

Marine Litter – Scope and Nature & Results of the „International Conference on Prevention and Management of Marine Litter in European Seas“



@ dpa & www.reluma.de

Stefanie Werner

German Federal Environment Agency (UBA)

www.umweltbundesamt.de

stefanie.werner@uba.de



Umwelt
Bundesamt

Factor human being

Nature, Volumen 502, 10/13:

1900: 220 million people in urban areas:
< 300.000 tons of daily waste

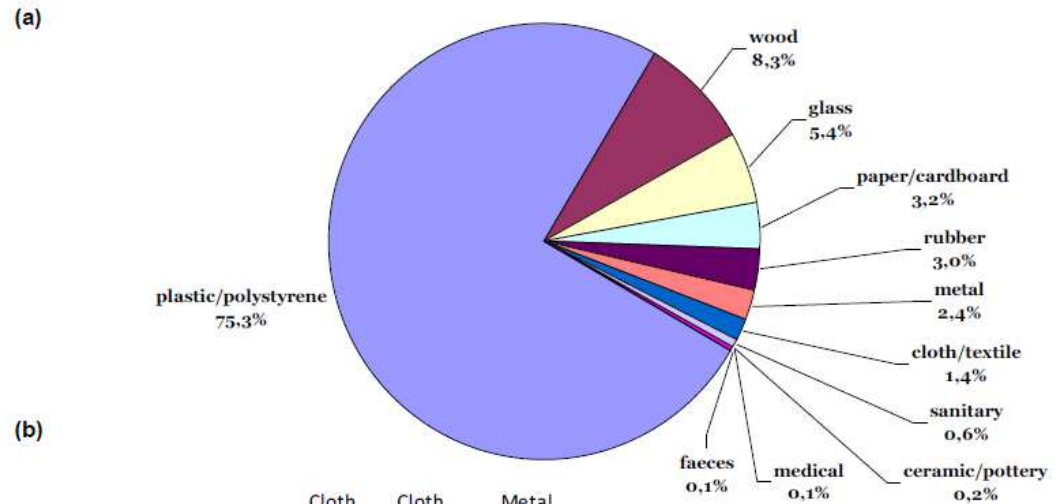
2025: 5.8 billions people anticipated in cities globally:
~ 6 million tons of daily waste



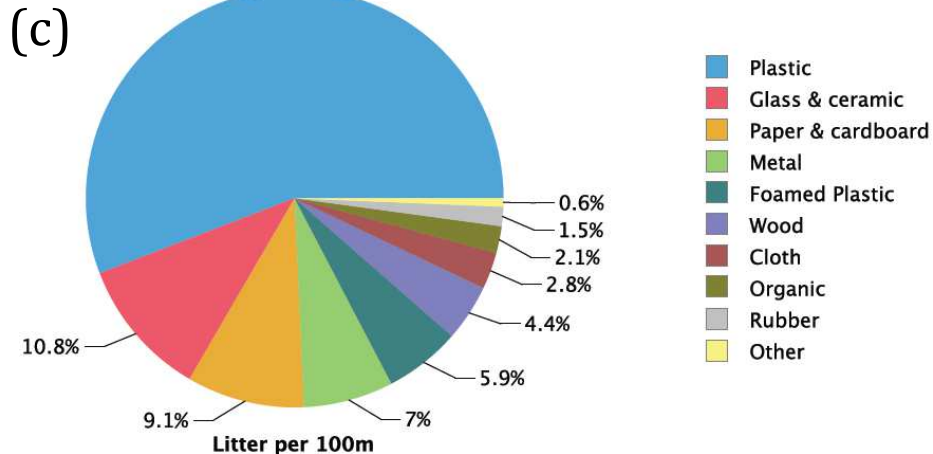
River Citarum (Jakarta, Indonesia)
@ <http://dornob.com>

Marine litter – Predominance of plastics

- a) OSPAR-beach litter monitoring **Southern North Sea** (2002-2008)
- b) ICC-campaign **Mediterranean** (2002-2006)
- c) MARLIN-project **Baltic Sea** (2011-2014)



Proportion of marine litter (all measures since start)



- Plastic
- Glass & ceramic
- Paper & cardboard
- Metal
- Foamed Plastic
- Wood
- Cloth
- Organic
- Rubber
- Other

