GESAMP

Science for Sustainable Oceans

The Joint Group of Experts on Scientific Aspects of Marine Protection

Pollution indicators in the marine environment – a GESAMP perspective

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PICES 2011, Khabarovsk, W3 *Pollutants in a changing ocean: refining indicator approaches in support of coastal management*.

Content - Regional & global initiatives

UN Regular Process and the 'Assessment of Assessments'

Development of pollution indicators for the UN Trans- boundary Waters Assessment Programme (TWAP)

Development of pollution targets & indicators to establish 'Good Environmental Status' in Europe's Seas

Current GESAMP 'hot topics' & emerging issues

Cautionary tale

The Joint Group of Experts on Scientific Aspects of Marine Protection

An inter-Agency body of the United Nations – providing advice & global assessments

Executive Committee

GESAMP Members
10 - 20
independent scientists

Ad hoc activities

Working group

Working group

Working group

Partners
Regional commissions
Industry
ICES
PICES
NOAA
NGOs
Foundations
etc

Pool of experts

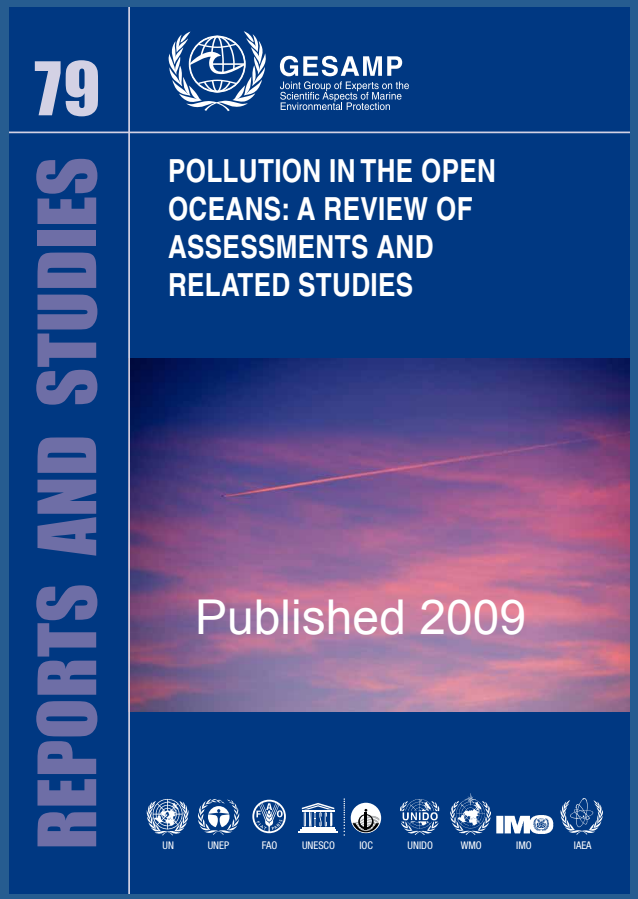
Independent experts

Current membership:
Australia, India, Mexico, Netherlands, Nigeria, Singapore, Philippines, P R China, UK, USA

Examples of GESAMP contributions to global assessments

1. UN Oceans & Law of the Sea - A **Regular Process** for global reporting and assessment of the marine environment, including socio-economic aspects (initiated in 2004) – backed by Member States

[Ad hoc Working Group of the Whole - continuing]



Number of reports/studies reviewed by GESAMP

Topic	Ocean sector			
	NA	NP	SP	global
CO_2 & SO_2 from ships	0	0	0	29
Atmos. N	13	7	2	6
Atmos. Fe, P & Co	22	10	3	8
Atmos. Zn	10	2	2	0
Marine debris	3	7	3	11
Heavy metals	28	10	3	8
VOCs	7	6	3	8
Oilspills	2	1	1	4

NA – North Atlantic, NP – North Pacific, SP – South Pacific

Examples of GESAMP contributions to global assessments

2. Trans-boundary Waters Assessment Programme (TWAP)

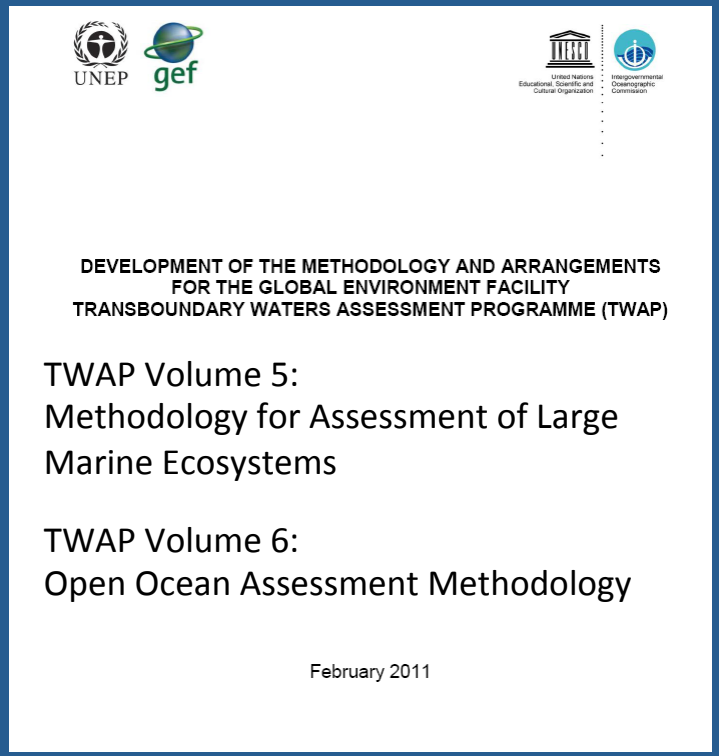
Groundwater – lakes – rivers – LMEs – open ocean

TWAP will provide a tool to assess transboundary water systems and means to improve their management. The outputs of the TWAP will respond to the need of GEF to prioritize transboundary concerns and to allocate resources more effectively. [GEF – Global Environment Facility]

Open Ocean & LME components – led by UNESCO-IOC

GESAMP helped to develop pollution indicators

TWAP Partners & Objectives



Objectives to develop:

i) *An indicator-based methodology for assessment/results tracking for each of the five categories of transboundary water systems (groundwater, lakes/reservoirs, river basins, Large Marine Ecosystems, and Open Ocean*

ii) *A partnership and institutional arrangements to conduct a global transboundary waters assessment (2012-2014)*

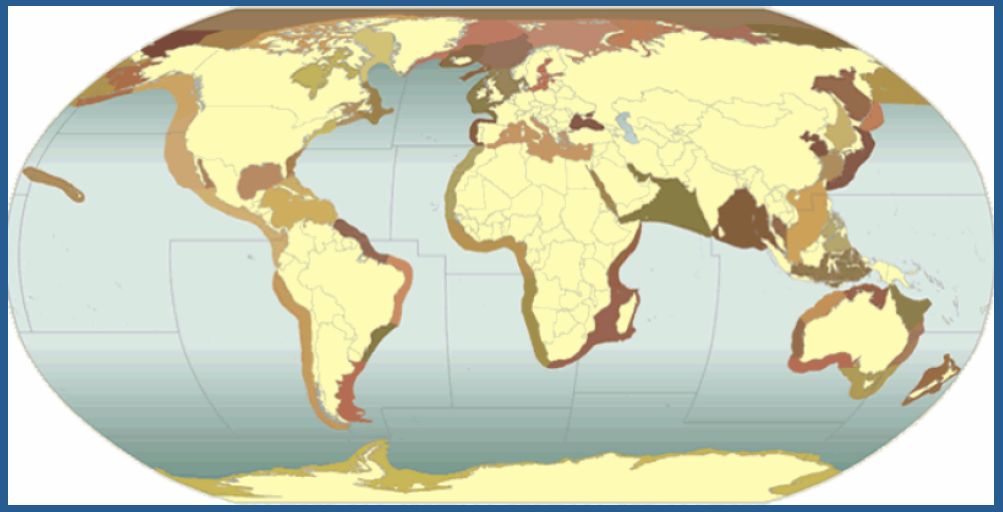
Indicators of:

