

THE MOST BEAUTIFUL OCEAN

IS THE ONE WE HAVE YET TO CROSS.

THE LOVELIEST CHILD HAS YET TO GROW UP.

THE MOST BEAUTIFUL DAYS OF OUR LIVES

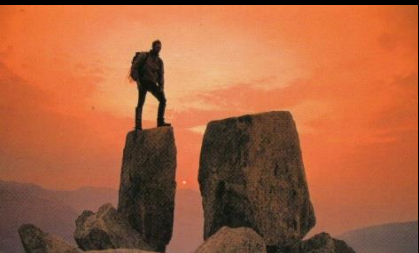
ARE THOSE WE HAVE YET TO LIVE.

AND THE LOVELIEST THINGS

I'D LIKE TO TELL YOU

ARE THOSE I HAVE YET TO TELL.

Nazım Hikmet



Marine Litter esp. Plastics.



110 bn. plastic bottles/yr.
3,400/sec.

Half were collected and
7% recycled

40kg thrown away by families/yr.

Allan Williams
UWTSD, Swansea
Wales.

UK Plastic Sector.

7,500 plastic companies.

£19 bn. Turnover.

35% exported/yr.

£6.7 bn. value of exports.

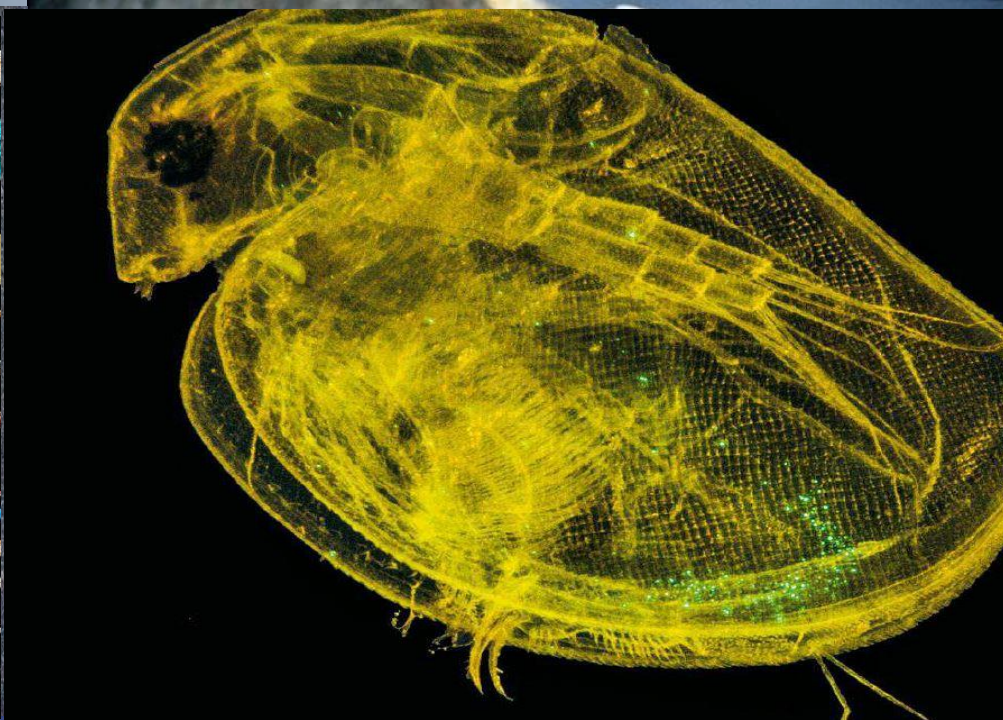
2.5 m. tonnes produced/yr.





**A multi-sectoral / cultural /
trans-boundary problem**









MARINE
LITTER!!!



'Curly Clam'



'Tsunami'

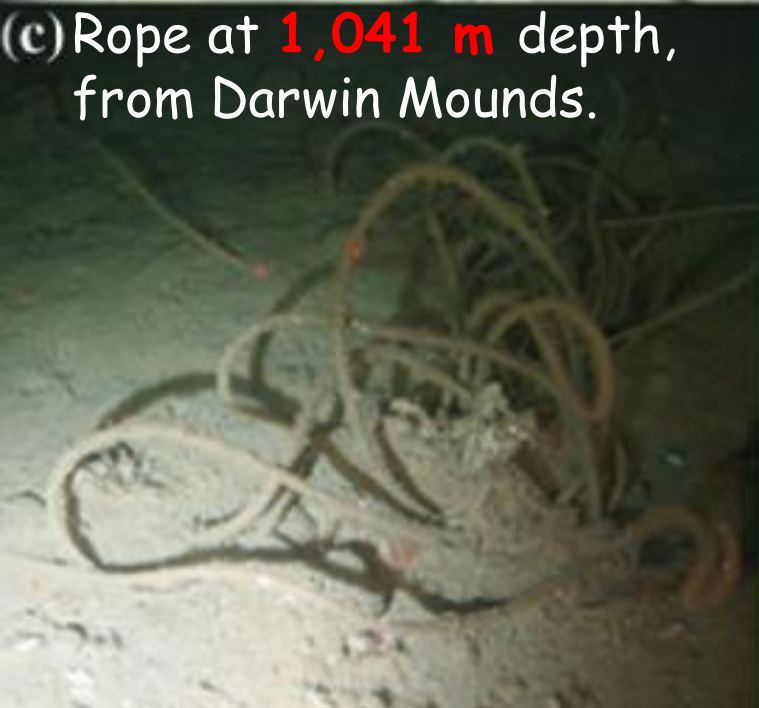
Definition of Marine Litter / Debris



70% sinks to the seabed, 15% drifts within the water column with the same percentage appearing on beaches (Williams and Simmons, 1997, Topcu et al 2013, Rech et al 2014).



'any persistent, manufactured or processed solid material discarded, disposed of, or abandoned in the marine and coastal environment.'



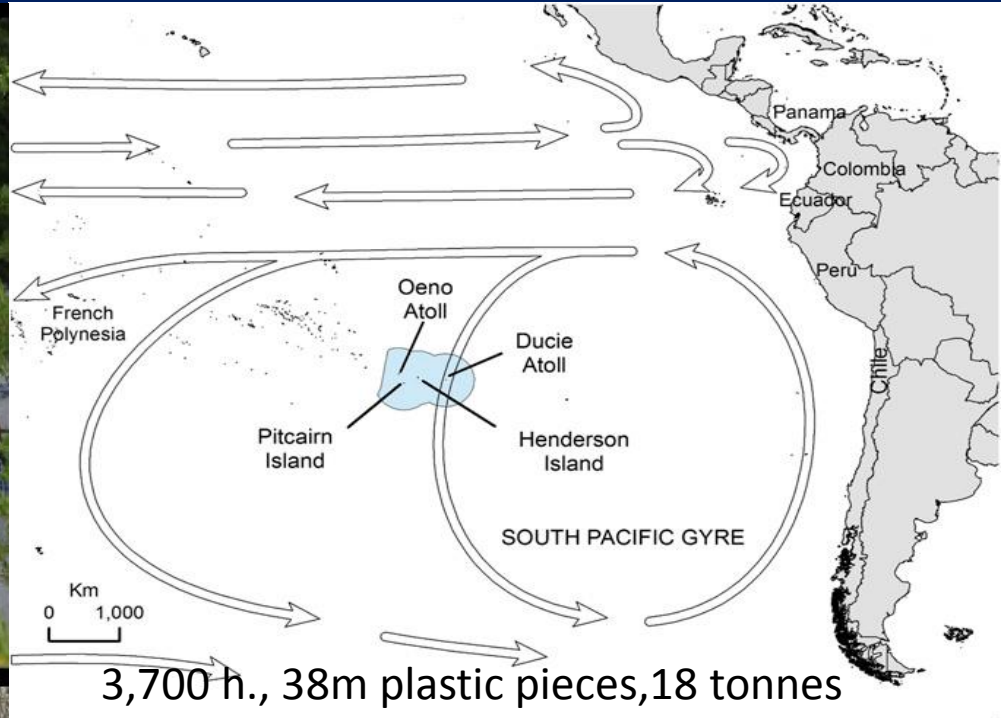




64 lb, GARBAGE in 33ft
whale, SE SPAIN,
Cabo de Palos, May, 2018.

Trash bags, drum, nets,
ropes, polypropylene sacks





A) East Beach. **Fishing-related activities or land-based sources** in China, Japan, & Chile. **671 items /square metre**; 27% from South America.



B) **3,579 plastic** items washed up **daily** along high tide line at one beach.

6,774
Plastic
pellets

486
Bottle caps
and lids

220
Fishing
line

245
Crates

50
Plastic
buoys

60
Plastic
bags

67
Glass
fragments

207
Plastic
netting

27
Plastic
pipes

43
Melted
plastic

4
Foam
buoys

3
Cigarette
lighters

3
Tiling
spacers

2
Tooth-
brushes

2
Plastic
cutlery

25
Buckets

4
Shoes

4
Plastic
razors

5
Pieces
of metal

7
Pieces
of wood

642
Plastic
strapping

24
Lollipop
sticks

8
Glass
bottles

3,336
Fishing
cords/
ropes

121
Plastic
fencing

16
Polystyrene

10
Drinking
straws

16
Glow sticks

10
Pen
caps

115
Plastic
bottles

16
Aluminum
buoys

10
Light
bulbs

Hawaiian Islands

OCEAN CURRENTS
PACIFIC OCEAN

Henderson
Island

New
Zealand

Global garbage dump

The Henderson researchers were able to read labels and determine the country of origin for 88 of the items they found. More than a third came from China or Japan, more than a quarter from South America. Some came from as far away as Scotland and Germany.



Large volumes of plastic litter drifts onto coasts and remote islands on the west of Japan



Household articles



Fishing nets and ropes



Styrofoam Floats



Plastic container

SOME PROBLEMS

- aesthetic, cosmetic, hygienic,
- entanglement and ingestion, death, injury, debilitation,
- 'quality of life', starvation.
- Ghost fishing (650k tonnes/yr.)
- smothering, transport, dispersal vectors,
- toxicity, sea surface micro-layer,
- vessel hazard,
- tourism.

Barnes, (2005), -the 1982 report of 8 million marine debris items entering the world's oceans/seas each day needs to be updated by multiplying several fold



Crab pot 1000m depth, Oregon



Effects:

A threat to marine life & human health.

Impact:

Economic losses to fishermen, coastal communities, tourism, boat owners, power stations, navy, etc.

Social on communities & tourism.

Environmental on life & biodiversity.

Paul Gauguin

D'où venons-nous? Qui sommes-nous? Où allons-nous?

Where Do We Come From? What Are We? Where Are We Going?

Откуда мы пришли? Кто мы? Куда мы идём?

Ida dove veniamo? Chi siamo? Dove andiamo?