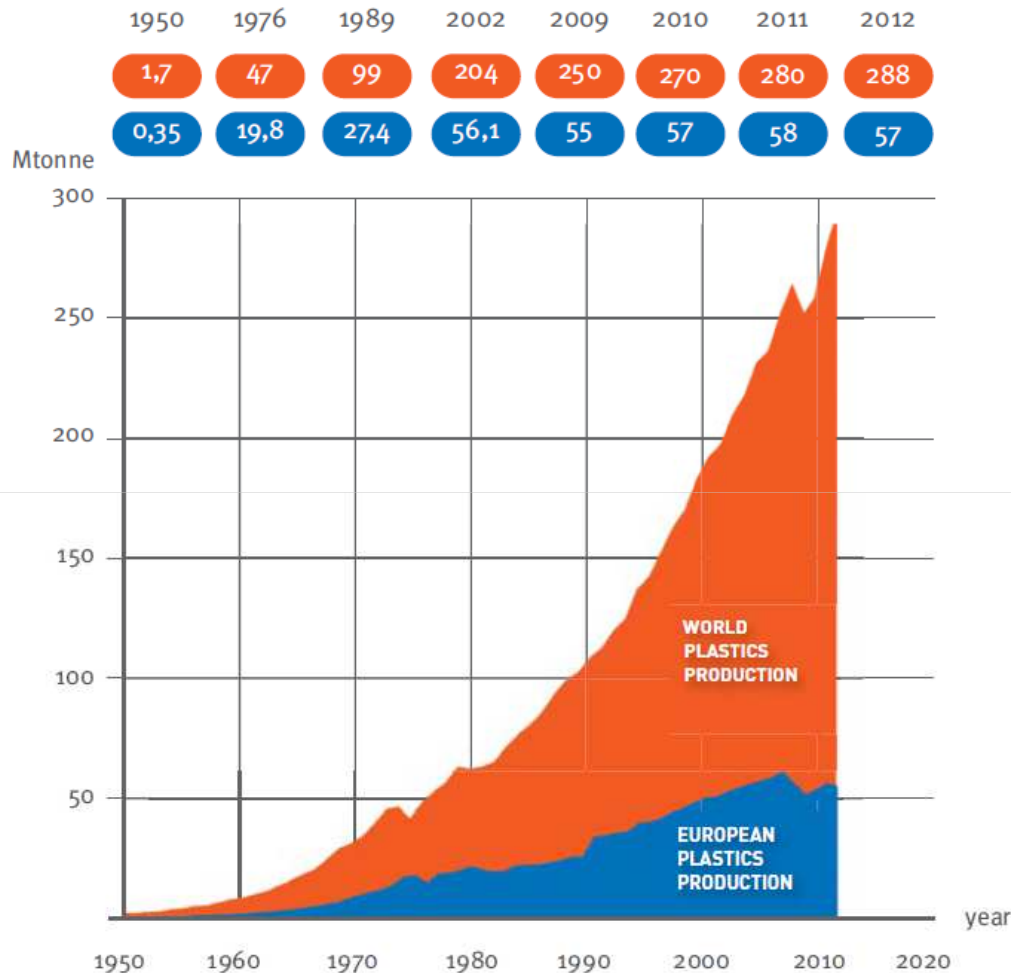
Degradation times of marine litter

WIE LANGE BRAUCHT DER MÜLL IM MEER UM ABGEBAUT ZU WERDEN?



World plastics production

World plastics production grows



With continuous growth for more than 50 years, global production in 2012 rose to 288 million tonnes – a 2.8% increase compared to 2011.

However in Europe, in line with the general economic situation, plastics production decreased by 3% from 2011 to 2012.

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-fibers

Source: PlasticsEurope (PEMRG) / Consultic

Life cycles of plastics: Recovery and waste

Plastics value chain: “an overview”

The diagram below shows the main steps in the life cycle of plastics – from converter demand to disposal and recovery. Converter demand reached 45.9 million tonnes in 2012. 25.2 million tonnes of plastics ended up in the waste stream in 2012. In 2012, post-consumer plastics waste volumes stayed at the same level as the year before.

