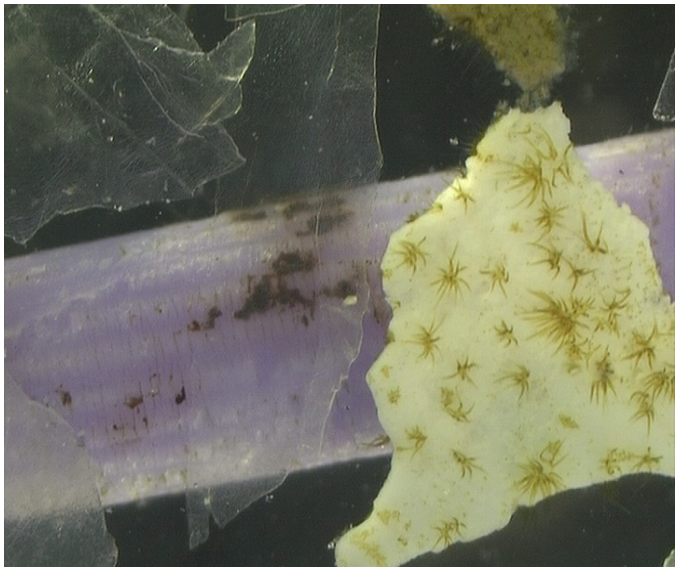


Deep sea litter (Canyons) : 2009-2010, 260 dives (ROV and submersible)

FLOATING LITTER

10.1.2 Amount and composition of litter at sea (surface/ sea floor)
10.1.3 Amount, distribution and composition of microparticles





- Concentrates in zones (garbage patches)
- Larger objects can pose serious threats to the safety of nav
- Transport alien species

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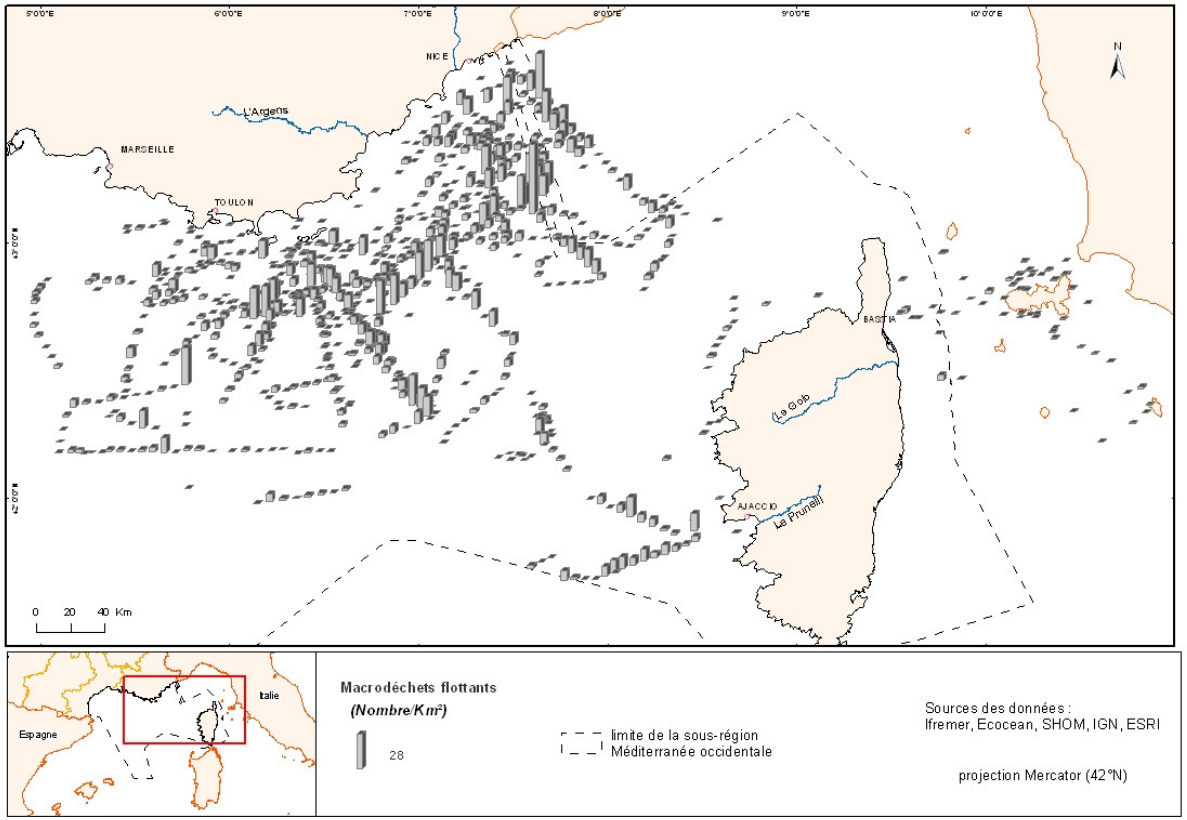