De dónde venimos? ¿Qué somos? ¿A dónde vamos?

Woher kommen wir? Wer sind wir? Wohin gehen wir?

MARINE POLLUTION PROBLEMS IN THE 21ST CENTURY.

- Nutrient eutrophication.
- Algal blooms.
- Environmental oestrogens.
- Alien organisms & pathogens.
- **PLASTICS.**



Ed Goldberg, Nobel Laureate, 1995.

Top Concerns of Marine Scientists

Early in 2001 marine experts of United Nations organizations listed issues of global concern regarding deterioration of the marine environment (no particular order):

- **Eutrophication and anoxia**
- **Harmful algal blooms (HABS)**
- Classical contaminants (*e.g.* sewage, metals, petroleum hydrocarbons)
- Deforestation
- Increased or decreased mobilization of sediments
- Demise of coral reefs
- Loss of wetlands
- Habitat destruction
- Climate change and sea-level rise
- Inundation as a consequence of physical alteration
- **Increased risks to human health**
- **Reduced biodiversity**
- **Over-fishing**
- **Exploitation of coastal mineral resources, particularly sand and gravel**
- **LITTER**





Among the five trillion bits of plastic floating around the ocean are weird curlicues like these—shavings from various fabrication or drilling processes. To Barker they resemble seahorses and other marine creatures. She spent five years collecting them on far-flung beaches.

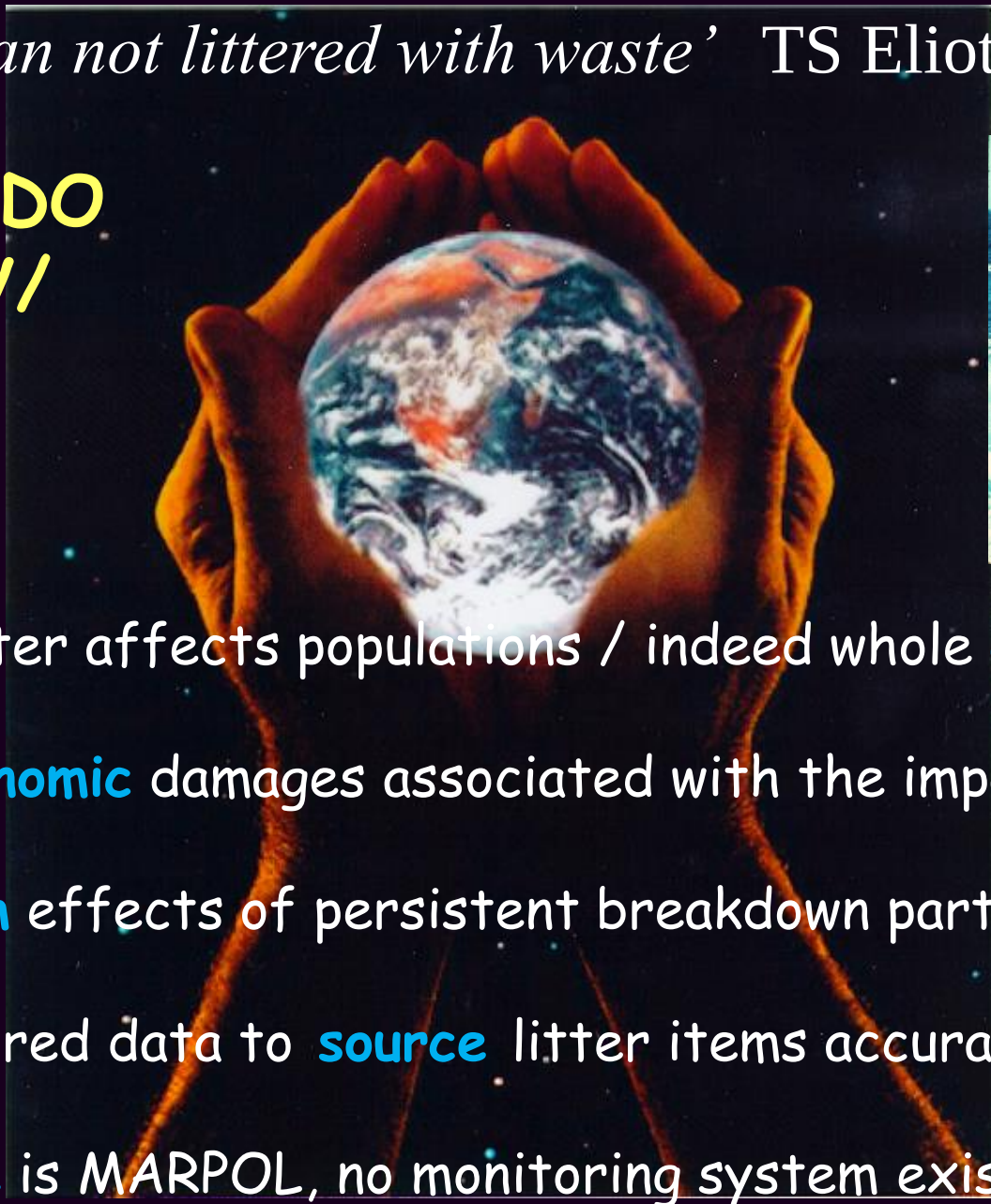
Found on Kamilo Point Beach, Hawaii: "plasticiglomerate," a type of rock formed when plastic debris—perhaps in a campfire—fuses with sand, rock, shells, and coral. Geologists think it may become an enduring marker of our impact on the Earth.

WHAT DO WE KNOW?

- Legislation **ineffective**.
Little coordination.
- Economic impact is **significant**.
- **80%** originates from land based sources.
- Litter items on beaches are **small** (<30cm).
- 50-90% comprises plastics that persists in the sea for a **long time**.
- Much SRD still originates in **CSOs**.
- Many **volunteer**-based schemes.

*'We cannot think of a time that is oceanless
or an ocean not littered with waste' TS Eliot.*

WHAT WE DO
NOT KNOW/
HAVE.



How marine litter affects populations / indeed whole **ecosystems**?

Assessing **economic** damages associated with the impact of litter.

The **long-term** effects of persistent breakdown particles.

Enough monitored data to **source** litter items accurately.

How **effective** is MARPOL, no monitoring system exists to measure any effects of legislation?

Neuston catamaran, manta trawl net few studies used mesh sizes $<300\ \mu\text{m}$ Nets are usually 3-4.5 m long and a mesh size of around $300\ \mu\text{m}$.





More than 5tn pieces of plastic in the world's oceans, weighing some 269,000 tonnes, 0.1% of annual global plastic production

The tiny fibres were found at depths from 300m down in the Mediterranean to over 3,000m deep, at volumes 1,000 times higher than those at the surface of the sea.





Public 40.4%



Fishing 13.9%



Shipping 3.9%



Fly tipping 0.7%

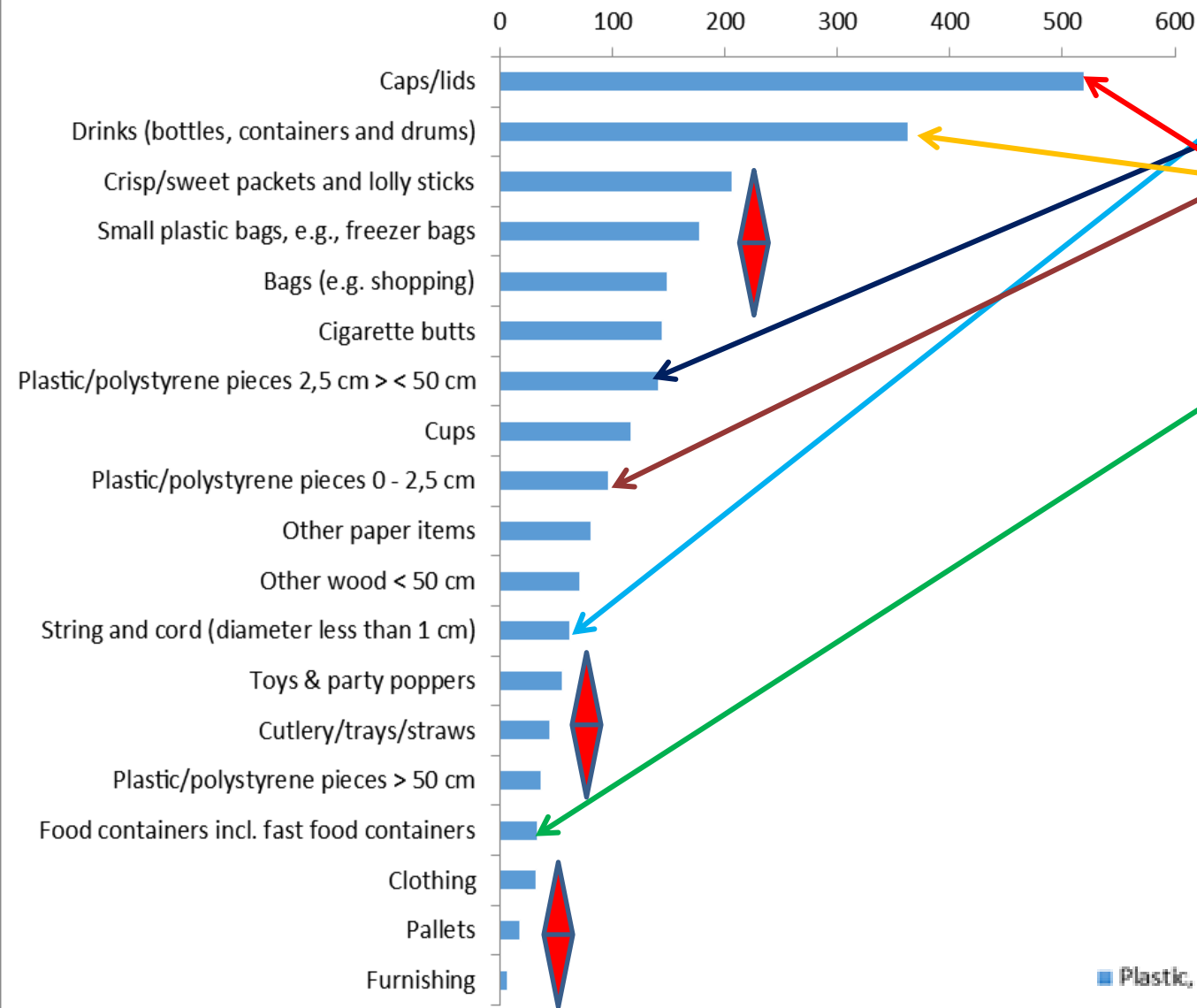


SRD 4.5%



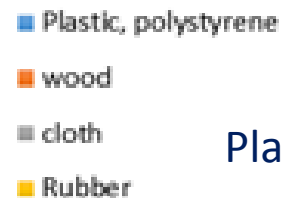
UNKNOWN 36.3%

The most common marine litter items found in the highest numbers on the reference beaches.