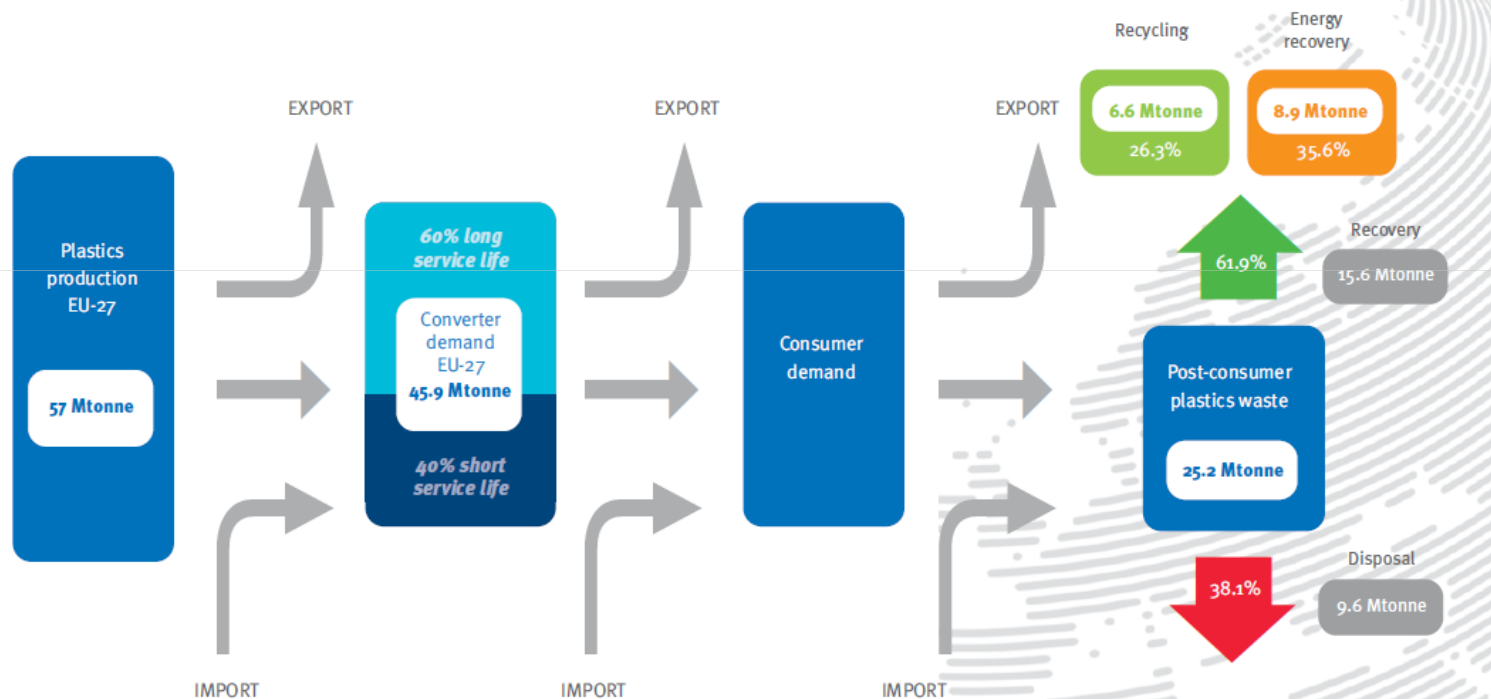


Figure 10: Life cycle of plastics in 2012 (EU-27+N/CH)
Source: PlasticsEurope (PEMRG) / Consultic

Annual plastic waste in Europe = 9,6 million tonnes

Plastics frequently detected in the marine environment



@S. de Wolf (EcoMare)



@shiftethos.com

Gear-related plastics

- Polyethylene
- Polypropylene
- Nylon
- Polyester

Packaging-related plastics

- Polyethylene, polypropylene
- PVC
- Polyester
- Polystyrene (styrofoam)



@BBC



@S.Narvikk, iStockphoto

Sources/Pathways

Sea (ocean)-based sources of marine litter (SSL)	Land-based sources of marine litter (LSL)
Waste from vessels	Individual actions
<ul style="list-style-type: none"> • Merchant shipping (cargo, equipment, etc.) • Naval and research vessels • Private vessels (pleasure) • Public vessels (cruise liners, ferries) 	<ul style="list-style-type: none"> • Littering in general (inland and coastal) • Littering caused by tourism (recreational visitors to the coast) • Events (e.g. charity, fly balloons)
Fishing activities	Facilities and construction
<ul style="list-style-type: none"> • Fishing vessels • Abandoned, lost or otherwise discarded fishing gear (fishing nets, ropes and light sticks) • Aquaculture installations 	<ul style="list-style-type: none"> • Industrial or manufacturing outfalls (e.g. by-products, plastic resin pellets) • Construction and demolition sites • Harbours (Seaport, commercial port, fishing port, ferry port etc.)
	<ul style="list-style-type: none"> • Ship-breaking yard • Agriculture activities
Other structures	Municipalities
<ul style="list-style-type: none"> • Legal and illegal dumping at sea; • Offshore oil and gas platforms, and drilling rigs 	<ul style="list-style-type: none"> • Litter and waste generated in coastal and inland zones from improper waste management • Wastes from dumpsites located on the coast or riverbanks • Untreated municipal sewerage
Transport of litter and waste	Transport of litter and waste (on land or on waterways)
<ul style="list-style-type: none"> • Natural events (tsunamis, storm, strong sea) 	<ul style="list-style-type: none"> • Rivers and floodwaters; • Discharge from storm water drains / sewer; • Natural storm related events (e.g. mistral, tornadoes, hurricanes)

Regional sources

Nordostatlantik	Maritime activities (fishing, shipping) und land-based recreational activities/tourism (40% each) plus input of municipal waste via rivers and canals und other solid waste via industrial facilities, land fills and sewage systems along the coasts
Baltic Sea	Domincance of consumer related waste with high share from recreational activities/tourism, input via rivers and along the coasts, fisheries as most important sea-based source
Schwarzes Meer	Lack of data, indications of dominance of municipal wastes, effluents from poorly managed land fills, other important sources are maritime transport, harbours, recreational activities and fisheries
Mittelmeer	Around 40-50% consumer waste from recreational acitivites/tourism mainly on land, approximately another 40 % municipal waste, most important sea-based source fisheries

Where does marine litter end up?