Floating macrolitter , data from ecocean (NGO), Summer sampling , 2006-2008.

Ecocean

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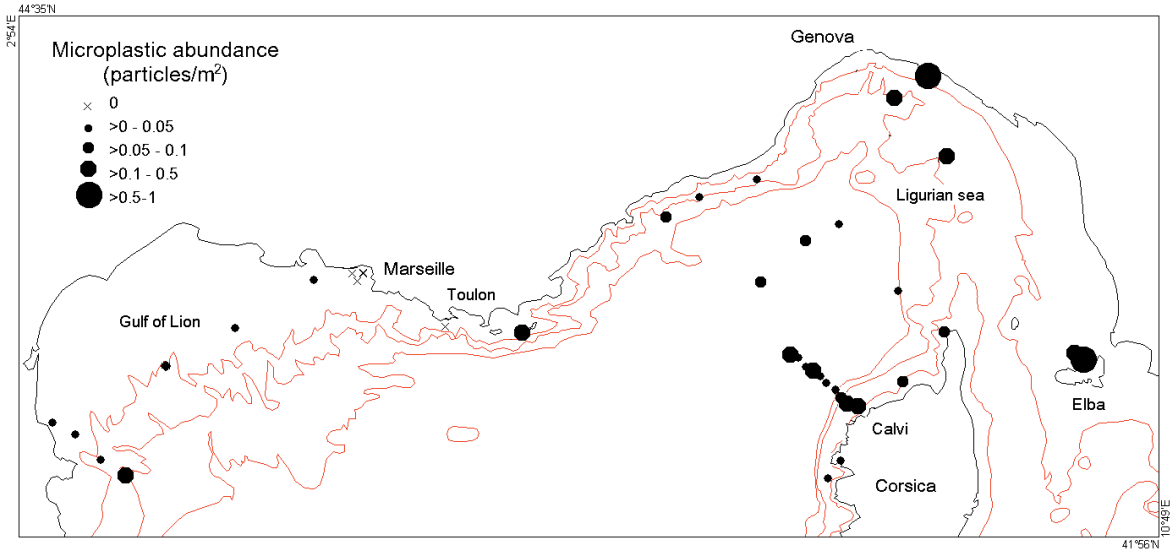

Floating microplastics: 2010 (Collignon et al, 2011, Mar. Poll. Bull.)

115 000 / km2 , max at 920 000 /km²

250 billions items / Mediterranean sea

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- Floating Marine debris moves in chaotic patterns.

- Marine debris on the surface is affected by ocean currents,

- Transborder transportation is a serious problem

A necessary background for the implementation of the MSFD

MODELLING EFFORTS CAN ASSESS:

- Key transport pathways
- Accumulation areas
- Environmental forcing
- Sources and sinks
- Guiding monitoring and clean-up strategies.

Studying drifter trajectories (historical data):

The distribution of drifters in space depends not only on ocean currents but also on locations and intensity of drifter sources.

For marine debris:
- Sources are not well documented and understood.
- A simple model experiment may detect locations of main regions where floating matter accumulates on a long run.