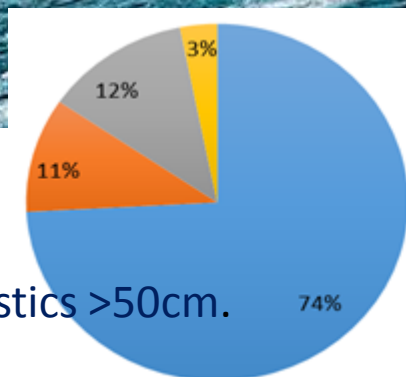


String/cord
 Plastic > 2.5 cm
 Plastic < 2.5 cm
 Drink containers
 Caps
 Food containers
 ROPE
 METAL CANS
 GLASS

Northern
 Ireland, UK



Plastics > 50 cm.



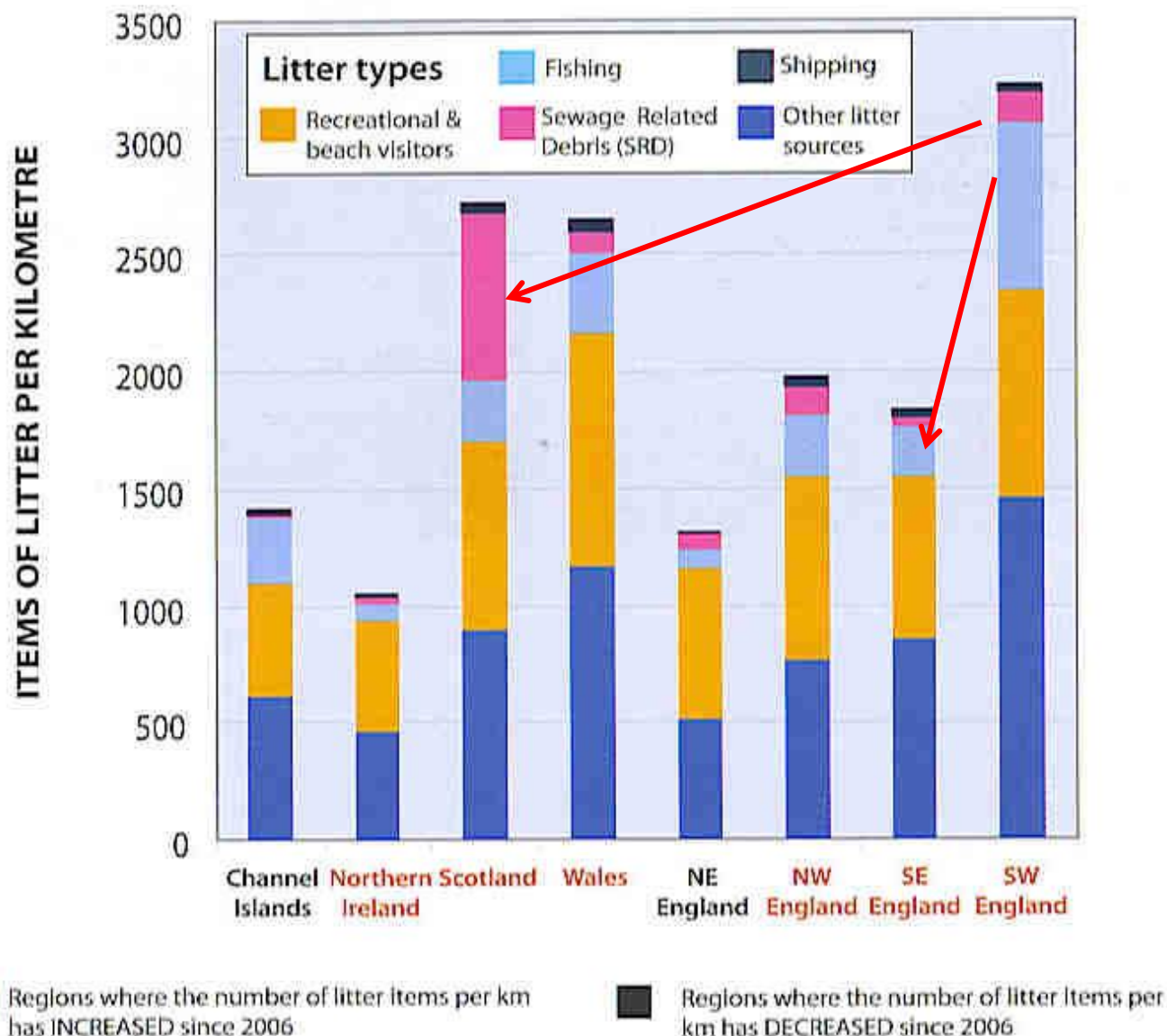
UNEP study
>46k pieces of
plastic/mile²
of ocean.

In UK density
is 1,189 items
/km. 126%
increase since
1994..

Nb. pollutants
can be
attracted to
plastic pieces
and ingested
by mammals &
fish.

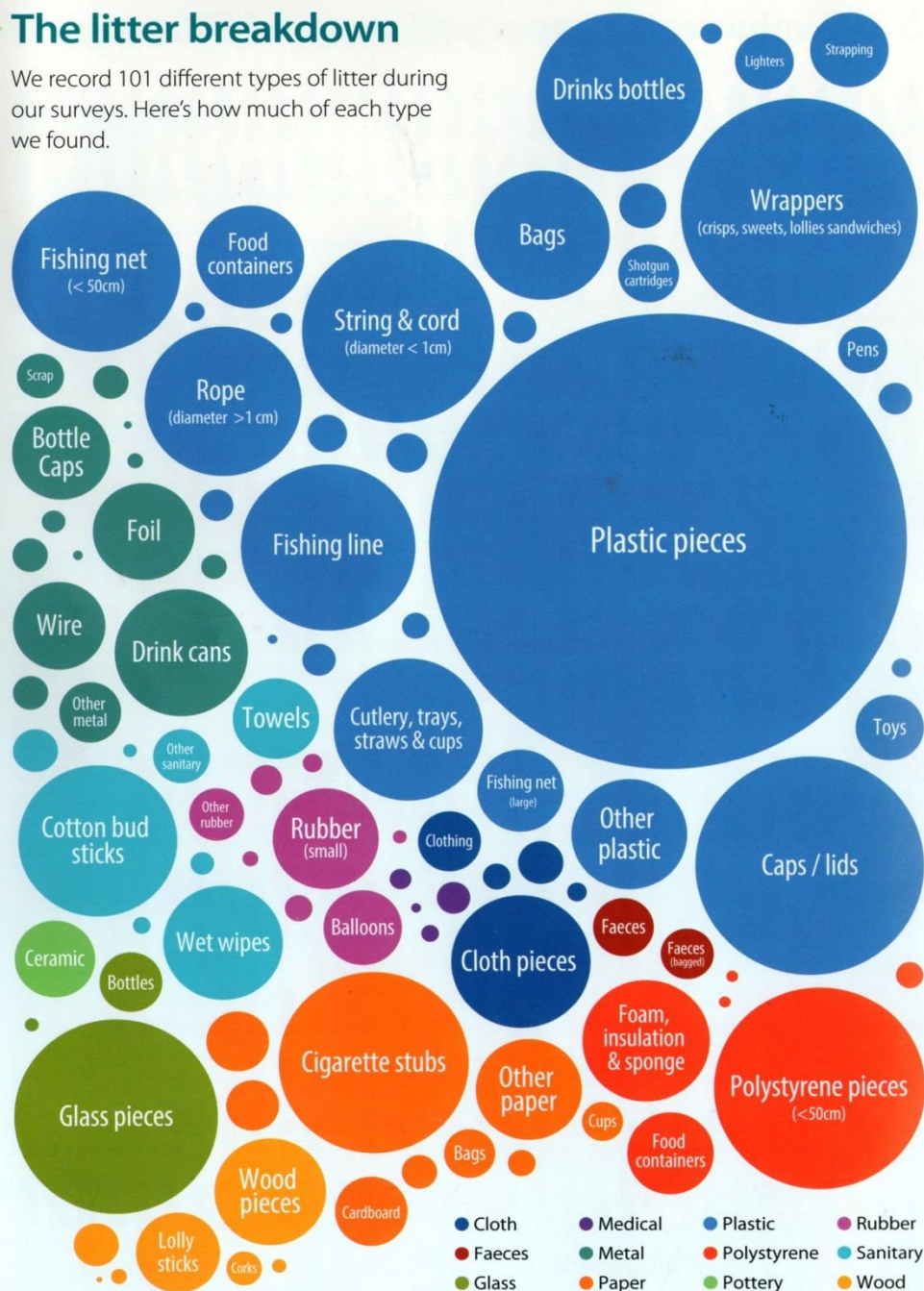
We eat them!

Regional variations in sources and densities of litter



→ The litter breakdown

We record 101 different types of litter during our surveys. Here's how much of each type we found.



EC 2015. Final Economic Policy Package for waste.