- Transboundary stressors & environmental state
- Socioeconomics (drivers & impacts)
- Governance/response

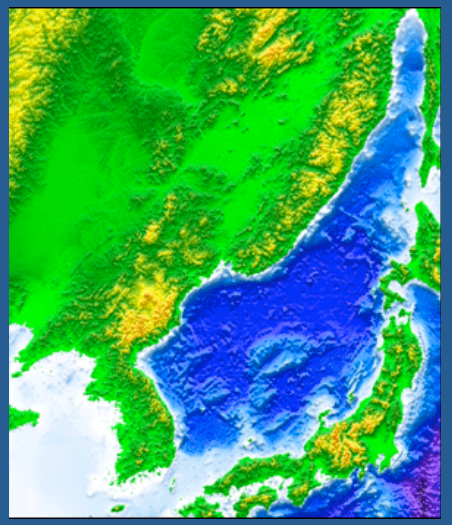
http://twap.iwlearn.org

Ocean Governance – dividing up the seas

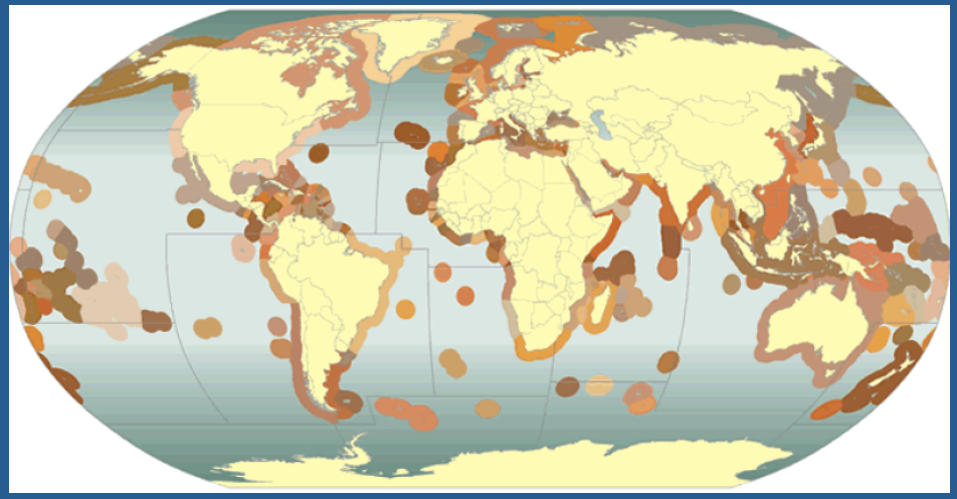
Large Marine Ecosystems (LMEs) - TWAP



UNEP Regional Seas Programme e.g. NOWPAP – NW Pacific Action Plan



Exclusive Economic Zones (EEZs) - nations



International waters outside EEZs

- UN Convention Law of the Sea
- IMO MARPOL
- London Convention & Protocol
- IMO Convention anti-fouling paints
- FAO Regional Fisheries Conventions
- IMO Ballast Water Convention
- UNEP Mercury Convention

Assessment indicators of pollution in LMEs

Indicator description

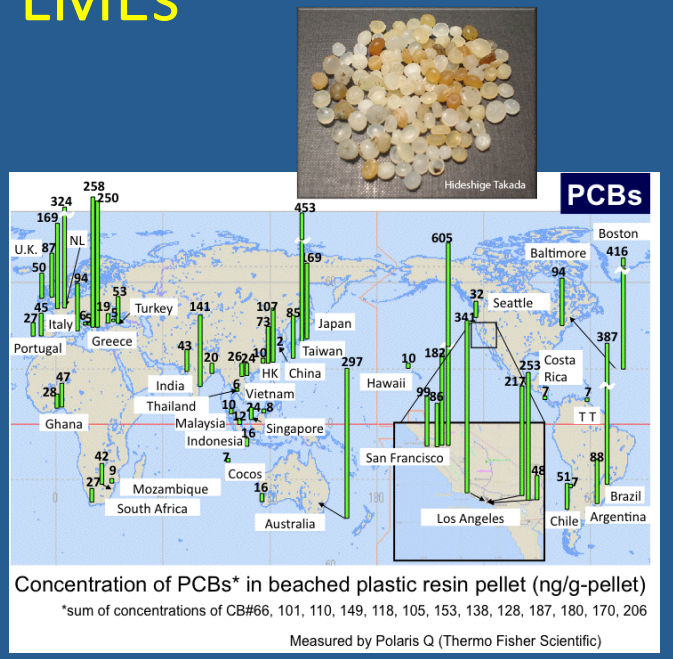
- Relevance - justification
- Methodology & data availability
- Institutions/experts – to carry out assessment

Core indicators:

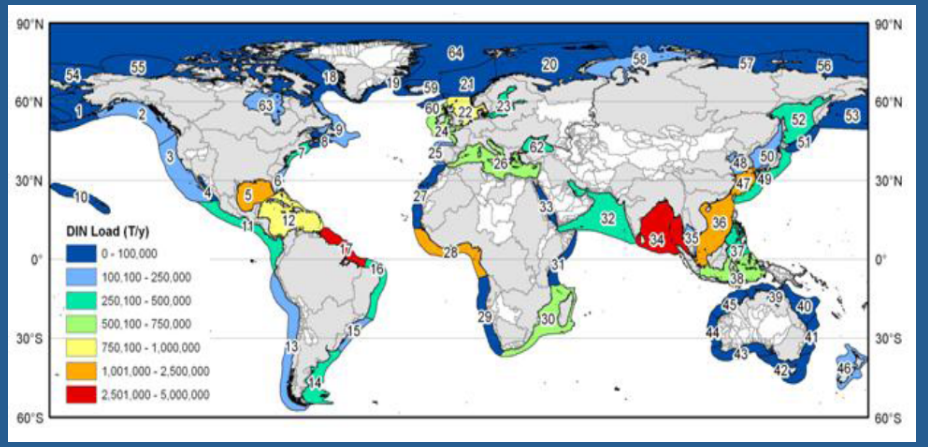
- Mercury
- POPs in plastic resin pellets
- Nutrients -
- Dissolved oxygen – negative trends

Other indicators:

- Shipping density
- POPs in marine mammals
- Cadmium & lead
- Harmful algal blooms
- Freshwater discharge
- Sediment discharge



Hideshige et al.,



Global NEWS model

Development of Methodologies for GEF Transboundary Waters Assessment Programme (TWAP)

TWAP objectives for LME assessment*

Level 1 assessment

- Global comparative assessment of all LMEs
- Current state & trends
- Supporting assessment of biodiversity & ecosystem services
- Future projections to 2030 & 2050
- Repeated every 3 – 5 years

Level 2 assessment

- Selected LMEs
- More detailed assessment
- Transboundary diagnostics
- Causal chain analysis