Example 1:Tracking the chaotic movement of marine debris

Argos transmitter (Nomad Science inc.)

Koki Nishizawa, Tottori University of Environmental Studies, Japan

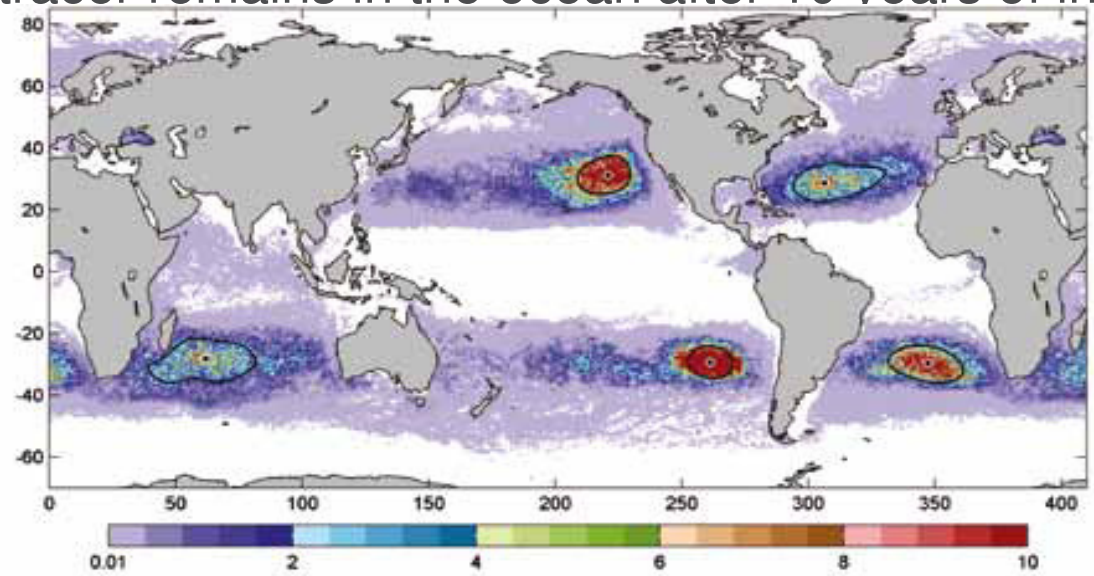
The trajectories of three Argos-equipped plastic bottles deployed in the Pacific Ocean (90 days)

Example 2: Predicting the location of garbage patches

(probabilistic model, trajectories of 10,561 Argos drifting buoys released during the Surface Velocity Program (SVP)/ Global Drifter Program (GDP):

- Drifters are quickly (1-3 year) pushed into the five subtropical gyres.

- In ten years, drifters are redistributed to form more compact clusters. 70% of the tracer remains in the ocean after 10 years of integration.



University of Hawaii at Manoa, N. ***Maximenko et al.***

Example 3: Numerical modelling of floating debris in the world's oceans (HYCOM/Mercator grid)

Lebreton et al. 2012, Marine Pollution Bulletin, 64(3)

Floating litter and debris are modelled from source to sink using particle tracking.