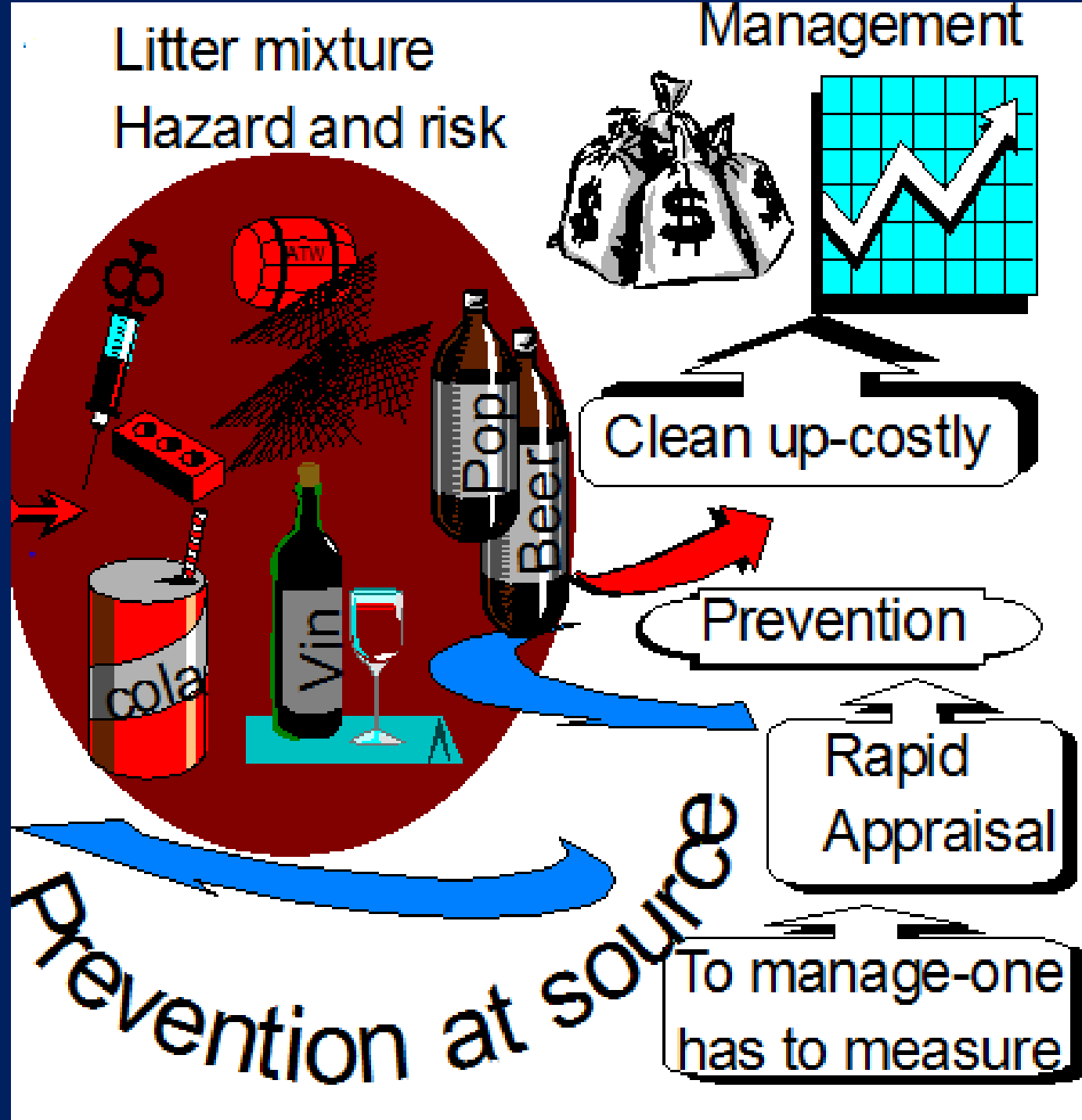
Recycling target of 75% of all waste & landfill by 2030.

How long can items last in the environment?

Paper	1.5 months
Waxed milk carton	3 months
Plastic cup	50 years
Plastic bottle	400 "
Wool socks	5
Grocery bag	20
Mono fishing line	60
Glass	?
Nappies	450
Tin can	50
Al. can	200

SOURCES

1. Commercial recreational fisheries and aquaculture.
2. **Vessels** – e.g. cargo, military, research, passenger & pleasure crafts.
3. Stormwater & urban run-off.
4. **Wind** - blown from land.
5. **Riverine inputs.**
6. Beach users, + deliberate illegal dumping.
7. Offshore oil rigs



ACCEPTANCE OF THE UNACCEPTABLE; LITTER



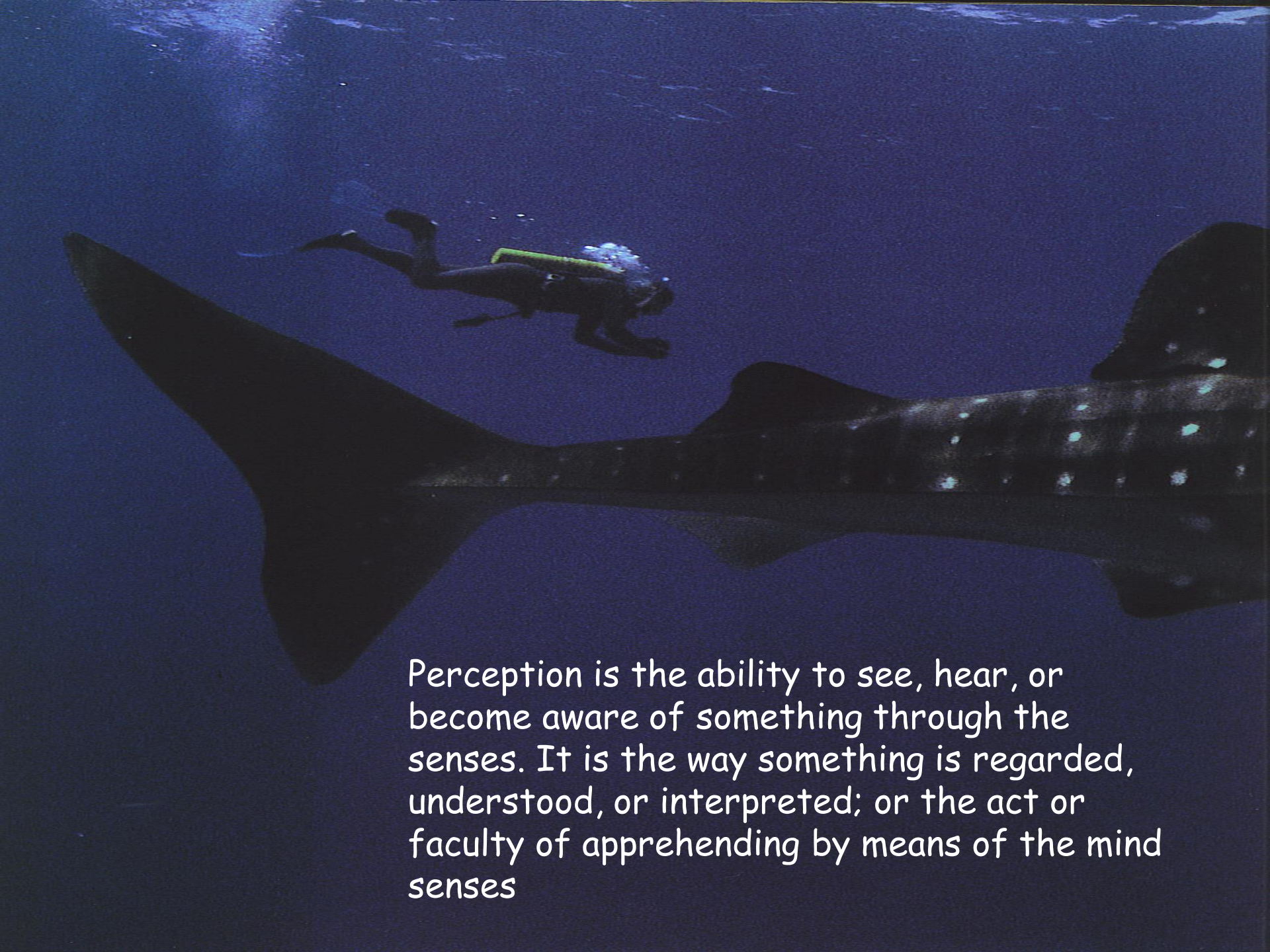
100k tonnes



Litter becomes familiar the way a landscape becomes familiar.

'No matter how gruesome or spectacular, over time you become used to it. Eventually, you can walk through it without feeling any need to comment.'

Fr. Richard John Neuhaus, Institute on Religion & Public Life.



Perception is the ability to see, hear, or become aware of something through the senses. It is the way something is regarded, understood, or interpreted; or the act or faculty of apprehending by means of the mind senses



It is an act of mind & not simply the eye, as info. & instructions travel along nerves from eye to brain & *vice versa*.

Perception is not only a **psychological process** but also a **cultural** one.

Chabris and Simons :The Monkey puzzle - Havard expt.

Question: Count how many times a white jersey passes the ball?

1. Half audience did **not** see the **gorilla**;
2. **No one** noticed: the **back curtain** change **colour**.
3. " a **black jersey** player **left** the group.

It is a fusion between **object & observer**, **thought & emotion**, **action and reflection** - **SYNAESTHESIA**

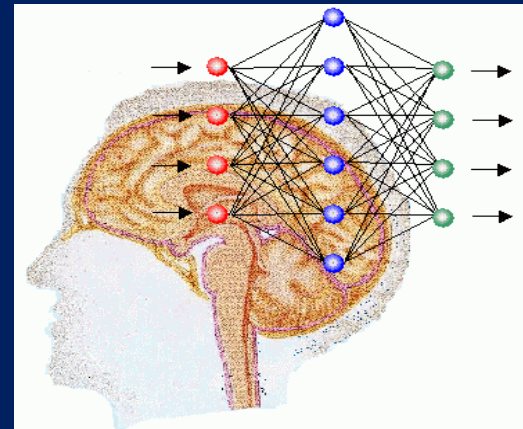
One **sees** *via* a **personal and cultural lens**, according to lifetime habits shaped by a particular culture. Seeing is by far the best perceptual tool and the foremost way to engage with the world.

It is an act of mind and not simply the eye, as information and instructions are travelling along nerves from the eye to the brain and *vice versa*.

The fusion between object and observer, thought and emotion and action and reflection has been called synaesthesia

What are most important: Facts & logic or stories/feelings, emotions?

This bears **no** relationship to how the mind and brain works.
It is an emotional brain – a vast array of neurons that work together to generate our experience of the world. Associations of networks, bundles of thoughts, feelings, images and ideas become connected over time



A dramatic photograph of a massive wave crashing over a lighthouse. The wave is a towering wall of white foam and water, reaching high into the sky. The lighthouse is a white, cylindrical structure with a dark lantern room at the top, partially obscured by the spray of the wave. In the foreground, a crowd of people is silhouetted against the base of the wave, watching the spectacle. The sky is a deep, clear blue.

Light weight & extremely versatile.

Very durable, mobile, inexpensive.

Resistance to chemicals, water & impact-long lived, active for **decades**

Excellent thermal/electrical properties.

Good safety & hygiene properties for food packaging.

WHY PLASTIC?

1 tonne of plastics = 20k two litre drinks bottles; 120k carrier bags.

Total elimination of plastics is unreal -hospitals etc.

Packaging market -grocery takes 70%; 10 m tonnes.

Retailers dealing with > 50 tonnes /year register with National Packaging Waste Database (NPWD) - which only publishes how much is recycled or exported.