@<http://blog.agquahealth.com>; Garry Bell Corbis & <http://coastalcare.org>

Some numbers on marine litter pollution

Thompson 2006, Wright 2013:

Up to 10 percent of plastics produced worldwide end up, remain & accumulate in the worlds oceans

NOAA: **100 Million tonnes** already present

Annual input

World Ocean Review 2010: **6,4 million tonnes**

COM (2013) 123 final: up to **10 Mio. tonnes**

UNEP 2005: **1/10** of it = abandoned and lost fishing gear

CBD 2012: 2 kinds of litter mainly responsible for negative interaction with marine life:
Remains of packaging material & fishing gear

UNEP 2011: **13.000 plastic particles** per per km² sea surface



@Jan van Franeker (IMARES)

Remains of fishing gear

Fishery	Estimated length of ghost nets/ year/km	Percentage of nets used lost/year	Number of nets lost	Pieces of netting lost
Swedish net fisheries	156.1	0.1	1448	
UK net fisheries	36		325	884
Spanish net fisheries			~5500	
French Mediterranean fisheries	6.25			
French North and West Brittany fisheries	5.49			
French North sea and East Channel	5.5			
Selected Norwegian net fisheries		> 0.1	685	
Total	209.24		7958	
Deep water net fisheries	1254		25,080	

@www.noaa.org



@ Brown & Macfayden 2007

Ecological impacts



- **Ingestion:** 43% of all cetaceans, all sea turtles, 36% of sea birds, many fish and invertebrates
- **Entanglement:** frequently reported for 136 marine species
- **Transport** of non endemic species in new habitats (thereunder invasive species and algae with toxic blooms)
- **Hardening** of benthic substrate & **smothering** of benthic symbiotic communities
- **40 % increase** since 1997– 280 publications, 663 species – 76% in relation to plastics (CBD 2012)



@ S. Werner (UBA), S. de Wolf (EcoMare), P. Quint

Example Northern Fulmar – North Sea

- Small relative of Albatross
- Colonies e.g. in Ireland, Scandinavia, Iceland and Faeroes
- More than 95 Prozent dead found birds have plastics in their stomachs, in average 31 pieces (0,3 gramm)



@J. van Franeker (IMARES), www.forthseabirdgroup.org

Impacts from microplastics

@www.bund.net



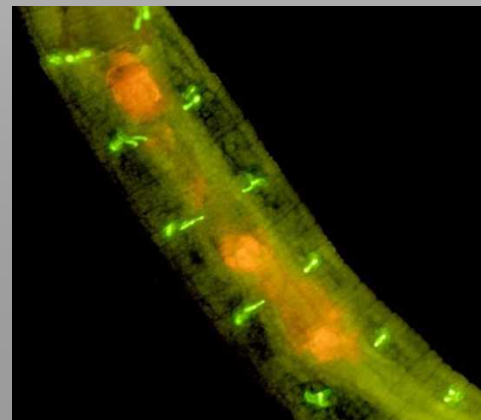
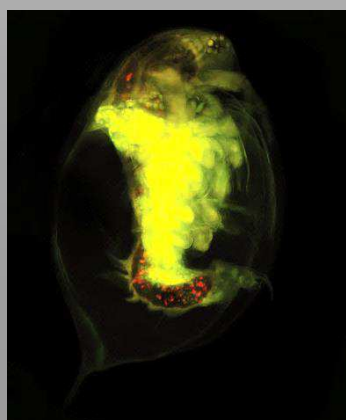
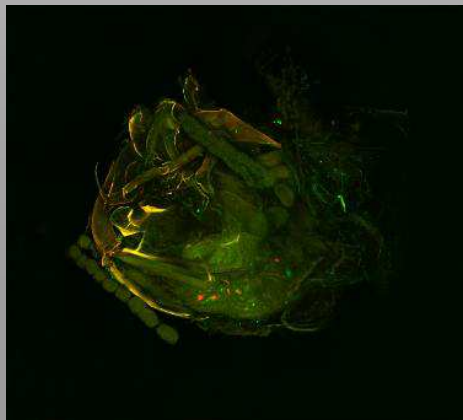
Morphology of particles: fibres, fragments and granulates

Size **1.6 μm - 5 mm**: **Large micro-plastics**: 1-5 mm and **small micro-plastics** : < 1mm (EU TG ML)