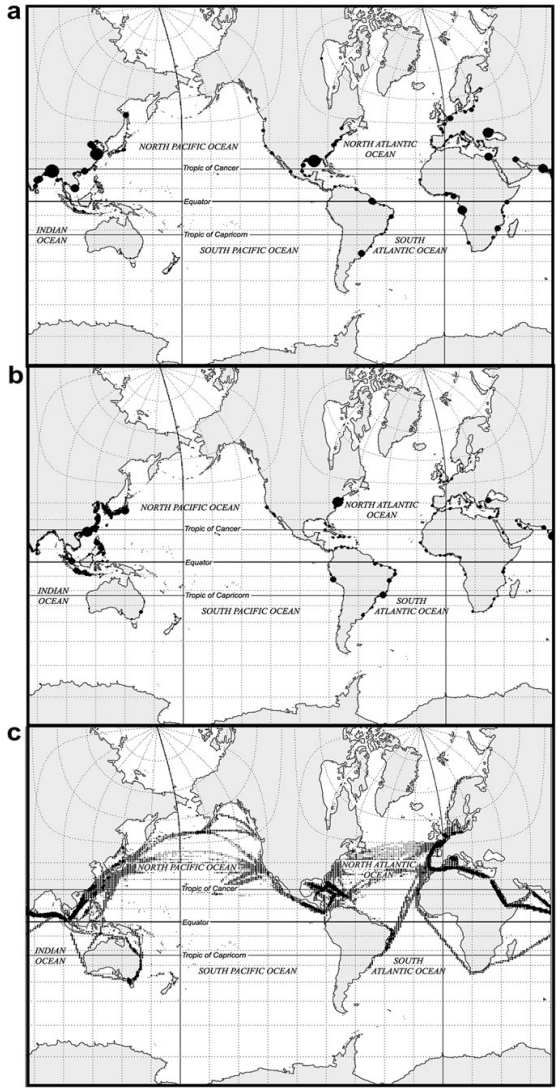
► Ocean surface currents drive a Lagrangian model for three input scenarios over 30 years.

► Results describe the relative size and concentration of oceanic accumulation zones.

► Accumulation zones are quantified according to particle pathway and source region.

► Model results are used to develop strategies for reducing marine litter worldwide.