** Depends on funding of full-size GEF project plus significant partner support*

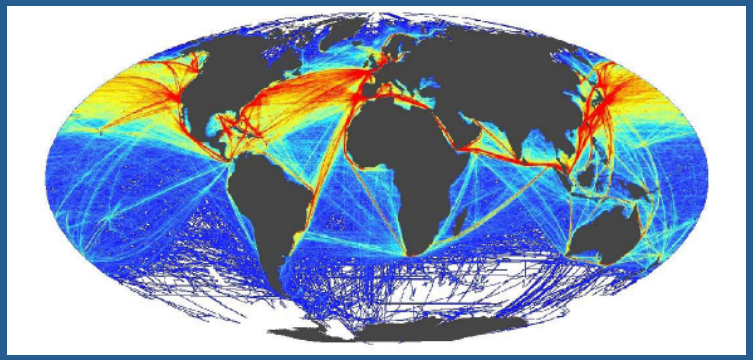
Assessment indicators of pollution in the Open Ocean

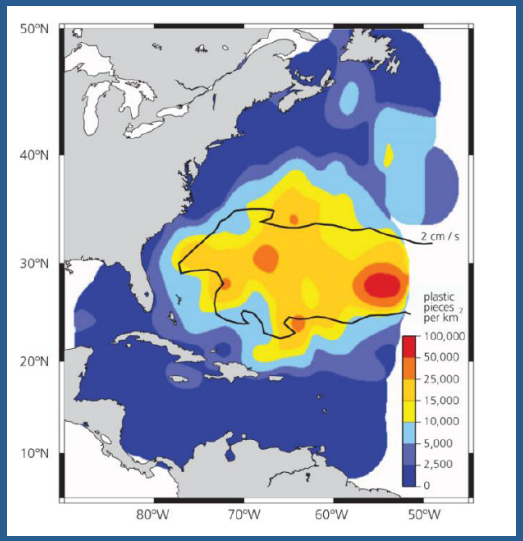
Indicator description

- Definition
- Relevance - justification
- Methodology
- Data source
- Partners
- References

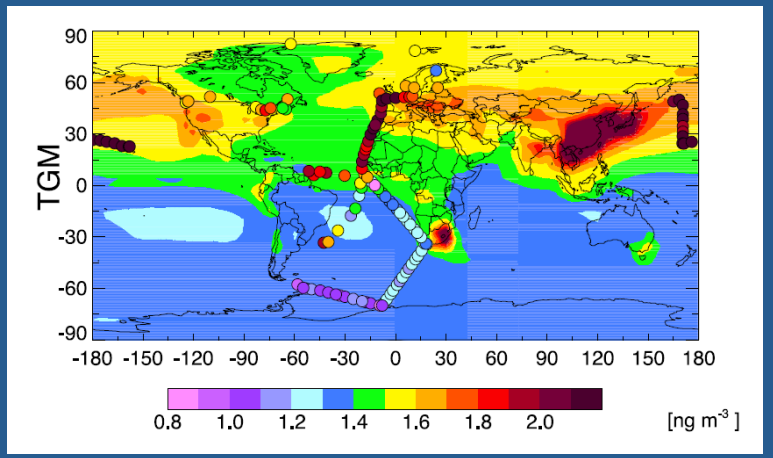
Core indicators:

- Shipping intensity
- Plastic marine debris concentration
- Seabed mining claims
- Atmospheric nitrogen deposition
- Atmospheric mercury deposition





Time-averaged concentration of plastic pieces in surface waters, Law et al., 2010



Annual average gaseous Hg in surface air, Selin et al., 2008

Regional assessments – examples from Europe

Regional assessments – examples from Europe

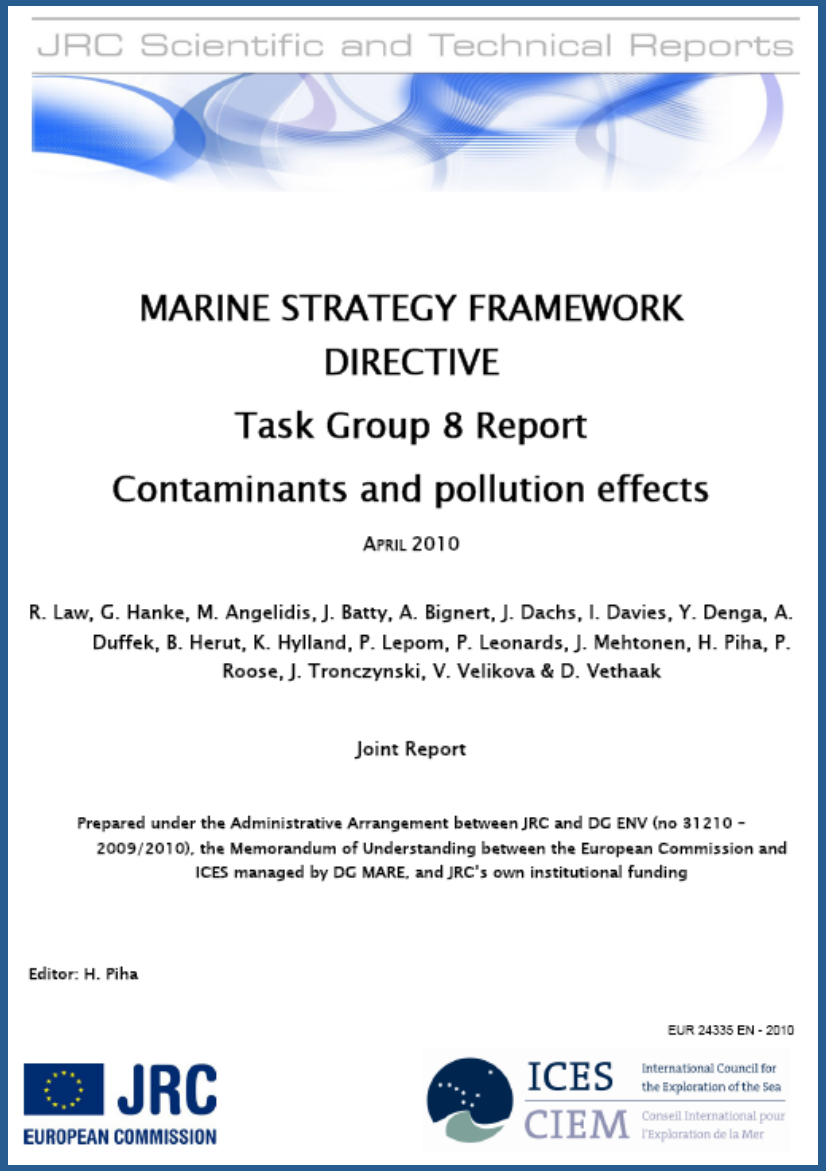
Directives from the European Commission – implemented by the 27 Member States in national law

- Habitats Directive
- Birds Directive
- Nitrates Directive
- Urban Wastewater Treatment Directive
- Water Framework Directive (water quality in freshwater, nearshore & estuaries)
- Marine Strategy Framework Directive (Good Environmental Status)

Regional Sea Commissions

- OSPAR – NE Atlantic (Oslo & Paris Conventions)
- HELCOM – Baltic Sea (Helsinki Convention)
- UNEP-MAP – Mediterranean Action Plan (Barcelona Convention)
- Black Sea Commission

Development of pollution targets & indicators for Europe's Seas – to establish Good Environmental Status*



JRC Scientific and Technical Reports

MARINE STRATEGY FRAMEWORK DIRECTIVE

Task Group 8 Report

Contaminants and pollution effects

APRIL 2010

R. Law, G. Hanke, M. Angelidis, J. Batty, A. Bignert, J. Dachs, I. Davies, Y. Denga, A. Duffek, B. Herut, K. Hylland, P. Lepom, P. Leonards, J. Mehtonen, H. Piha, P. Roose, J. Tronczynski, V. Velikova & D. Vethaak