Northwest Mediterranean: Ratio mesozooplankton to microplastics **2:1**

North-Pacific Gyre: Ratio mesozooplankton to microplastics **1:6**

Ubiquitous pelagic and benthic distribution: bio-available for organisms at the basis of the marine food web, who ingest randomly and are therefore particularly affected, e.g. planktonic organisms and commercially exploited fish species in their larval state , ingestion reported for **more than 250 species** in all marine compartments, e.g.:



@ C. Laforsch,
Universität Bayreuth

Risks

Many polymers are inert, but:

- Mechanical injuries in digestive tract remain an issue
- Additives can be toxic or hormonal effective
- Persistent organic pollutants (POPs) can absorb on the surface and potentially be ingested by marine organisms in an increased dosage
- Plastics are a potential vector for invasive species and pathogens



@ Zan Dubin

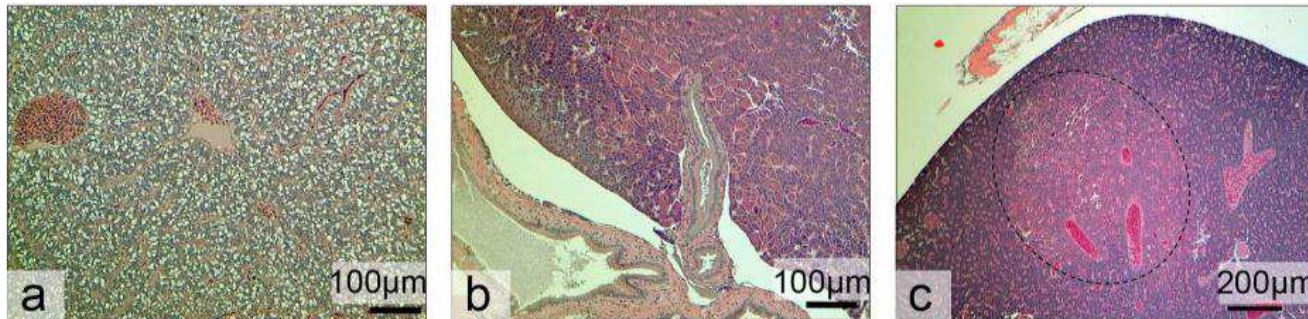


Figure 4 | Liver Histopathology in medaka sampled after 2 months. Micrographs show livers that are glycogen-rich from the control treatment (a) and glycogen-depleted from the virgin-plastic (b) and the marine-plastic treatment (c). An eosinophilic focus of cellular alteration, a precursor to a tumor, was observed in one fish from the virgin-plastic treatment (b). The circle highlights eosinophilic (pinkish coloration) hepatocytes, approximately twice as large as the basophilic (blue coloration) glycogen-depleted hepatocytes. The progression of neoplastic hepatocytes is evidence by the presence of a tumor, a hepatocellular adenoma, in one fish from the marine-plastic treatment (encircled in panel c).

@ Rochman et al., 2013

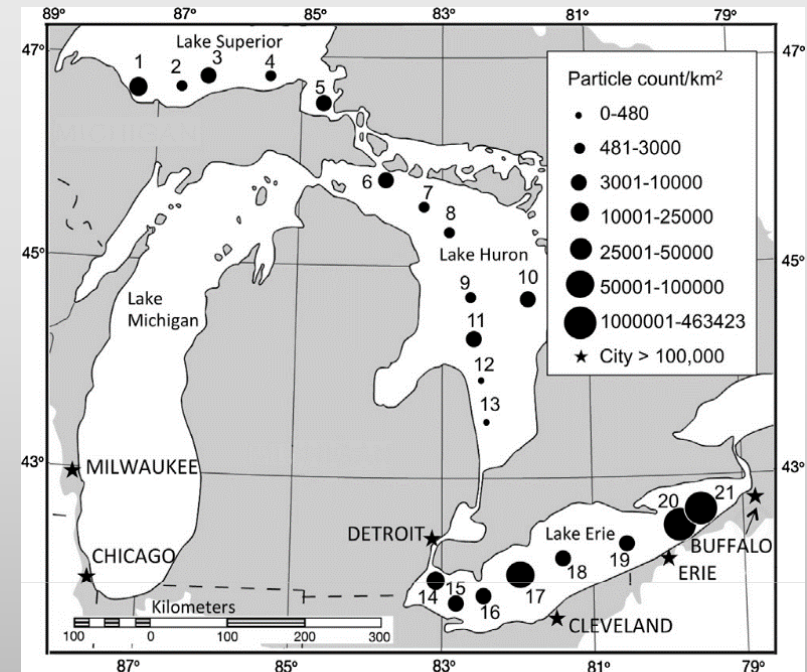
Findings of plastics in freshwater systems

Eriksen, M. et al. (2013) – Neuston samples „Great Lakes“: Average of 43.000 microplastic partikel per km²