30 years simulation

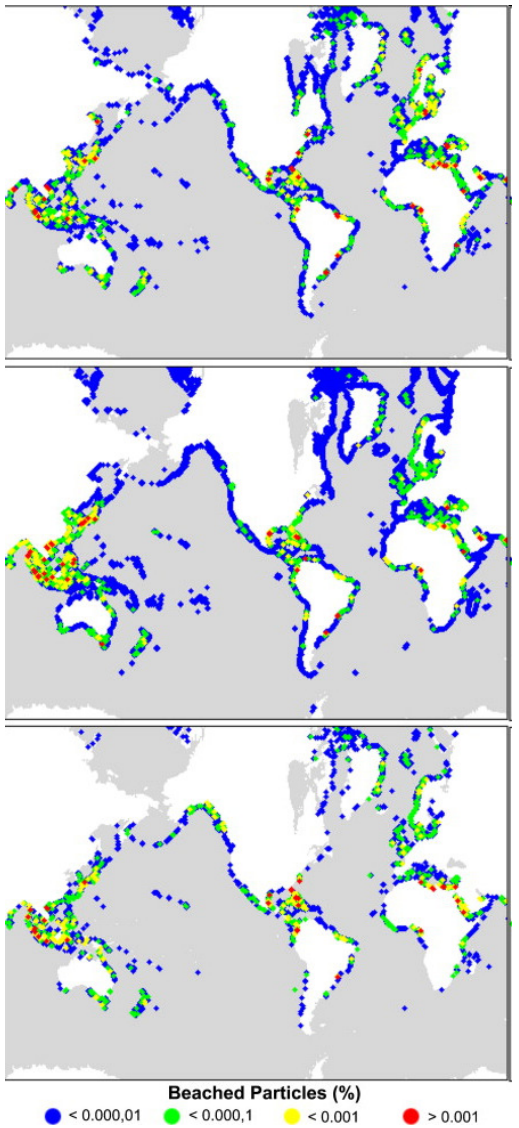


Input scenarii

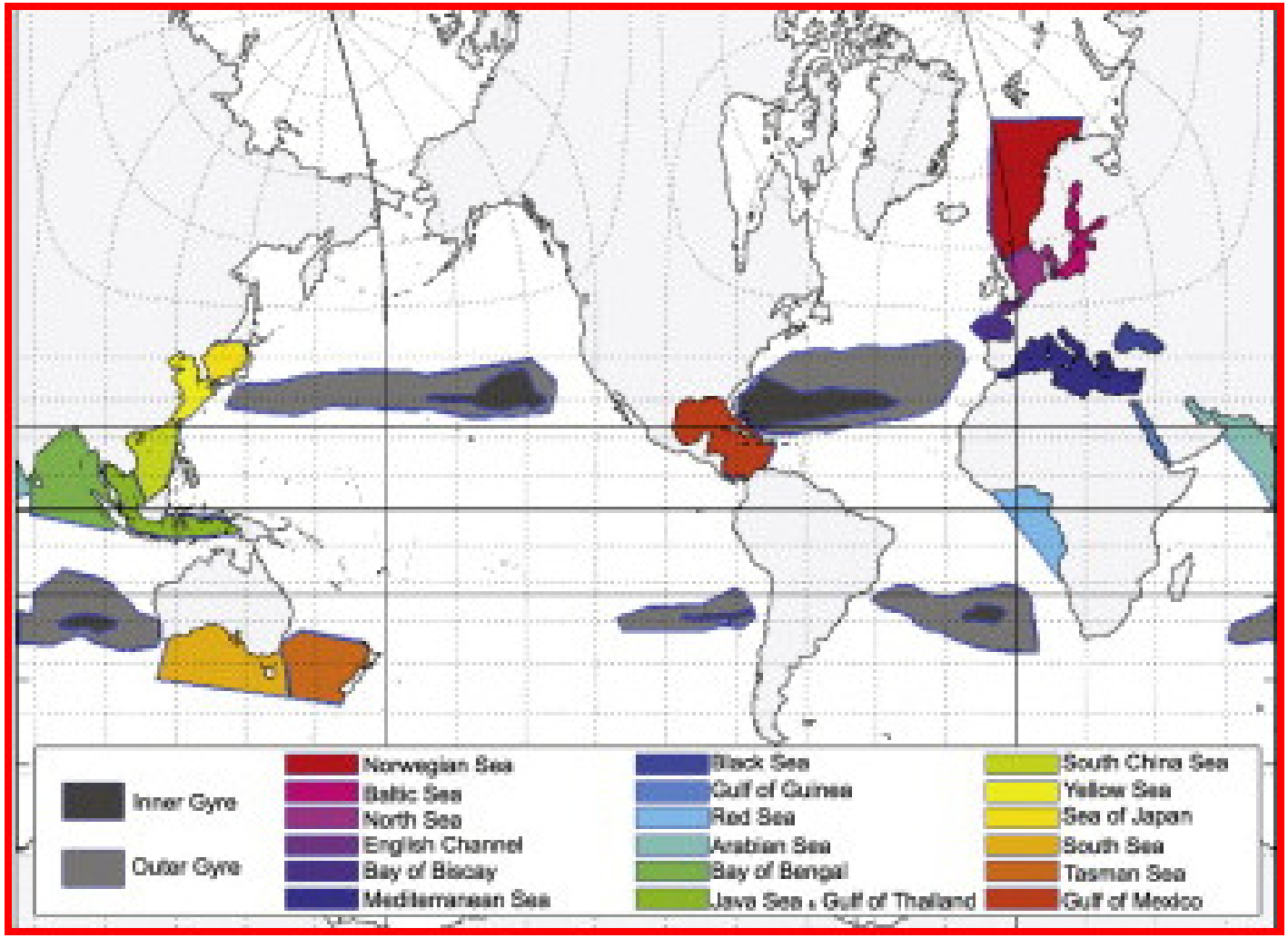
Scenario 1:
Watershed

Scenario 2:
Urban areas

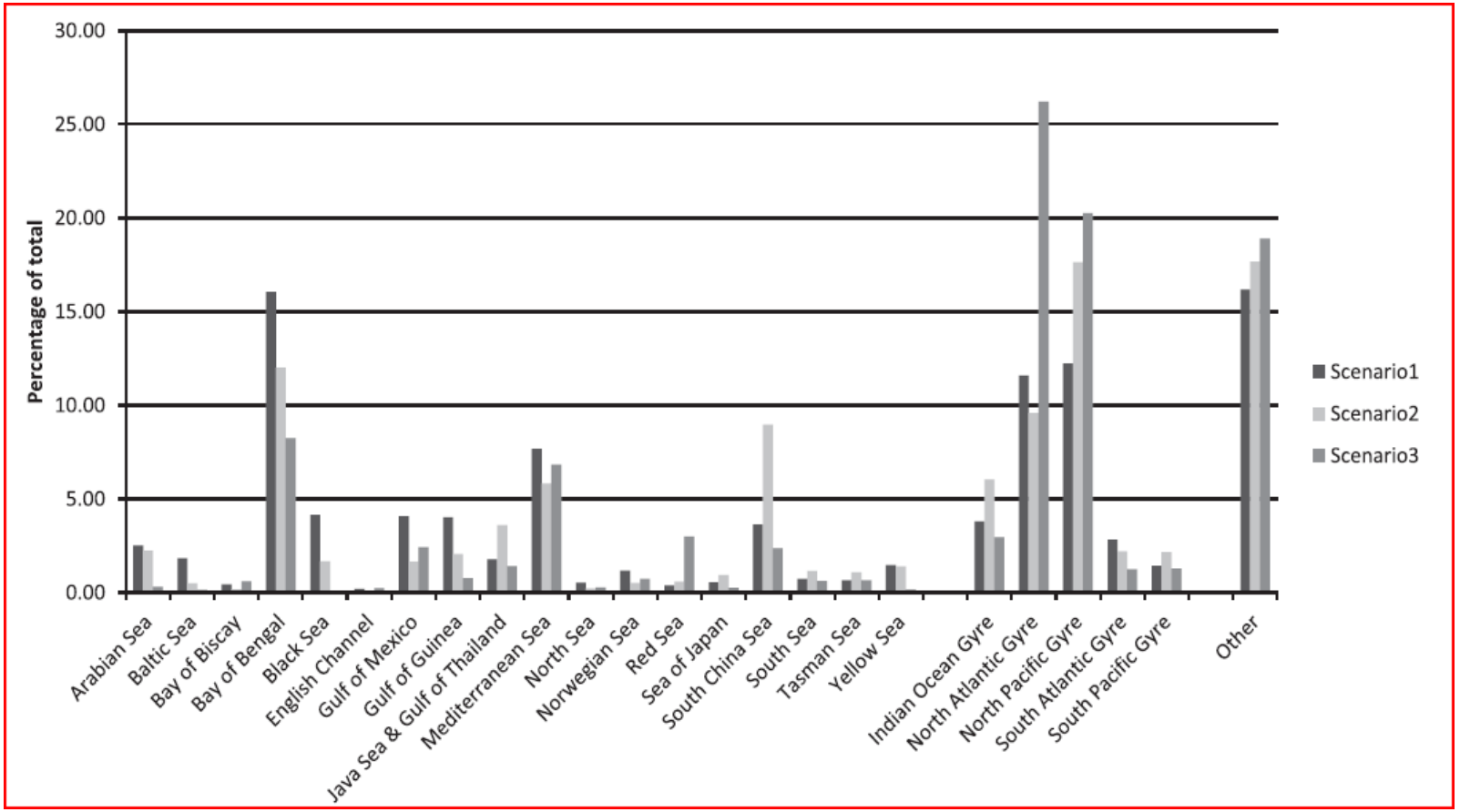
Scenario 3:
Maritime traffic



Beached particles



30 years simulation: Accumulation zones



Percentage of total number of particles existing in each accumula zone for each release scenario (after 30 years)