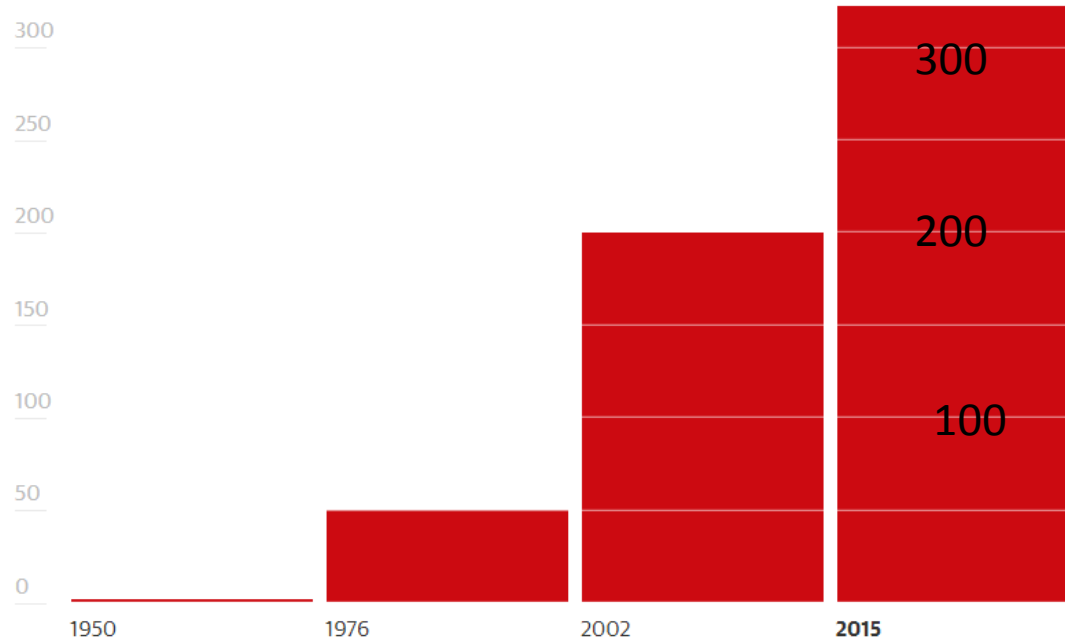
Jan 2018. UK exports to Malaysia rose from 3k to 16k, Vietnam 3k to 9k.

European demand for recycled plastics is only 7%.

Design improvements needed, e.g. vacuum packed meat trays multi layered different plastics.

After multiple use materials should be fully compostable -lignin (woody material from plants but degradation rates are unknown) i.e. edible, water soluble /compostable.

Full Cycle Bioplastics: bacteria (Polyhydroxyalkanoate) -not compatible with oil based plastics.



Guardian graphic | Source: Statista, PlasticsEurope

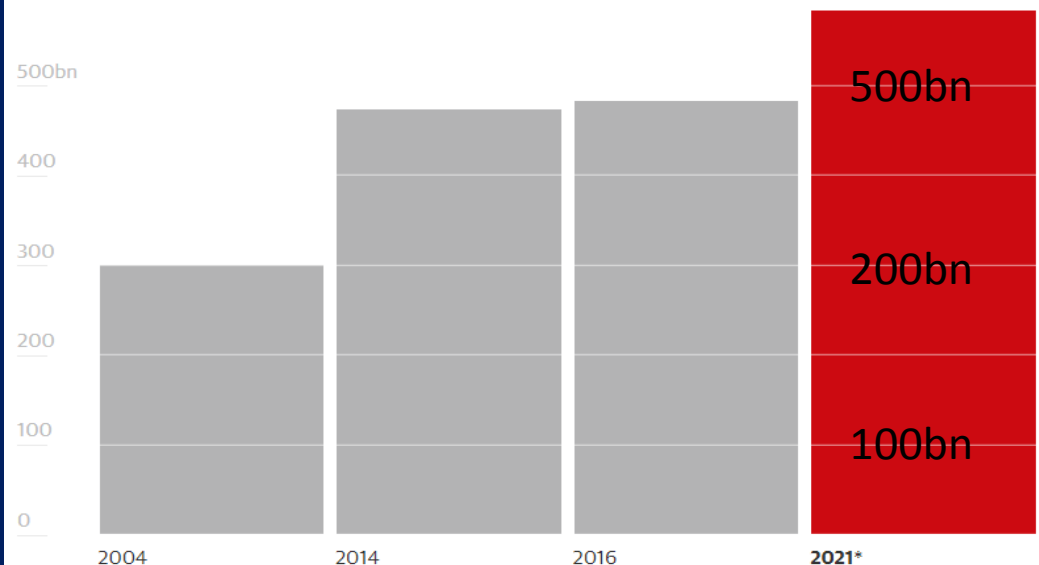
Aldi's plastic packaging went from 37,261 tonnes in 2013 to 64,000 tonnes in 2016.

The store recycled 3,400 tonnes of plastic in 2016 – just over 5% of the packaging waste it created.

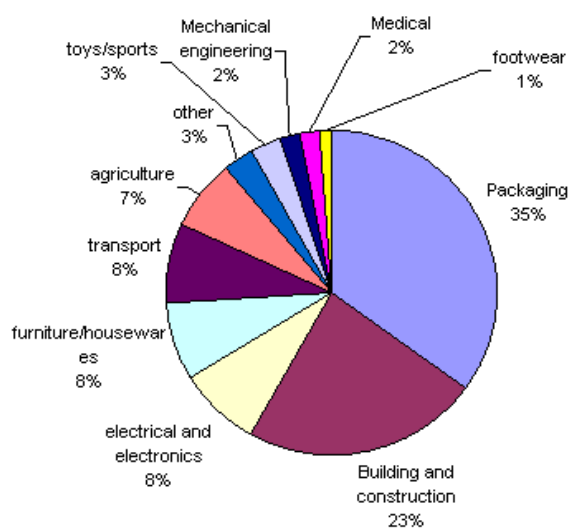
800,000 tonnes of waste from food and beverage products

The EU wants 55% of all plastic to be recycled by 2030 & for member states to reduce bag usage per person by 2026 from 90 a year to 40.

Worldwide, we produce almost 20,000 plastic bottles every second



Guardian graphic | Source: Euromonitor. *forecast



Household waste

- The amount of plastic generated annually in UK is *circa* 3 million tonnes.
- some 56% of all plastic waste is used packaging, 75% from households.
- Estimated that only 7% of plastics are recycled.

World's annual consumption of plastic materials - 5 m. tonnes (1950s) to 100 m. tonnes .

We produce and use 20x more plastic today than 50 years ago!

In UK, a total of 6.7 million tonnes of plastic products were used in various economic sectors in 2015.

Packaging is the largest single sector of plastics use in the UK (35% of plastics used) and is the material of choice in 50% of all packaged goods.

Plastic consumption is growing by 4% /year in W Europe



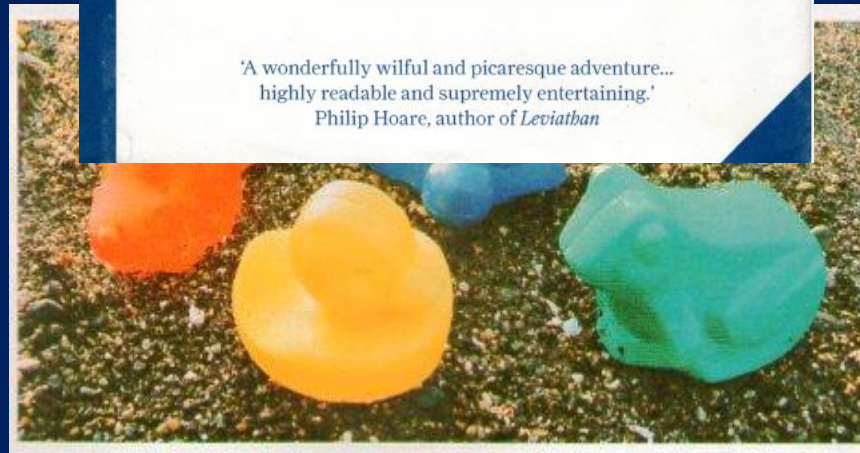
MOBY~DUCK



THE TRUE STORY
OF 28,800 BATH TOYS
LOST AT SEA

DONOVAN HOHN

'A wonderfully wilful and picaresque adventure...
highly readable and supremely entertaining.'
Philip Hoare, author of *Leviathan*



MV Evergreen Ever Laurel, owned by Technomar Shipping (Greece), operated by Taiwanese Evergreen Marine Corp.

Left Hong Kong, and on 10. 01 1992 - it happened.

Hurricane winds, 12 containers lost - 28,000 plastic animals 44.7°N 178.1° E. They went north due to El Nino.

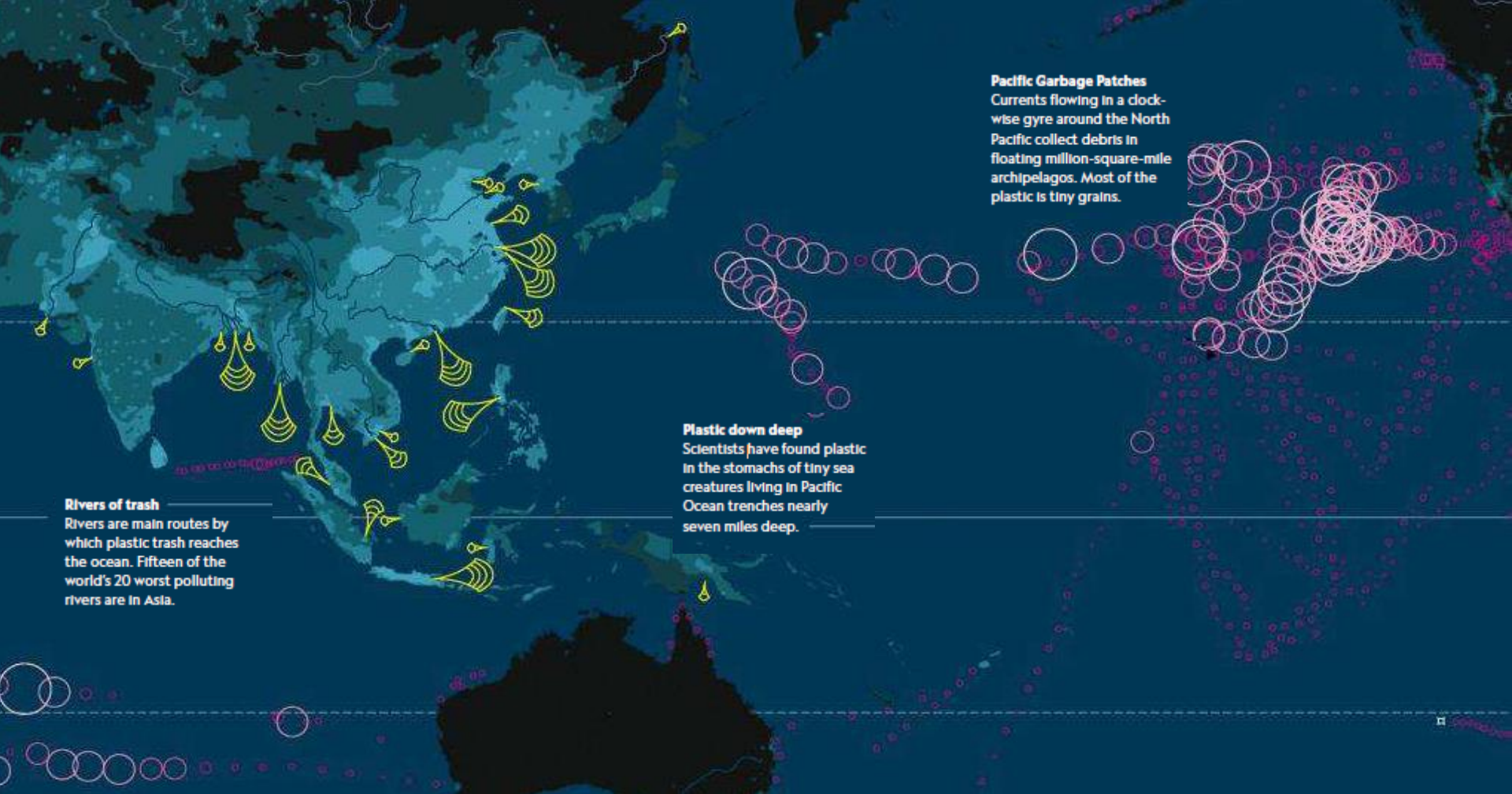


Great Pacific garbage patch



Yamuna River in New Delhi

Input quantities are increasing...
Increase of x3 in the last 10 years.