Free, C.M. et al. (2014) – High pollution with microplastics in large remoted mountain lake

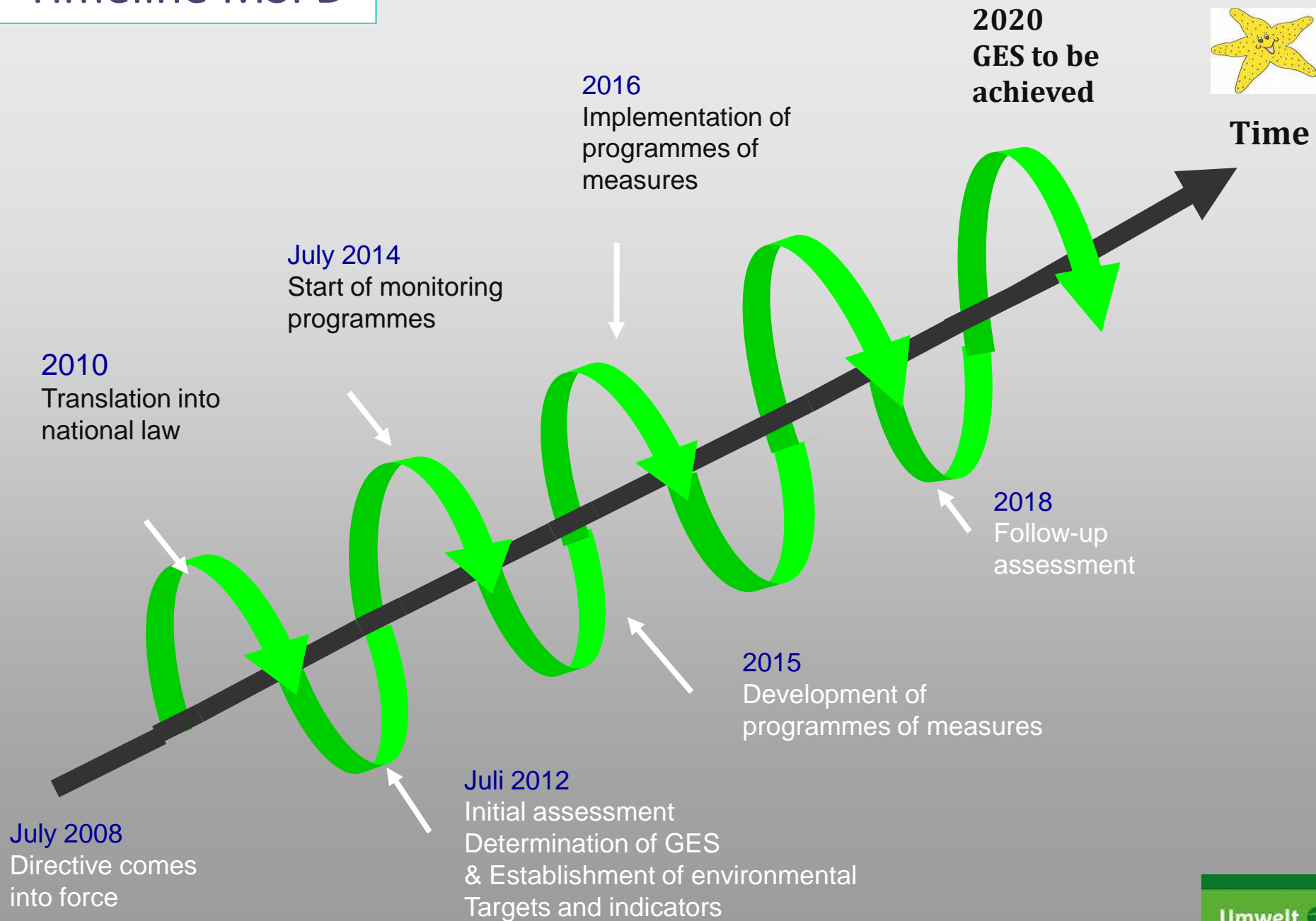
Moore et al. (2011) Los Angeles basin: introduction of 2 billions plastic particles in three days from two river mouthes

Lechner et al. (2014) Danube river: in average 317 plastic particles and 275 fish larvae per 1000 m³ water, daily input of 4,2 tonnes plastics in the Black Sea



@ Eriksen et al. 2013, Lechner et al. 2014)

Timeline MSFD



Time

Descriptor 10 – Marine Litter

GES Descriptors

Descriptor 10 – Marine litter does not cause harm to the coastal and marine environment

GES Criteria

- Characteristics of litter in the marine and coastal environment
- Impacts of litter on marine life