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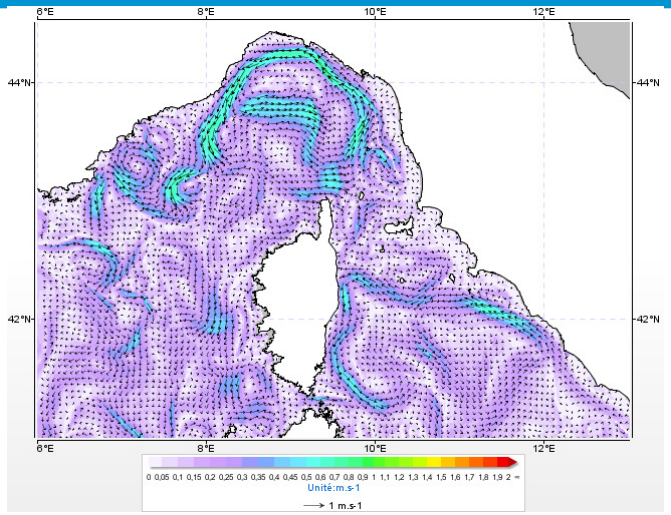
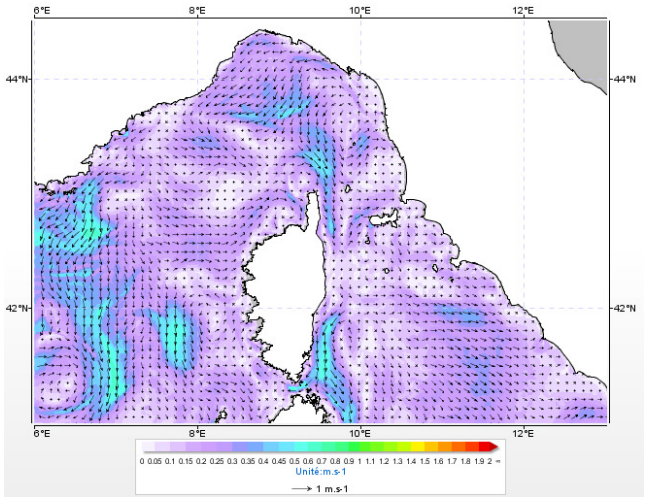
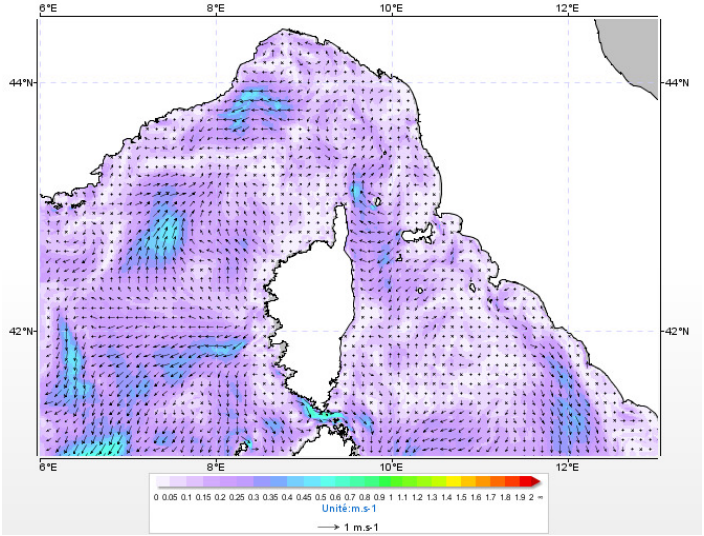