Joint Report

Prepared under the Administrative Arrangement between JRC and DG ENV (no 31210 – 2009/2010), the Memorandum of Understanding between the European Commission and ICES managed by DG MARE, and JRC's own institutional funding

Editor: H. Piha

EUR 24335 EN - 2010

JRC EUROPEAN COMMISSION

ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

Descriptors of GES:

1. Biological diversity
2. Non-indigenous species
3. Commercially exploited fish & shellfish
4. Food webs
5. Eutrophication
6. Seafloor integrity
7. Alteration of hydrographic conditions
8. Contaminants & pollution effects
9. Contaminants in fish & other seafood
10. Litter
11. Energy & noise

* Target date 2020

http://www.ices.dk/projects/projects.asp#MSFD

MSFD Descriptor 8: contaminants and pollution effects
Recommended target levels:

Concentrations of contaminants* in water, sediment and/or biota are below environmental target levels identified on the basis of ecotoxicological data;

Levels of pollution effects are below environmental target levels representing harm at organism, population, community and ecosystem level;

Concentrations of contaminants in water, sediment and/or biota, and the occurrence and severity of pollution effects, should not be increasing.

* Based on priority list of hazardous substances

Recommendations now being considered by national Governments for implementation

Hazardous substances of priority concern* for Europe's Seas:

- Heavy metals – mercury, cadmium & lead (copper, chromium, nickel)
- Organotin compounds – tributyltin
- Chlorobenzenes
- PCBs, dioxins – dioxins, furans, specific PCB cogeners, hexachlorobenzenes
- Volatile organic compounds – chlorinated solvents
- Brominated flame retardants – HBCD, PBDE
- Perfluorinated compounds – PFOS, PFOA
- Nonyphenol
- Octylphenol
- Chlorinated paraffins – short-chain chlorinated paraffins, chloralkanes
- PAHs – e.g. anthracene, pyrene, naphthalene, benzopyrene
- Organophosphorous compounds
- Pesticides – organohalogens (DDT), hexachlorocyclohexane (HCH), aldrin etc
- Chlorinated phenolics – pentachlorophenol
- Radioactive substances

* Based on Stockholm Convention plus Regional Seas Conventions: OSPAR (NE Atlantic), HELCOM (Baltic Sea), UNEP-MEDPOL (Mediterranean Sea)