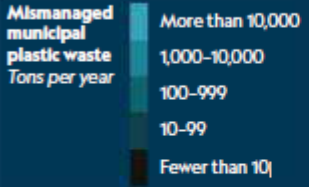
Pacific Garbage Patches
Currents flowing in a clockwise gyre around the North Pacific collect debris in floating million-square-mile archipelagos. Most of the plastic is tiny grains.

Plastic down deep
Scientists have found plastic in the stomachs of tiny sea creatures living in Pacific Ocean trenches nearly seven miles deep.

Rivers of trash
Rivers are main routes by which plastic trash reaches the ocean. Fifteen of the world's 20 worst polluting rivers are in Asia.

Plastic waste has been found (pink circles) in the ocean from the Arctic to the Antarctic and from the surface to the seafloor. Millions of tons enter the seas each year, much of it from places where it has been dumped carelessly on land and into rivers (light blue) and then swept out to sea (yellow). Ocean currents carry floating debris to the far corners of the world.

ON LAND

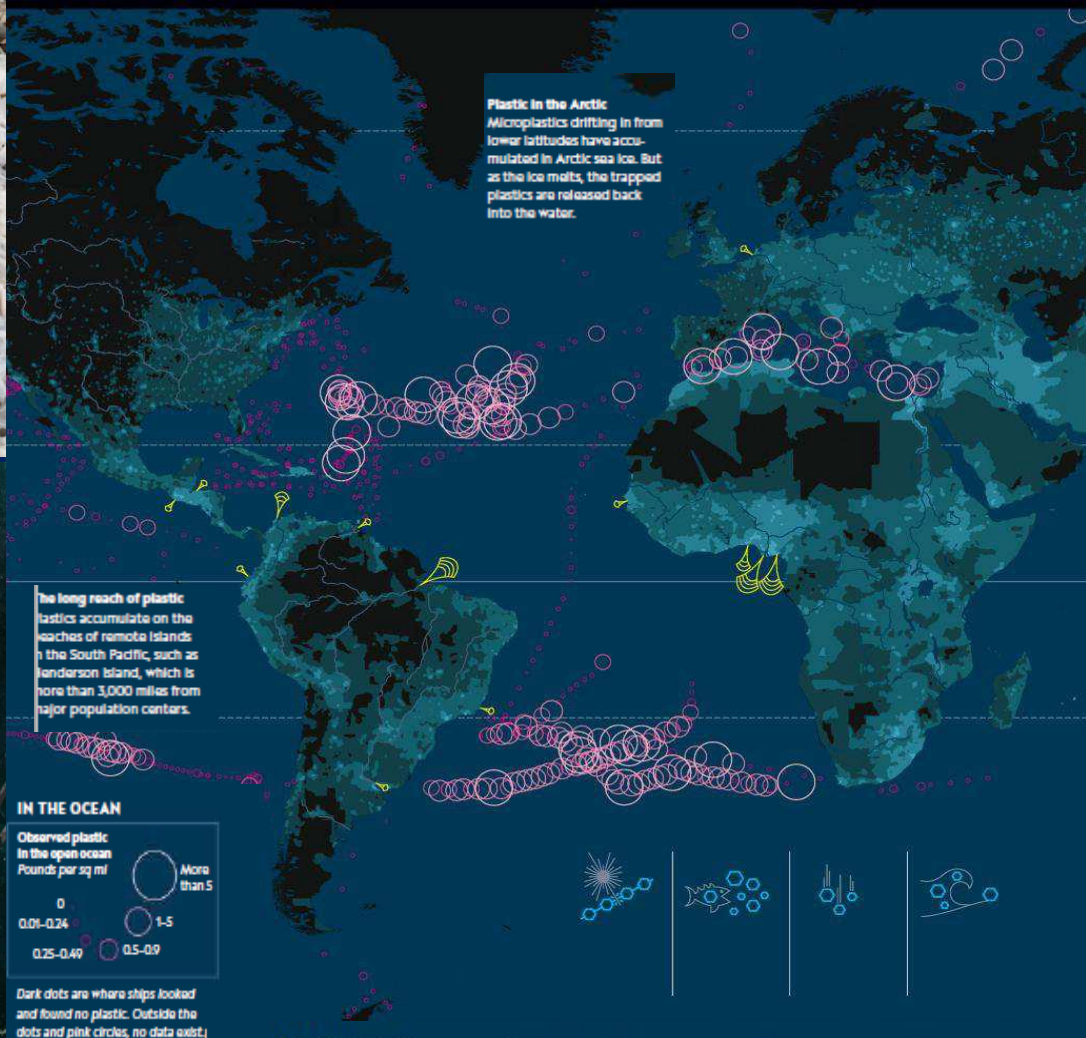
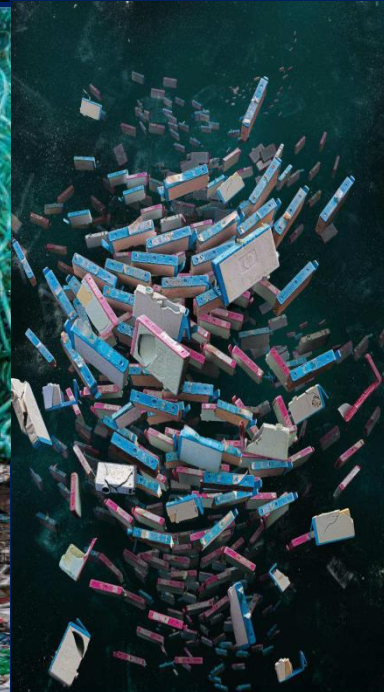


Mismanaged waste includes all plastic that is not recycled, incinerated, or landfilled.

IN RIVERS



The map shows the 39 river basins that collectively discharge millions of tons of plastic a year into the ocean.



Missing plastic

Researchers found just one percent of the plastic they expected floating at the sea surface—the rest was missing. One reason: Plastic breaks down into tiny pieces, which are less visible but may greatly

Fragmentation
Sunlight, waves, and bacteria break plastic into

Predation
Microplastics are ingested by animals of all sizes, from

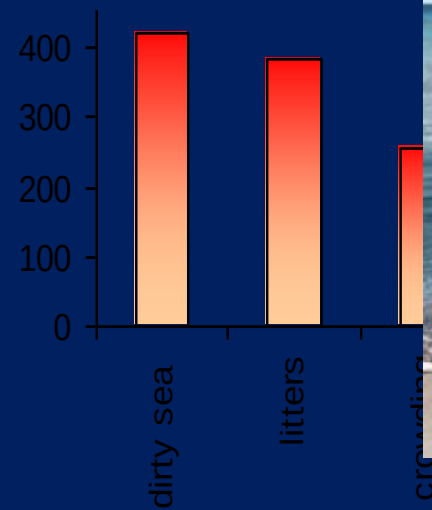
Sinking
Plastic that's dense or weighed down by marine life sinks

Shore deposition
Plastic fragments are transported by currents and tides back

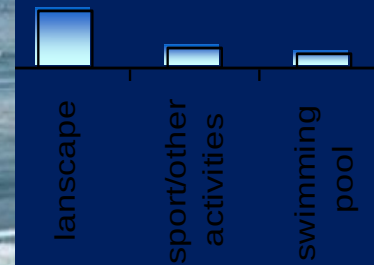
Type of Damage	Estimated Cost / year
Fishing – Japan - damage to fishing boats	6.6 Billion Yen
USA - Loss of fisheries production – ‘ghost nets’	\$250M in lobsters only
Canada - Loss of fishing gear and down time	\$10M only for retrieval
Leisure boats – USA - propeller's entanglement	\$792M
Human injury and fatality & search and rescue - UK	\$440,000
Shipping – Korea – Vessel loss	292 lives
Damage to cooling systems - UK	\$1.1M
Coastline tourism	\$28M
UK – loss of amenity and aesthetics to beaches	
Wildlife and marine ecosystems –	Unknown but estimated to
Worldwide – assessment of ecosystem services	be huge
AND THIS IS ONLY A FRACTION OF WHAT IS HAPPENNING GLOBALLY	

RESULTS: USERS' PREFERENCES

Q: "What do you most appreciate in beach?"

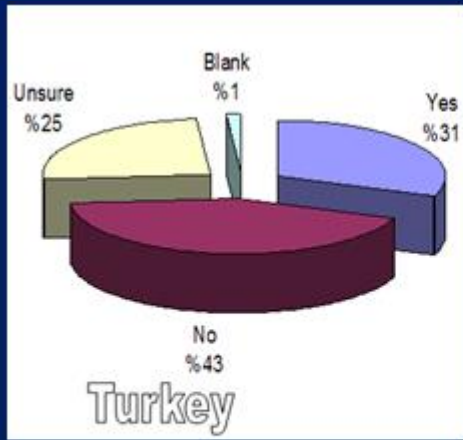


Q: "What do you most appreciate in beach?"

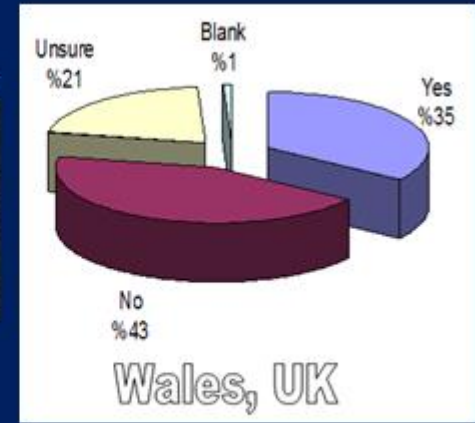
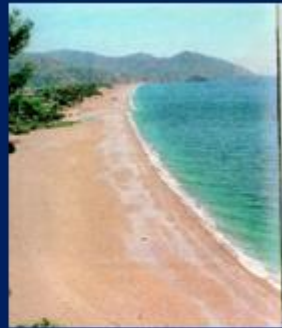


Ballance et al. (2000) on the South Africa coastline. a drop in beach cleanliness standards **reduces** tourism revenue by up to 50%.