Indicators

- Trends in amount of litter washed ashore and/or deposited on coastlines
- Trends in amount of litter in water column and deposited on sea-floor
- Trends in amount, distribution and where possible, composition of micro-particles
- Trends in amount and composition of litter ingested by marine animals

Targets

Examples:

- **XX%** of overall reduction in the volume/number of litter on coastlines from 2010 levels by 2020
- **Less than 10%** of northern fulmars having more than 0.1 g plastic particles in their stomach

Monitoring

Beach

- Beach litter monitoring (macro/meso)

Sea surface and water column

- Ship-based and aerial surveys
- Pelagic trawls
- Fulmars

Sea floor

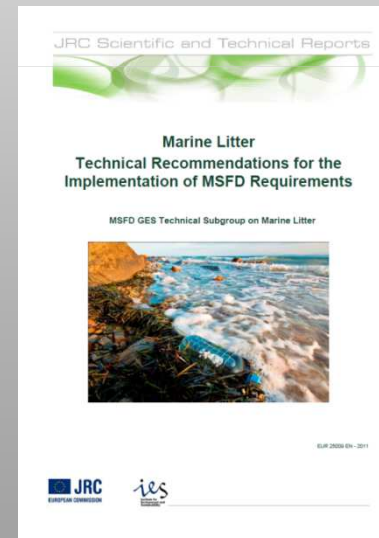
- SCUBA-Surveys for shallow waters
- Bottom trawl-surveys
- Submersibles

Microlitter

- Micro particles in sediments
- Continuous plankton recorder
- Microplastics in invertebrates

Biological impacts

- **Ingestion:** seabirds, fish (pelagic/benthic), sea turtles
- **Entanglement:** Plastics as nesting material in birds breeding colonies and associated mortality rates



International Conference on Prevention and Management of Marine Litter in European Seas

- **Conference partner:**



- **Venue and timing :** Berlin, Abion Spreebogen Waterside Hotel, 10.-12. April 2013
- **Organisation Committee:** UBA (for BMU), European Commission DG ENV/D2, Regional Seas Conventions (RSCs), Consultants *InterSus & Fresh Thoughts*
- **200 participants:** RSCs, MS, EC, UNEP, NOAA, national authorities, NGOs, industry, science
- **Conference web page:** includes database on measures to combat marine litter:

www.marine-litter-conference-berlin.info

(still online)

Aims

- **Marine litter = global pressure** for the marine environment, international cooperation required
- **Initiation/further development of regional action plans (RAPs):** to prevent further inputs from land- and sea-based sources and to reduce present marine litter
- **European contribution to the Honolulu Strategy** (global action plan to combat ML initiated by UNEP and NOAA) & **Rio+20** (“significant reduction of marine litter until 2025)
- To share **initiatives/best practices and commitments** to combat marine litter also in **support of EU MS** in development and coherent implementation of their **programs of measures in 2015/16**




Issue paper

- **Role:** Joint information basis for all discussions
- **Several commenting rounds by RSCs** (OSPAR, HELCOM, MEDPOL, Black Sea Commission)
- **Structure**
 - Review ecological impacts
 - Regional evaluation on sources, amounts, materials, items and composition of ML
 - Guiding principles, section on targets
 - Legal framework (global, european, regional)
 - Chapter 5: stepwise procedure for development of RAPs ML – common understanding on regional sources/pathways, operational targets, measures required and data gaps
 - Annex I & II: measures, initiatives



@ Z. Livnat

OSPAR breakout groups – top 10 measures

Prevention (I)	Prevention (II)	Law/Enforcement	Removal
Improved waste management, including increased recycling rates and phasing out landfilling (of PW)	Deposit refund systems for specific items, e.g. drink container, nets	Harmonised fee system for PRF –E.g. compulsory implementation of no-special-fee-system	Fishing for litter
Ban/tax on single use bags (or other items) –Taxes into environmental fund	Education and outreach (all sectors)	Incentives for responsible behaviour (land and sea based)/Disincentive for littering	
Elimination/Change of certain products on market –Sustainable production and extended producer responsibility –Lifecycle analysis for new materials/items/activities should include ML	Increased knowledge –Riverine litter –microplastics sed knowledge	Enforcement and control of international legislation –All sectors –Shipping: Port State Control, Coastguard	

The message from Berlin

Message from Berlin

Conclusions of the chairpersons of the International Conference on Prevention and Management of Marine Litter in European Seas, held in Berlin, Germany, 10 – 12 April 2013

The International Conference on Prevention and Management of Marine Litter in European Seas was held in Berlin, Germany, 10 – 12 April 2013. The Conference participants, which included a wide array of stakeholders, government representatives, businesses and regional organisations, analysed the issues at stake, reviewed current efforts and suggested ways forward in order to address marine litter.