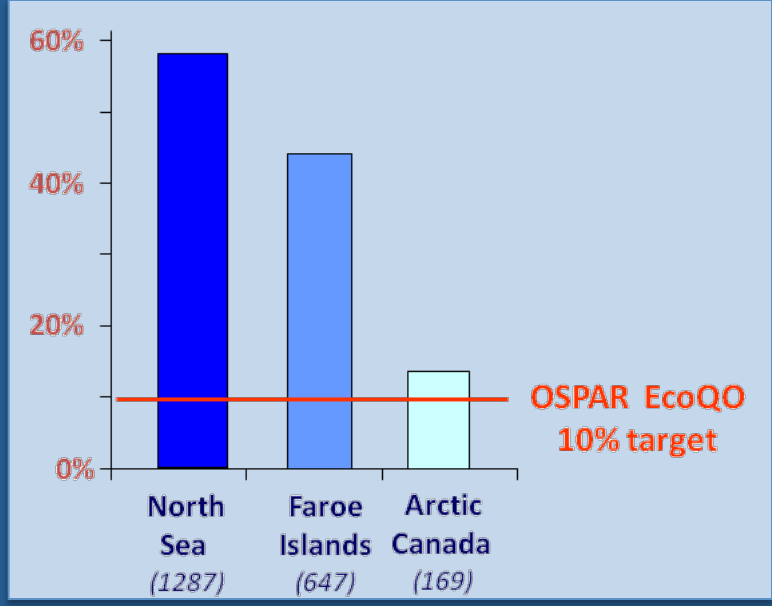
MSFD Descriptor 10 - litter

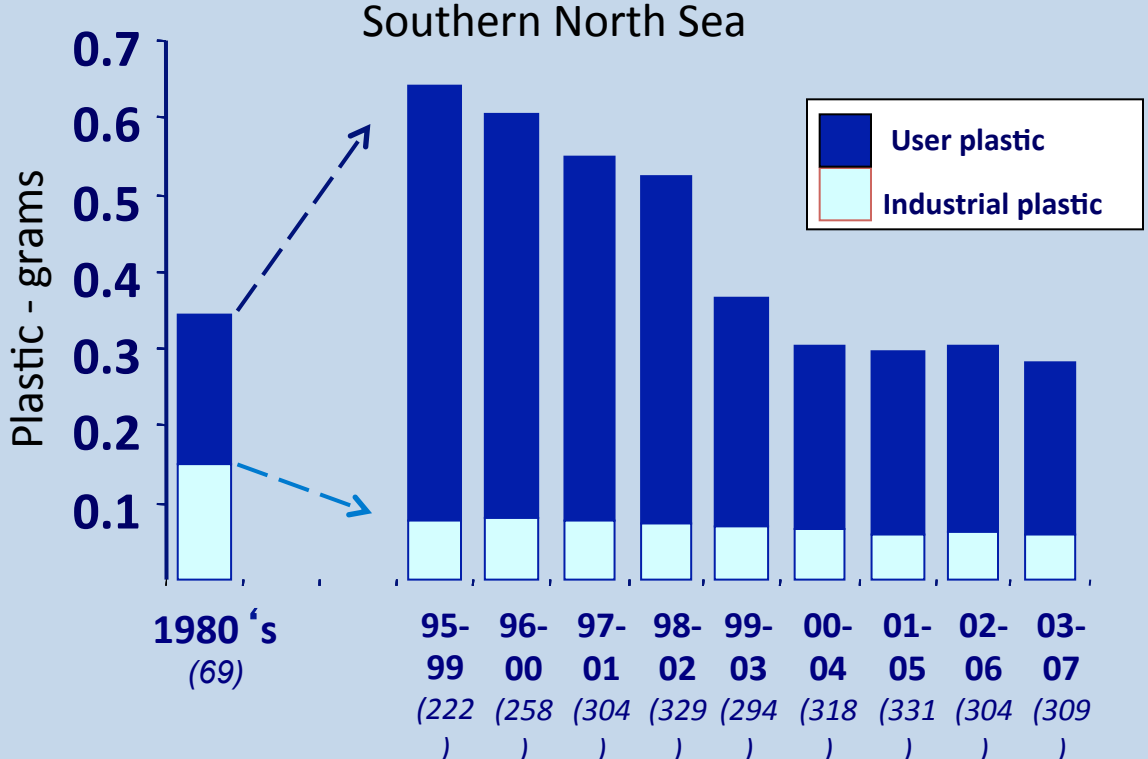
Example of existing indicator & target

Based on OSPAR Ecological Quality Objective

target is <10% of birds with > 0.1 g plastic in stomach

Northern Fulmar
Fulmarus glacialis





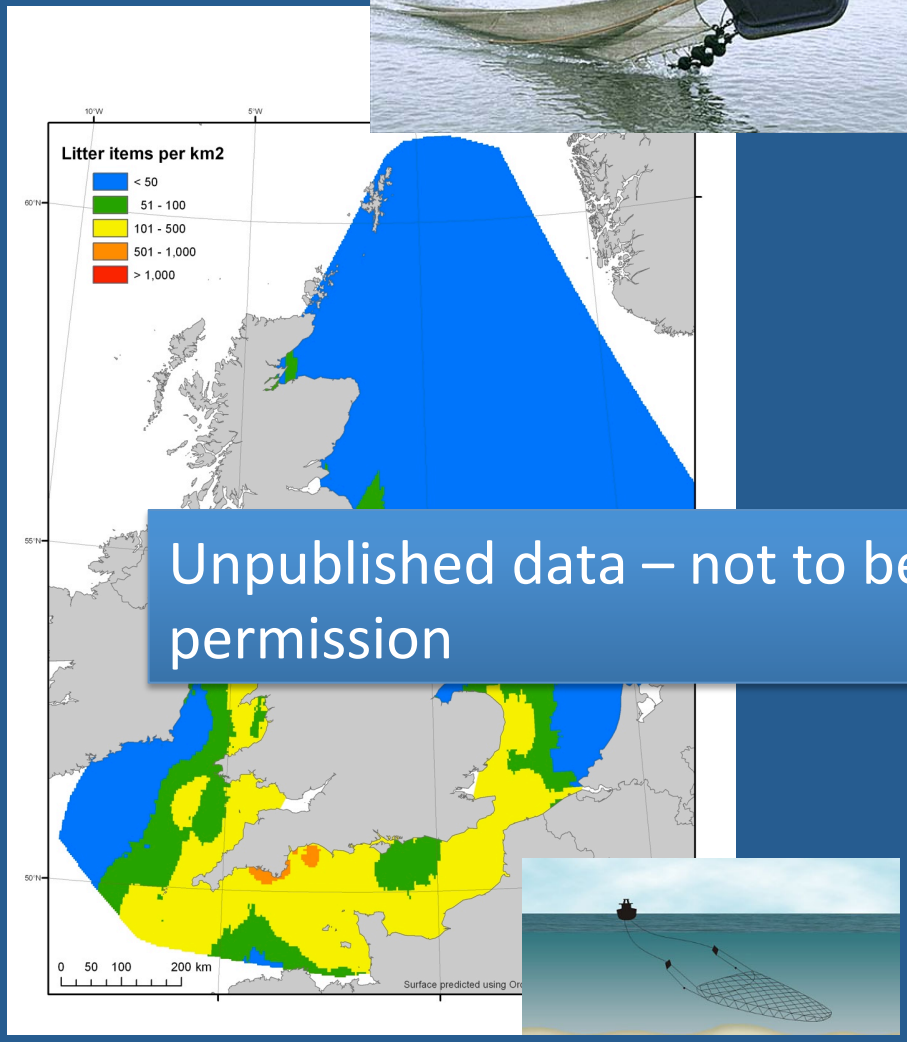
(Mallory et al., 2006, 2008; Provencher et al., 2009)

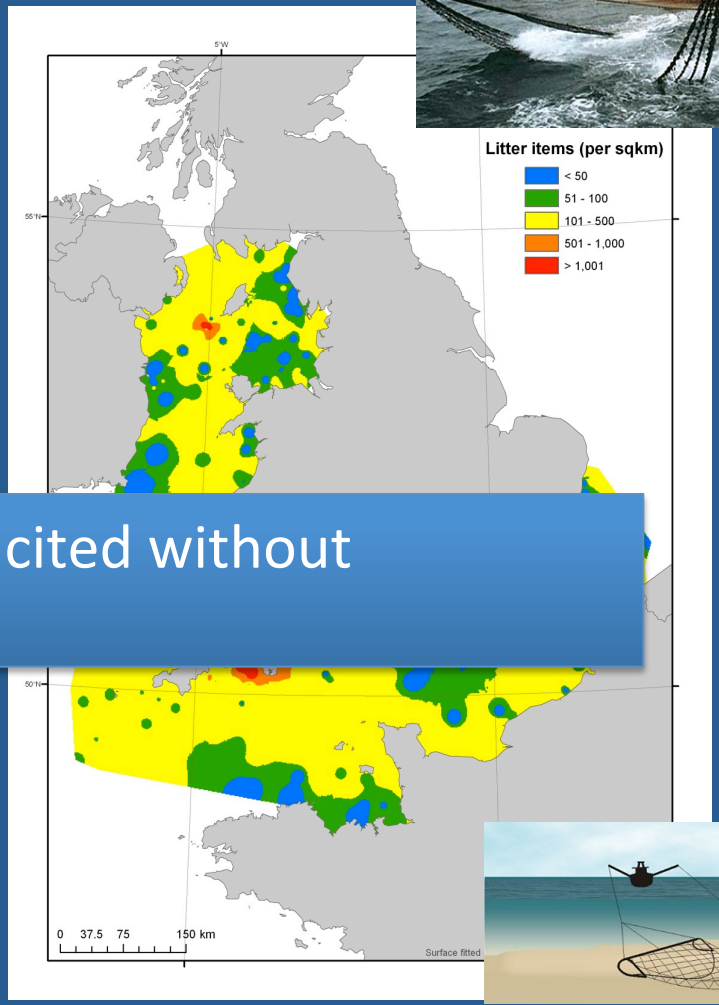
Jan van Franeker, IMARES

Seabed litter indicator – monitoring using fisheries surveys

Otter trawl

Beam trawl





Unpublished data – not to be cited without permission

Litter data – Maes & Niclaus, 2011

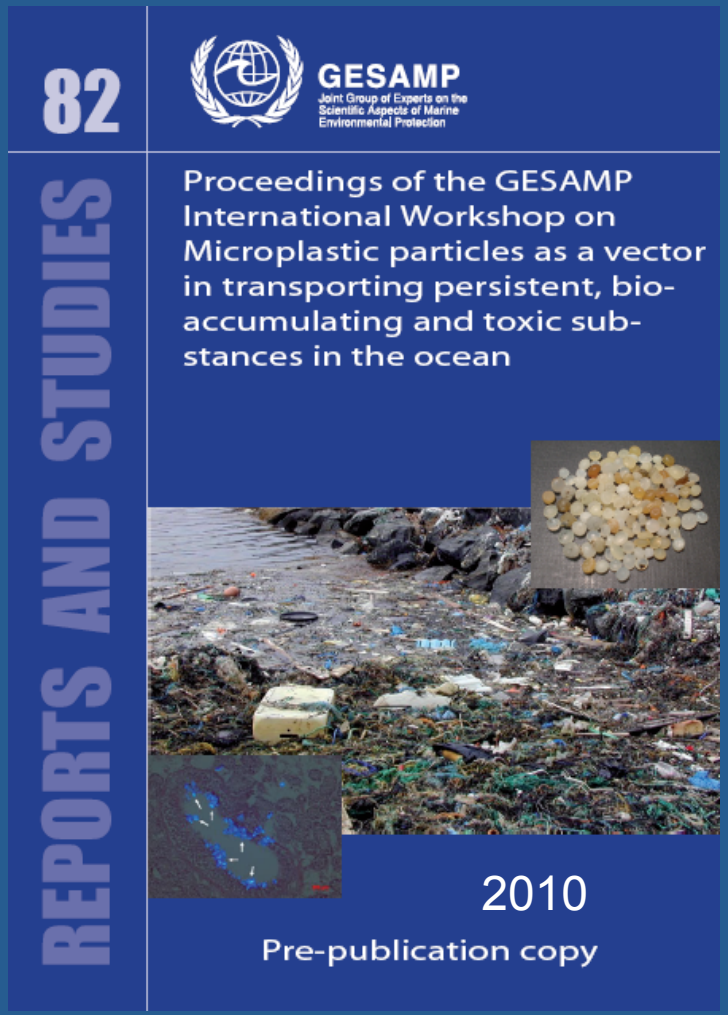
Images - www.ecomare.nl

GESAMP Emerging issues

1. micro-plastics & pollutants
2. Bio-magnification of pollutants

GESAMP Working Group 40: Sources, fate & effects of micro-plastics in the marine environment (2011 – 2015)

Lead sponsors: IOC & IMO;
additional sponsors: UNEP, UNIDO, NOAA, PlasticsEurope, American Chemistry Council)



Overall objective: to conduct a global assessment of the sources, fate and effects of micro-plastics in the ocean, based on existing information. This is to include the potential physical effects of ingested micro-plastic particles as well as potential effects of chemicals present within the plastic (e.g. additives) or as absorbed contaminants (e.g. PCBs).