(A) 30/07/2010

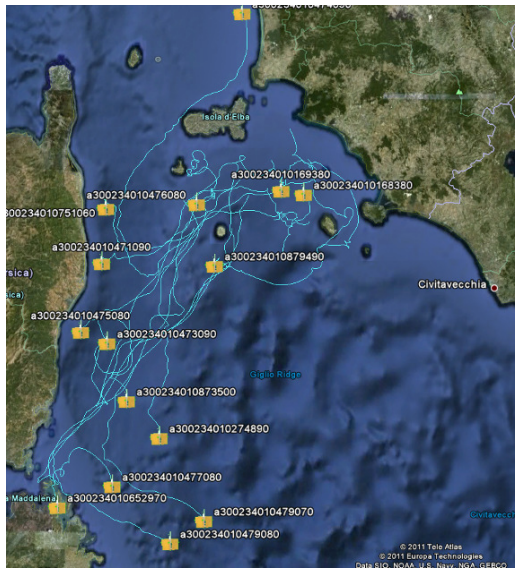


(B) 30/08/2010

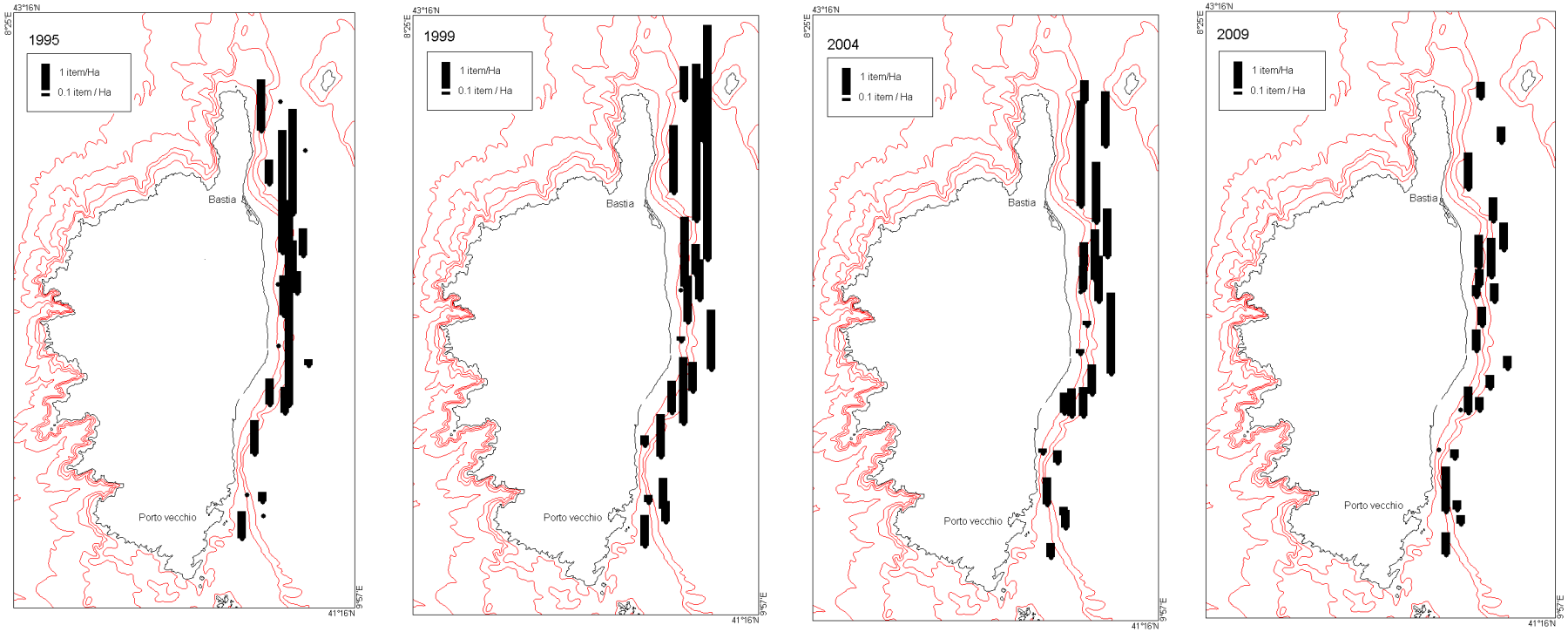
THE MEDITERRANEAN SEA: Possible transborder transportation of Litter in the MOMAR area (Data from cruise MILONGA, LaMMA, & Previmer.org)



(C) 15/12/2011



Litter on the sea bed , East Corsica (project MEDITS, 1994-2009, IFREMER)



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in progress (LIME, STELLAMARE, PERSEUS, etc.)

1. To identify and quantify the principle land- and sea-based sources of marine litter, by sector, taking account of regional differences. 3D GETM models (General Estuarine Transport Model, www.getm.eu, CEFAS) & regional models (LaMMa, IFREMER)

2. To identify the main transport pathways and model the re-distribution of floating ML.

3. To develop tools to better understand transportation of litter (gliders/camera; video imagery etc…) regard to the distribution, quantities and type of marine litter in European Seas.

Grazie per la vostra attenzione

CONSORZIO LaMMA

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