Problem statement

In particular, the conference participants:

- recognised that marine litter is a growing global environmental issue, as highlighted at the Rio + 20 UN Sustainable Development Conference,
- noted with alarm the growing evidence of the harmful effects of marine litter on wildlife and habitats and on marine biodiversity and environment,
- expressed concern at the increasing threat from marine litter to human health and safety, ecosystem services, and sustainable livelihoods,
- considered the high associated costs especially for sectors such as tourism and recreational activities, shipping and fishing,
- recognised that different materials, mostly plastics which are highly persistent and remain in the environment for centuries, constitute marine litter, which stems from land and sea based sources,
- underlined with particular concern the problem of micro-plastics, which are ubiquitous and, whether introduced directly or due to degradation of macro litter items, reach even the most remote areas and release harmful chemical substances which may contaminate the food chain,
- recognised the need to better understand regional specificities as well as the sources, amounts, pathways, distribution trends, nature and impacts of marine litter, including microplastics.

Current efforts

The participants recognised and welcomed the many efforts currently on-going at all levels and by a wide range of actors, to address marine litter and especially:

- reaffirmed the commitment of the Rio+20 UN Sustainable Development Conference “to take action to, by 2025, based on collected scientific data, achieve significant reductions in marine debris to prevent harm to the coastal and marine environment”,
- recognized the importance of international mechanisms, such as MARPOL and UNEP,
- welcomed the Honolulu Commitment and Strategy adopted by the participants attending the 5th International Marine Debris Conference held in Honolulu, Hawaii, 20-25 March 2011,
- welcomed efforts made under each of the Conventions for Europe’s Regional Seas to prevent and reduce marine litter such as developing dedicated Regional Action Plans in order to contribute to the Honolulu Strategy,
- welcomed efforts made by EU Member States to address marine litter as part of their implementation of the Marine Strategy Framework Directive and to achieve or maintain good environment status in the marine environment,
- acknowledged the many initiatives developed and implemented by the different stakeholders such as environmental NGOs, local governments and communities, the private sector, consumer organizations and research institutes to tackle the problem of marine litter.

Key principles

The conference participants emphasised that a number of key principles should guide action to address marine litter, in particular:

- the precautionary principle, that measures must not be postponed in the light of scientific uncertainties, because there is already sufficient knowledge available to develop priorities, target actions and implement solutions,
- the polluter-pays principle, the principle according to which those causing pollution should bear the cost to which it gives rise,
- the prevention at source principle, as avoiding waste and preventing waste from entering the (aquatic) environment is more cost-effective and efficient than cleaning up marine litter.

Priority actions

Finally, participants considered taking a number of priority actions contributing to the Rio +20 target, to regional action, to national measures, and to the EU quantitative reduction target under development, noting these would also constitute stepping stones towards achieving the goal of reaching Good Environmental Status for Europe’s regional seas, such as:

1. Fully implementing relevant EU legislation, such as the Waste legislation, the Water Framework Directive and the Marine Strategy Framework Directive and addressing the problem of plastic waste as part of the planned review of EU waste policy and legislation. This includes developing an integrated waste management infrastructure that supports waste prevention, collection, recycling and energy recovery and applying the waste hierarchy.
2. Promoting the green economy through increased resource efficiency facilitating sustainable consumption and production patterns, including improving life-cycle design, high quality recycling and sustainable packaging, encouraging extended producer responsibility and environmentally responsible fishing and maritime transport practices such as adequate port reception facilities.
3. Improving our scientific understanding of the sources, amounts, pathways, distribution, trends, nature and impacts of marine litter, including the effects of micro-plastics and their additives and absorbed substances, on marine biodiversity and public health and identifying ways to better coordinate and improve marine litter data collection, including with a view to establish an EU baseline.
4. Developing ambitious targets to reduce marine litter at all relevant levels, giving priority to sources of marine litter with the strongest impact, such as for example microbeads or plastic bags.
5. Contributing to raising awareness on marine litter at all levels and facilitating initiatives preventing waste from entering the (aquatic) environment while putting emphasis on addressing the complex multi-sector issues surrounding littering behaviour and building the notion of waste as a resource.
6. Initiating and further developing Regional Action Plans on marine litter for the regional seas of Europe.
7. Collaborating with global, regional and sub-regional organisations, to address the transboundary aspects of marine litter and enhance the effectiveness of multilateral initiatives aimed at preventing, reducing and managing marine litter.
8. Encouraging financial support for actions (including environmentally friendly cleaning actions) that contribute to the reduction of marine litter and its impact on the environment.
9. Sharing expertise to prevent, reduce and manage marine litter in particular through contributing to the conference follow up by providing further information on best practices and new initiatives collected in the Marine Litter Toolbox.
10. Participating in networks of stakeholders committed to take action to prevent, reduce and manage marine litter in Europe’s four regional seas in an environmentally sustainable manner.

Thank you for your attention!



@ J.v. Franeker (IMARES)