GESAMP Working Group 40: Sources, fate & effects of micro-plastics in the marine environment (2011 – 2015)

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Terms of Reference

1st Phase

1. Estimate rates of inputs of micro-plastics (resin pellets, abrasives, personal care products) and plastics (including main polymer types); involves developing methodology, using monitoring data, identifying proxies(e.g. population centres, shipping routes, tourism revenues)
2. Modelling transport, distribution & areas of accumulation

2nd Phase

3. Processes (physical, chemical & biological) controlling the rate of fragmentation and degradation, including estimating long-term behaviour
4 Modelling continues using results of ToR 3

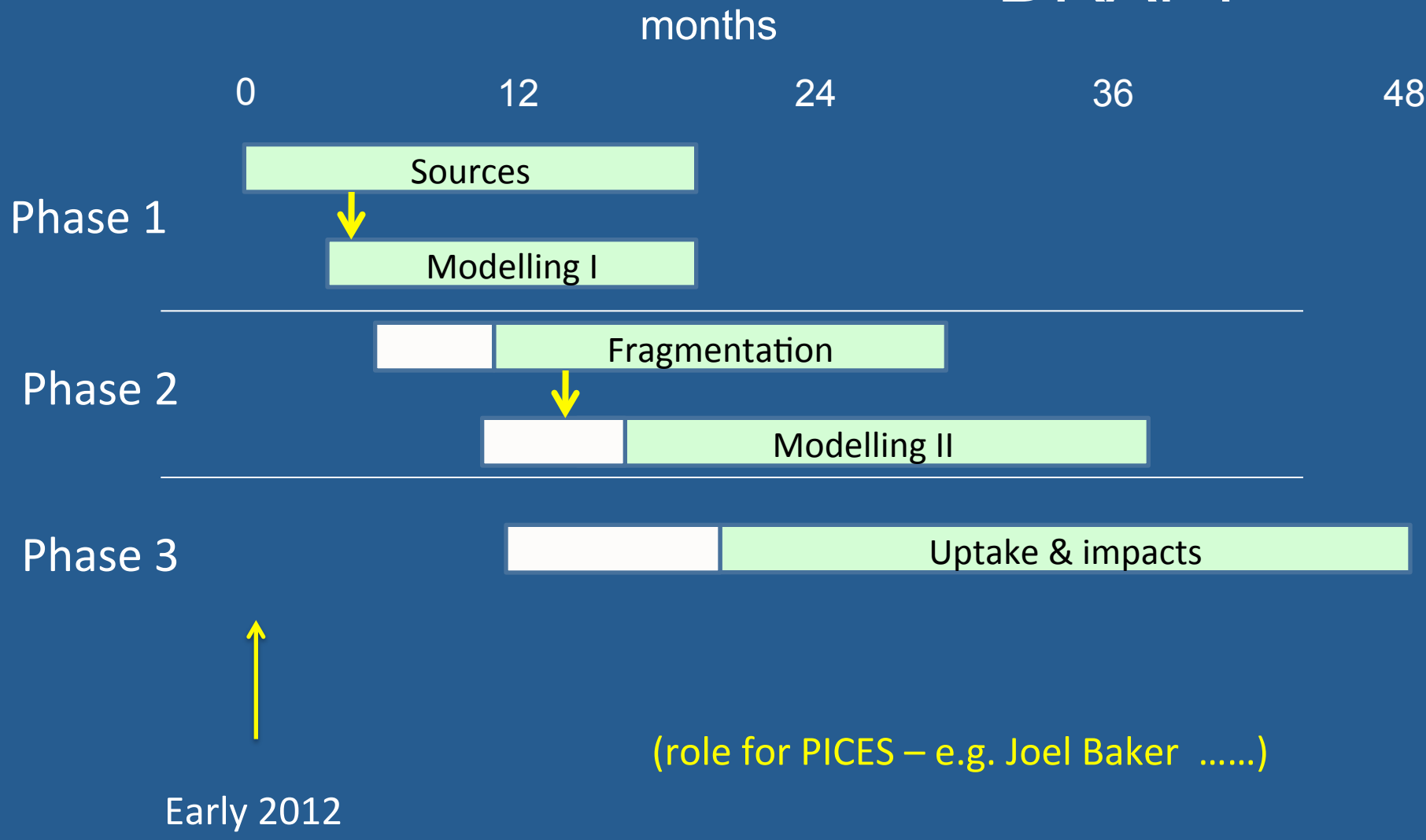
3rd Phase

5. Uptake by biota and biological impacts

DRAFT

WG40 – potential time-frame

DRAFT

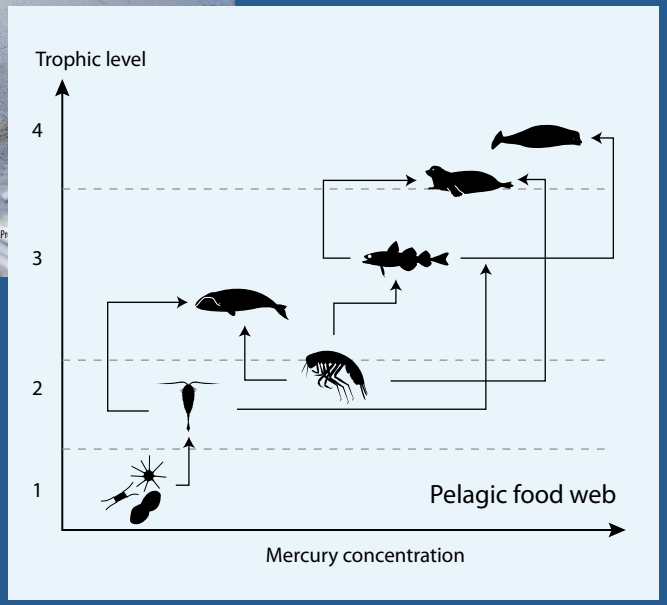


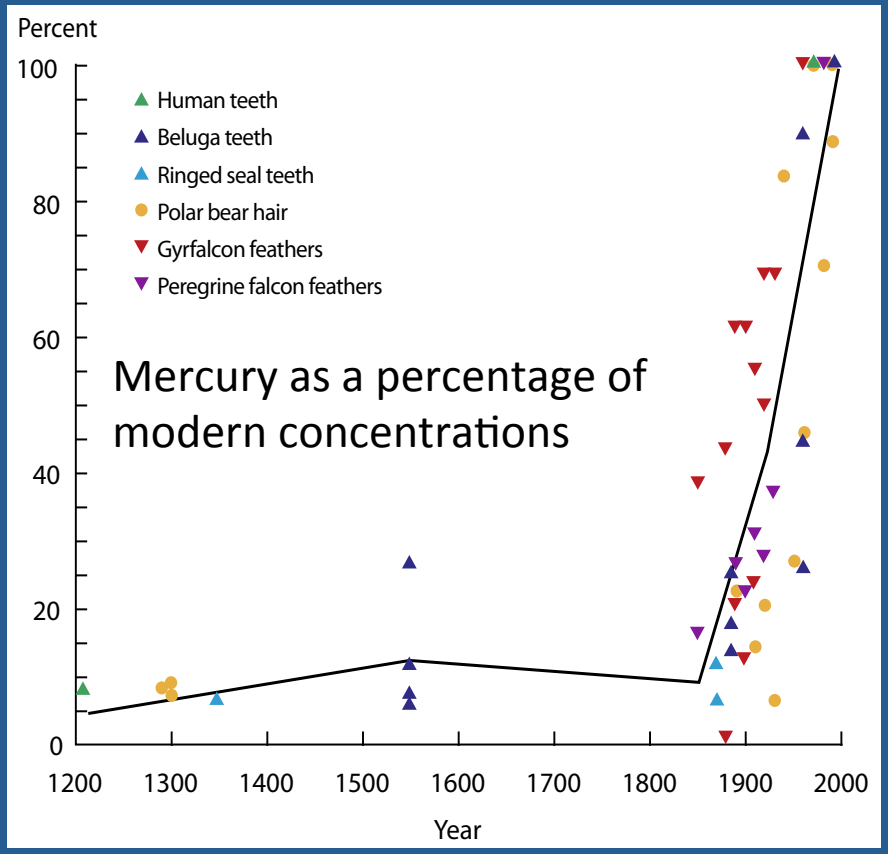