85% of beach users would **not visit** a beach with **three plus** ldebris items per metre.

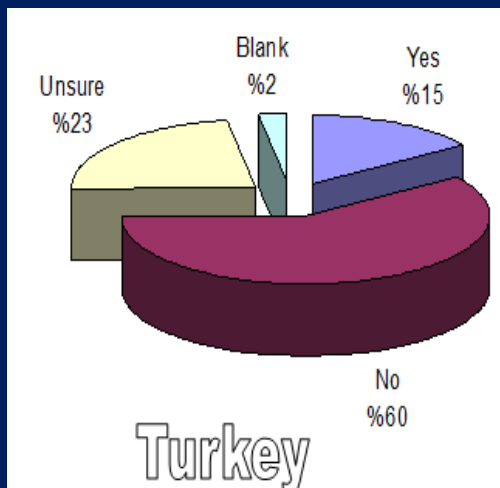


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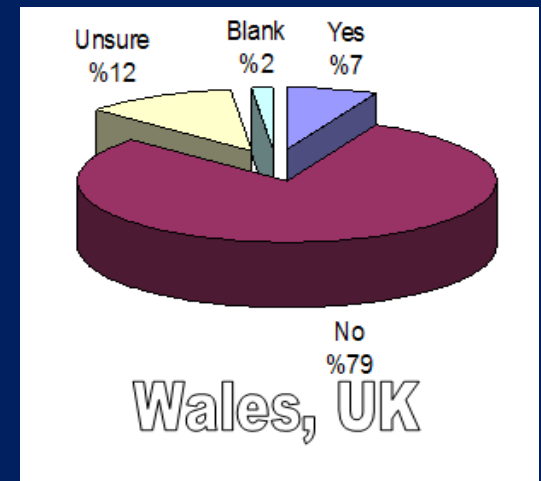


n= 171

97% stated they would **not** visit a beach with **10** or more **litems of** debris per metre.



Knowledge of beach user perception of litter is essential to development of any management strategy



MERMAID'S TEARS :

PLASTIC RESIN PELLETS & THEIR THREAT TO THE OCEAN AND COASTAL ENVIRONMENT



2017 Lorient & USA phased them out for face creams;
2018 UK, France, Sweden.
2019 Belgium

Estimates : 100,000 plastic particles /sq.km of seabed and 300,000 items of plastic/ per sq.km of sea surface.



What are plastic resin pellets?

The USA intends
banning usage of
micro-beads in
2017 for cosmetic
products,



(bar is 1000 μ m)

Unilever,
L'Oreal
phase them
out 2017.

A scanning electron micrograph showing numerous spherical and irregular microplastic particles. Some particles have a smooth surface, while others are textured or fragmented. A scale bar at the bottom left indicates 500µm.

TAP WATER RAIN

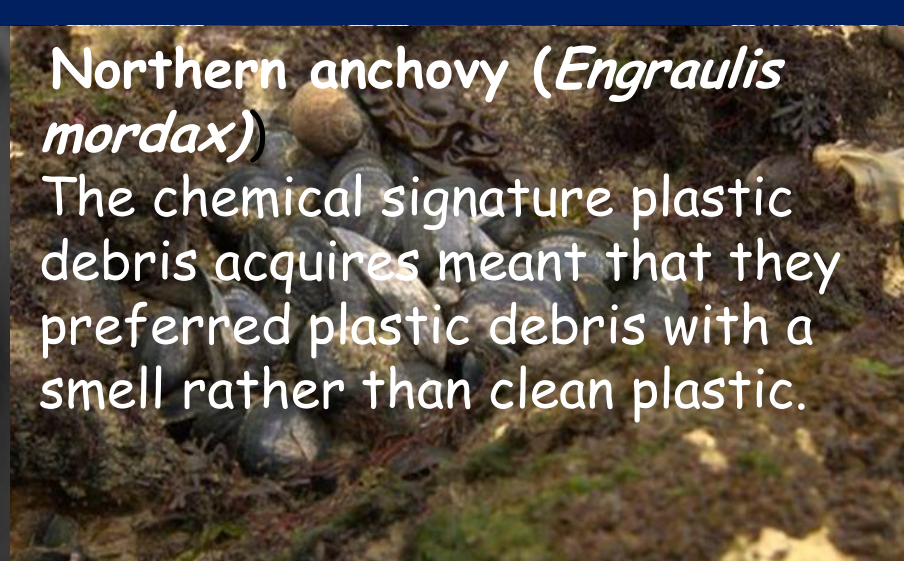
One third of all fish eaten in the UK contains **PLASTIC**

500µm

In the **US** some **100 tons** of micro-plastic annually (Gouin et al. 2011).

Larger plastic debris items progressively **ultraviolet light, heat & fragment** with (Andrady 2015) so present a **considerable**

5 trillion micro-plastic particles litter & release **100,000s of micro-fibres** each (15 - 51 trillion is latest figure).

A photograph of a school of Northern anchovy (Engraulis mordax) swimming in the ocean. The fish are small, silvery, and have a slightly humped back.

Northern anchovy (*Engraulis mordax*)

The chemical signature plastic debris acquires meant that they preferred plastic debris with a smell rather than clean plastic.



1 / SYNTHETIC FIBERS IN THE WASH

Synthetic clothes like fleece, acrylic, and polyester emit thousands of microscopic fibers with every wash. An estimated 1 million tons of these tiny fibers are discharged into wastewater each year, where more than half evade treatment and escape into the environment.

2 / TIRE DUST

Styrene butadiene tire dust is washed into sewers, and from there into streams, rivers, and oceans. Cars and trucks emit more than 20 grams of tire dust for every 100 kilometers they drive. It adds up. Norway, for example, produces a kilogram of tire and road dust each year for every Norwegian woman, man, and child.

3 / PAINTS

Dust from road markings, ship paint, and house paint contribute more than 10 percent of microplastic pollution in the oceans. Studies show that paint dust coats the ocean surface.

4 / SECONDARY MICROPLASTICS

At least 8 million tons of mishandled plastic waste washes into the world's oceans, rivers and lakes each year. These forks, bags, straws, and takeout containers churn and fragment in the frigid seas, breaking down into ever-smaller pieces to join the marine and human food chains — the microplastics of the future. We have produced more plastic in the last 10 years than in the entirety of the last century.

5 / SYNTHETIC FIBERS IN THE AIR

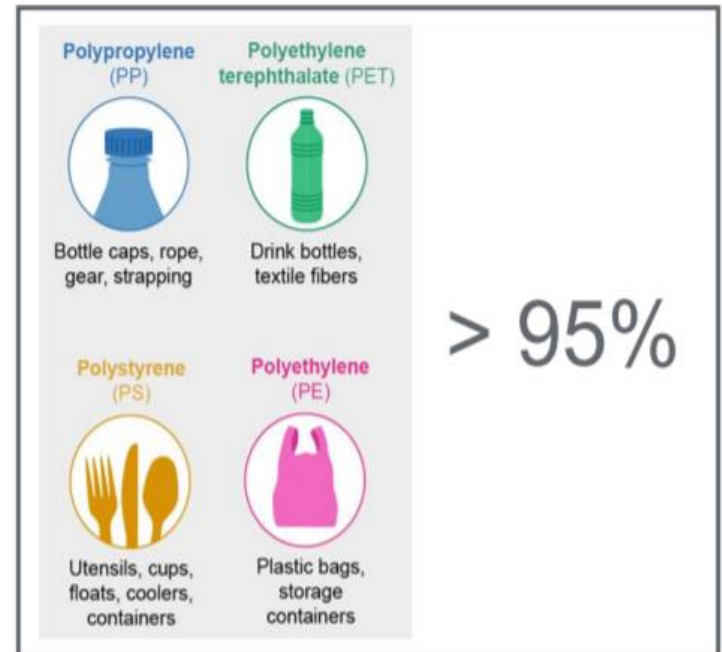
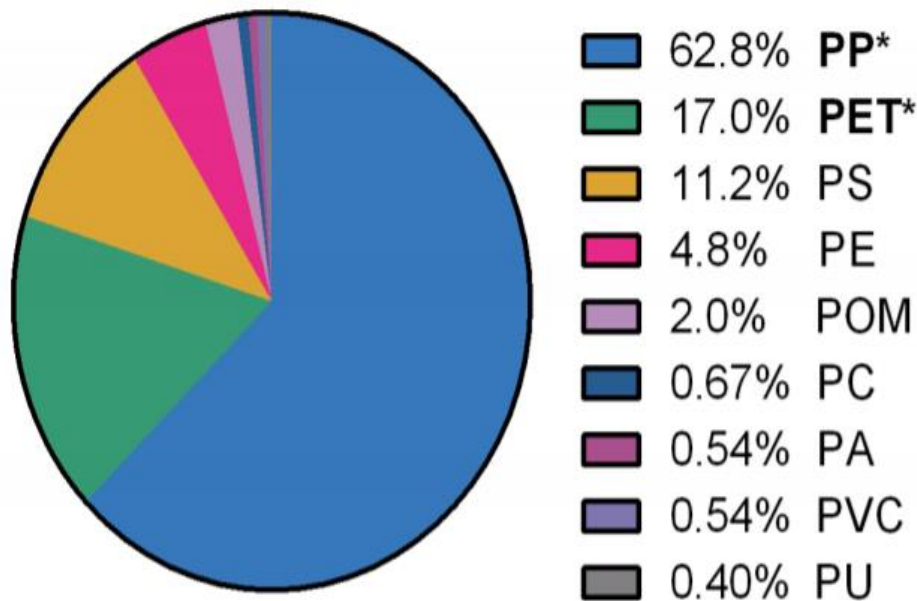
Scientists are only beginning to examine how microscopic fibers reach the atmosphere, and their role as a source of land and marine pollution. One guess is that common abrasion – the simple friction of your limbs brushing against each other - causes clothing fibers to break off into the air, like a cat shedding fur. A 2015 study in Paris estimated that between three and 10 tons of airborne fibers reach that city's surface each year.

6 / MICROBEADS

Banned in facial cleaners and some cosmetics in the U.S. and Canada, it is estimated that more than 8 trillion microbeads polluted U.S. waterways in 2015.