GESAMP emerging issues: Bio-magnification of mercury and other persistent pollutants in top predators (including humans)

GESAMP scoping paper on 'Bio-magnification …..' May 2011

Planning workshop planned for early 2012 – CIESM, GESAMP, FAO, WHO + ….
Potential links with PICES, ICES, AMAP

www.amap.no





Conclusions

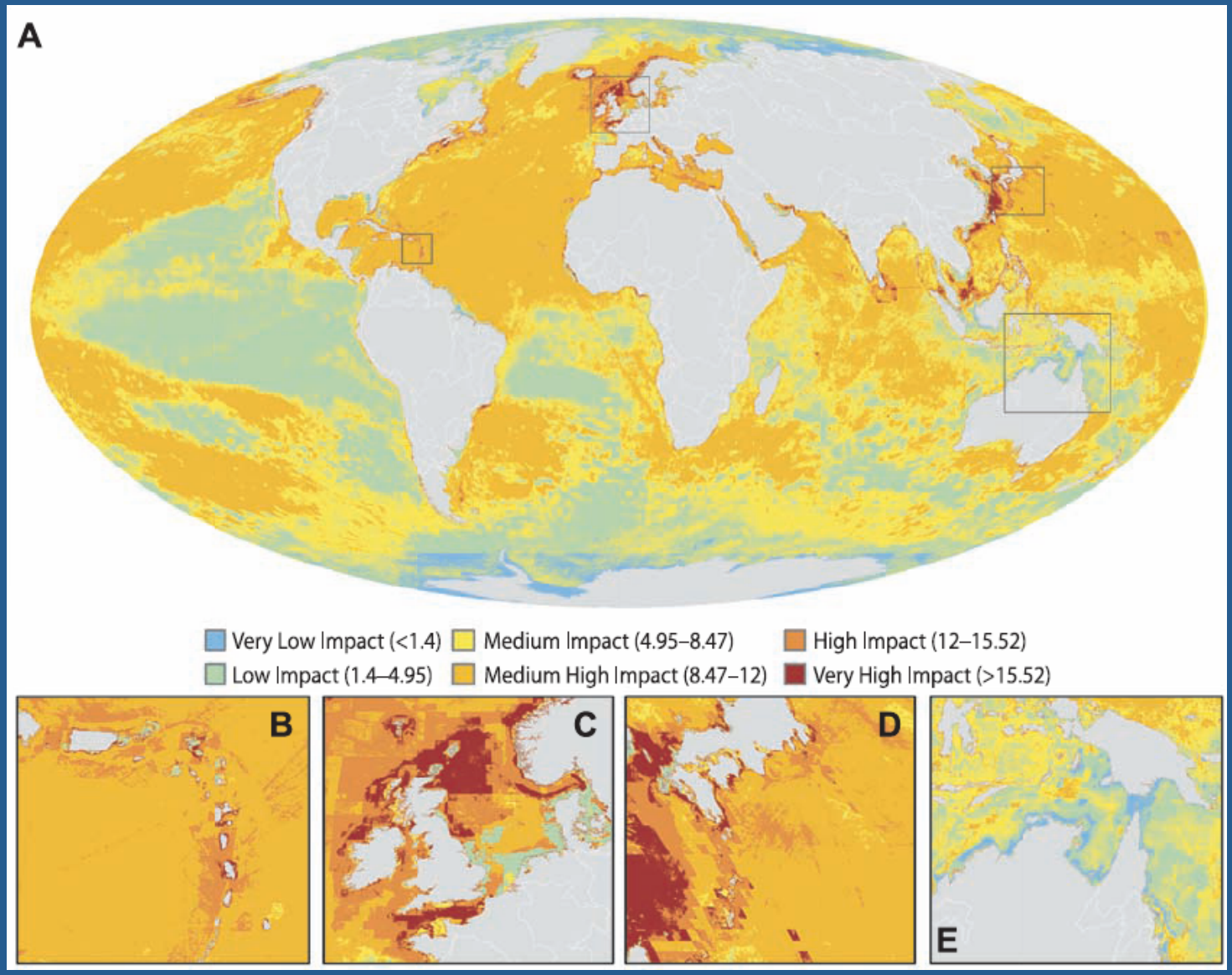
1. Pollution indicators methodologies developed for the TWAP for global assessment LMEs & Open Ocean – will be applied to PICES region

2. Descriptors of pollution (plus indicators & targets) being developed in Europe to define 'Good Environmental Status' in national/regional context – approach could inform PICES-led assessment

3. Indicators need to be linked to pressures & hence measures (e.g. input reduction)

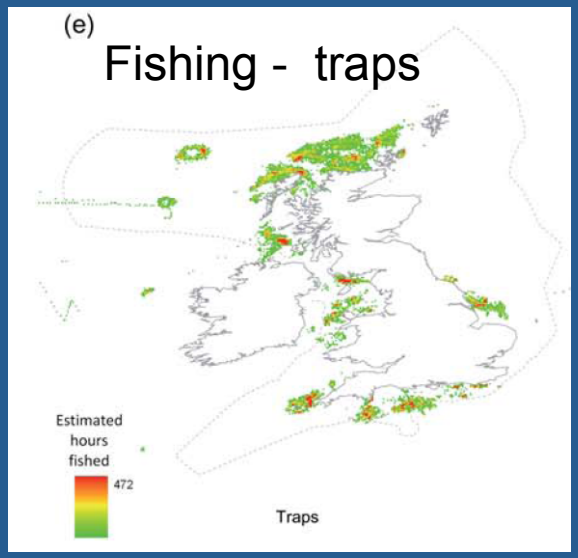
4. New GESAMP initiatives on micro-plastics & bio-magnification – encourage PICES involvement

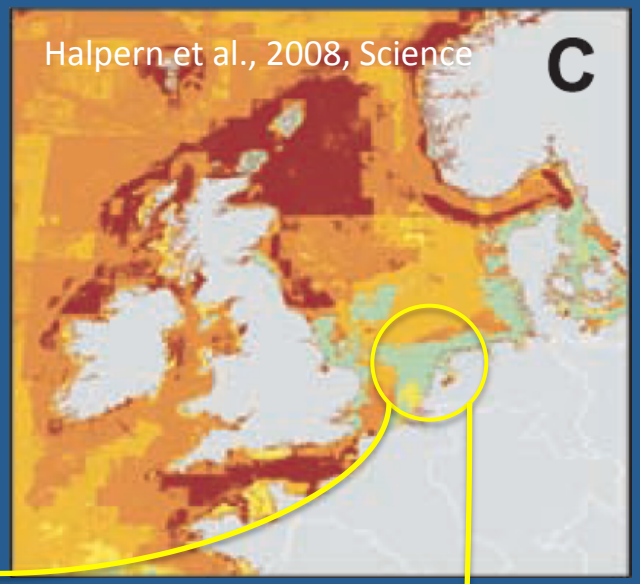
Indicators of cumulative human 'impact' vs activity

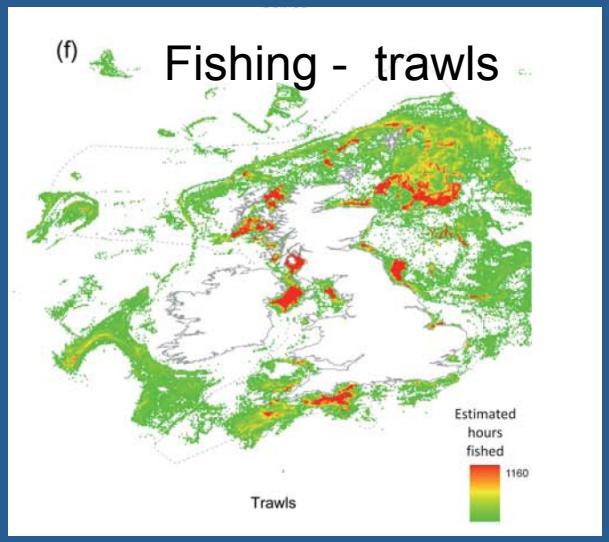


Halpern et al., 2008, Science

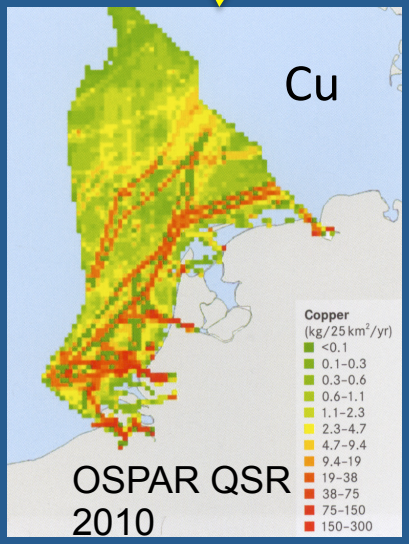
Distribution of human influence & impacts is patchy

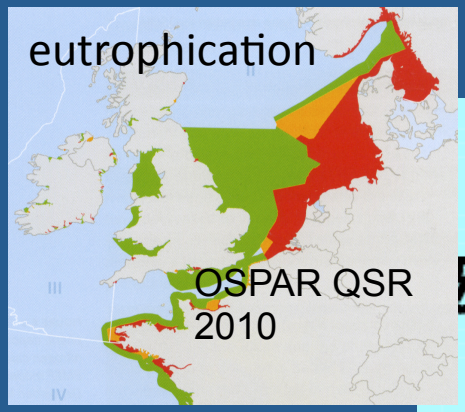


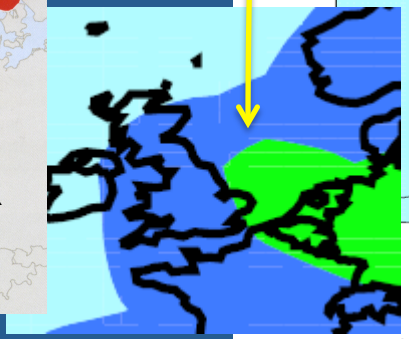


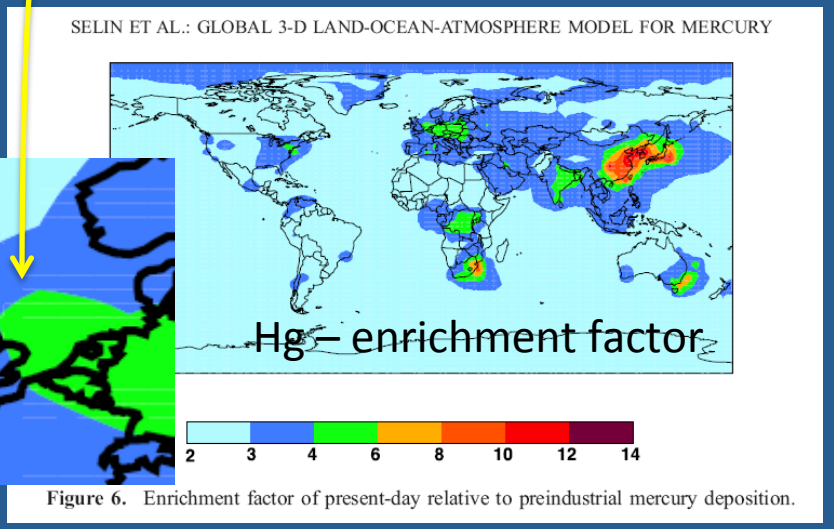


Very Low Impact (<1.4) | Medium Impact (4.95–8.47) | High Impact (12–15.52)
Low Impact (1.4–4.95) | Medium High Impact (8.47–12) | Very High Impact (>15.52)

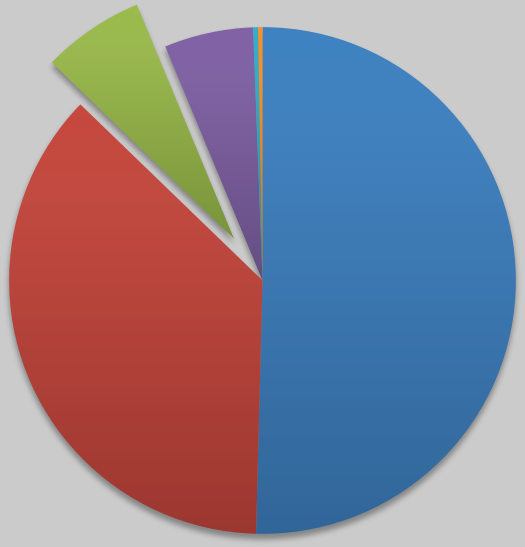




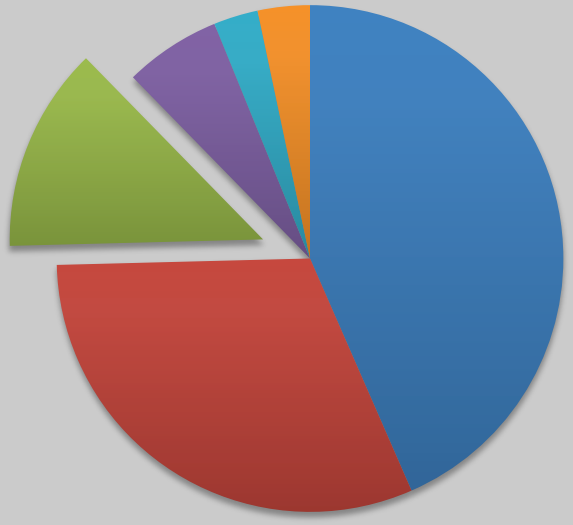




‘Threat’ scores of human impact – based on Halpern et al., 2009



Global



Coastal

Public perception of the marine environment

Public perceptions in Europe – '*When you are thinking about the coastline or the sea, what are the three most important environmental matters that come to mind?*'

www.clamer.eu

n = 10,106 respondents

Buckley, Pinnegar, Dudek & Arquati, 2011

Thank you for your attention

www.gesamp.org

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