Fibres in human stools

Results – relative frequency of different microplastic types



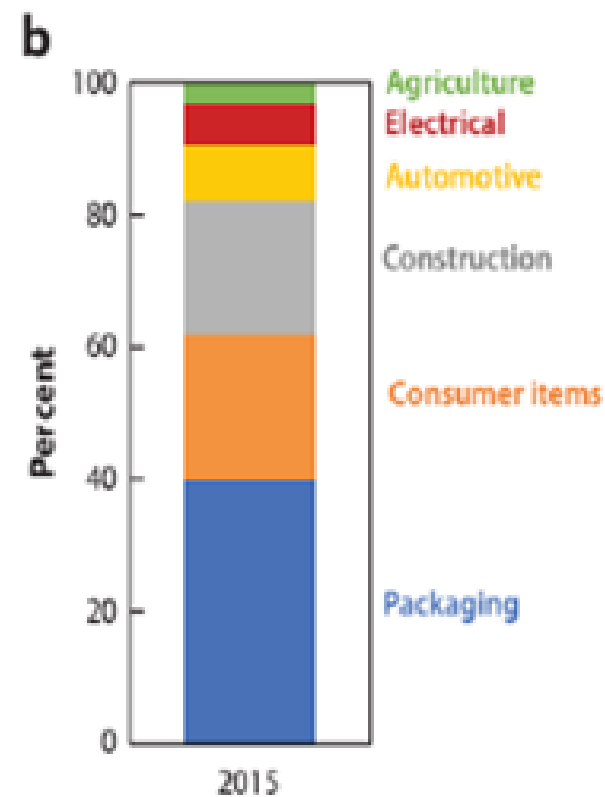
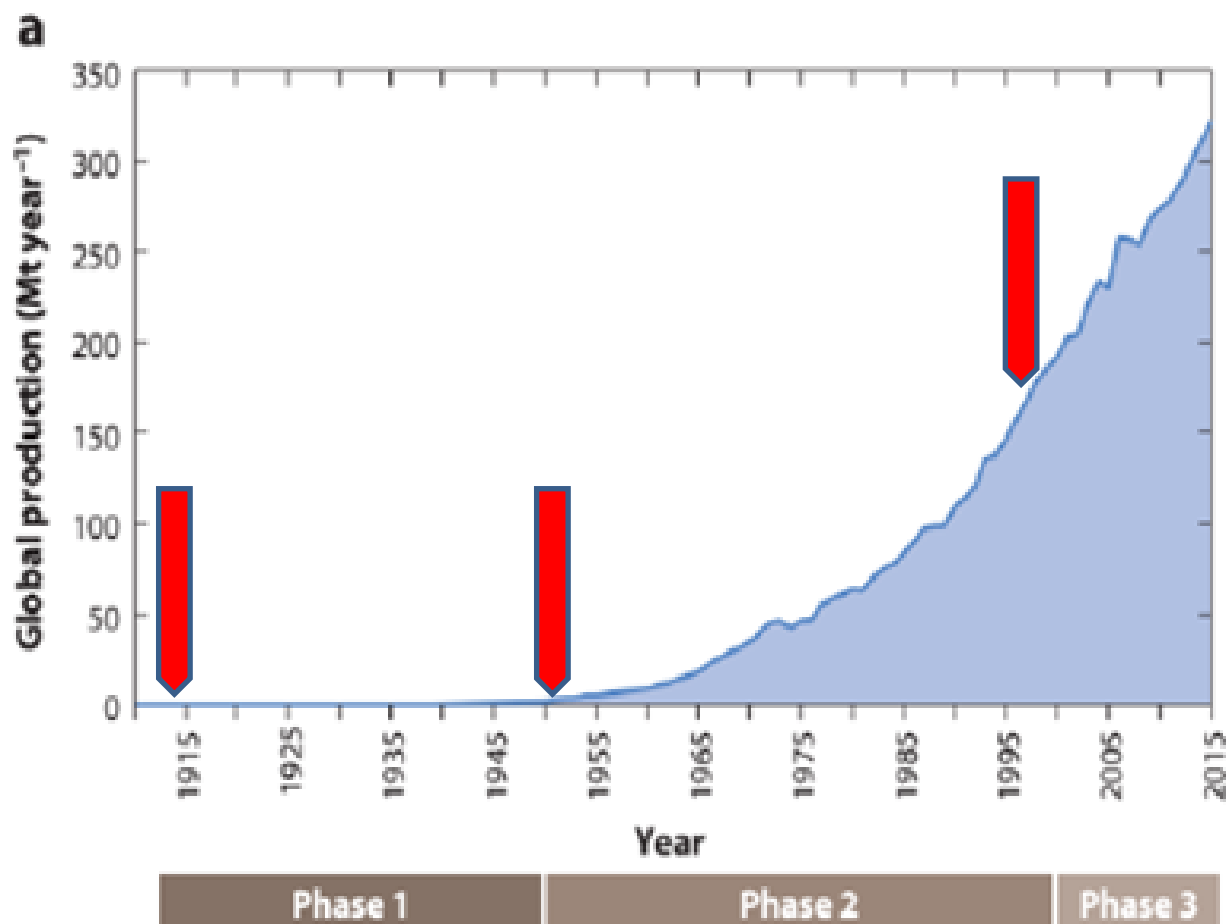
*PP and PET were found in all 8/8 samples



OK, 1. Why so long?
2. What can be done?



1. 15.4% expected growth in bio-plastics 2015-2022.
2. 15,800 kilotonnes of plastic used in packaging, 2016.
3. 7,800 kilotonnes was in the Asia-Pacific market.
4. 80% of global share in 2016 = food & drink beverages.
5. 3.3% rise in paper volume from 2015-2022.



Phase 1. **Innovation phase**, slow development.

Phase 2. **Growth phase**. Rapid global expansion & exponential growth.

Phase 3. **Consolidation phase**. More linear dynamics, mirroring global economic growth.

'Worm, B., Lotze, H.K., Jubinville, I, Wilcox, C and Jambeck, J, 2017
Plastic as a persistent marine pollutant'

How we decide : KAHNEMAN'S SYSTEM

Track 1

Easy way
Intuitive
Emotional
Unconscious
Reflexive

THE HUMAN BRAIN IS AN
AMAZING ORGAN. IT KEEPS
WORKING 24 HOURS A DAY.
7 DAYS A WEEK.
52 WEEKS A YEAR...

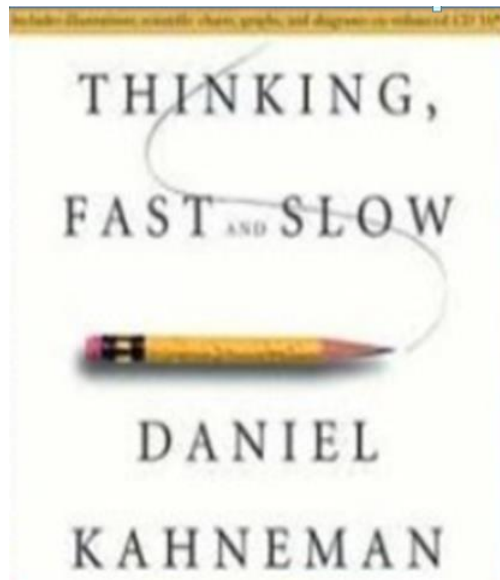


Track 2

Hard way
Analytical
Conscious
Reflective

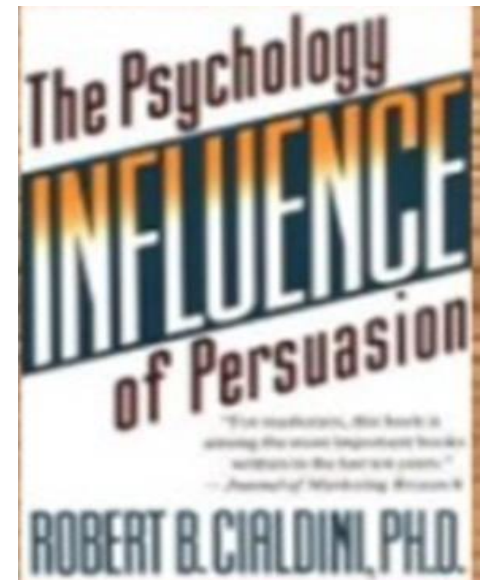
95%+ decisions

rare



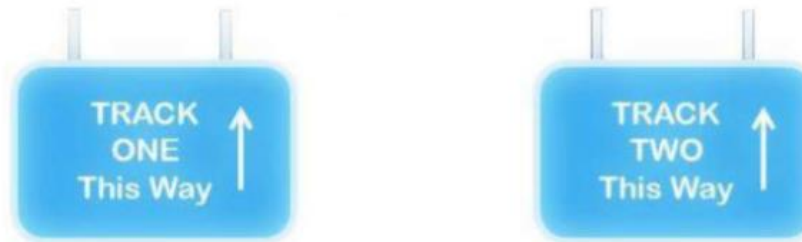
Behaviours

rationalisation



A Two-Track Tool For Issues Development and Campaign Design

Posted on [December 7, 2017](#) by [tochrisrose](#)

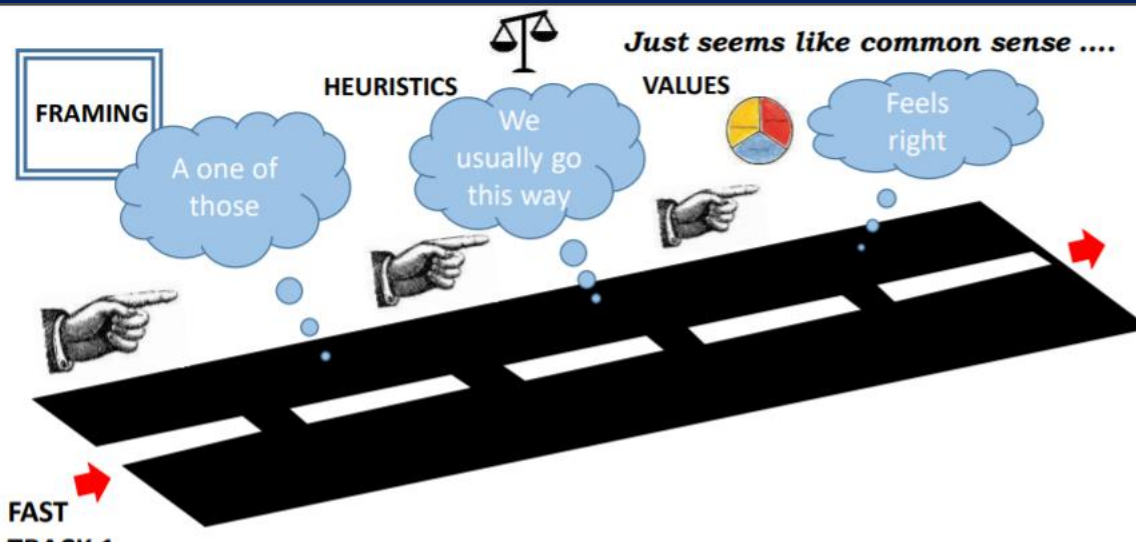


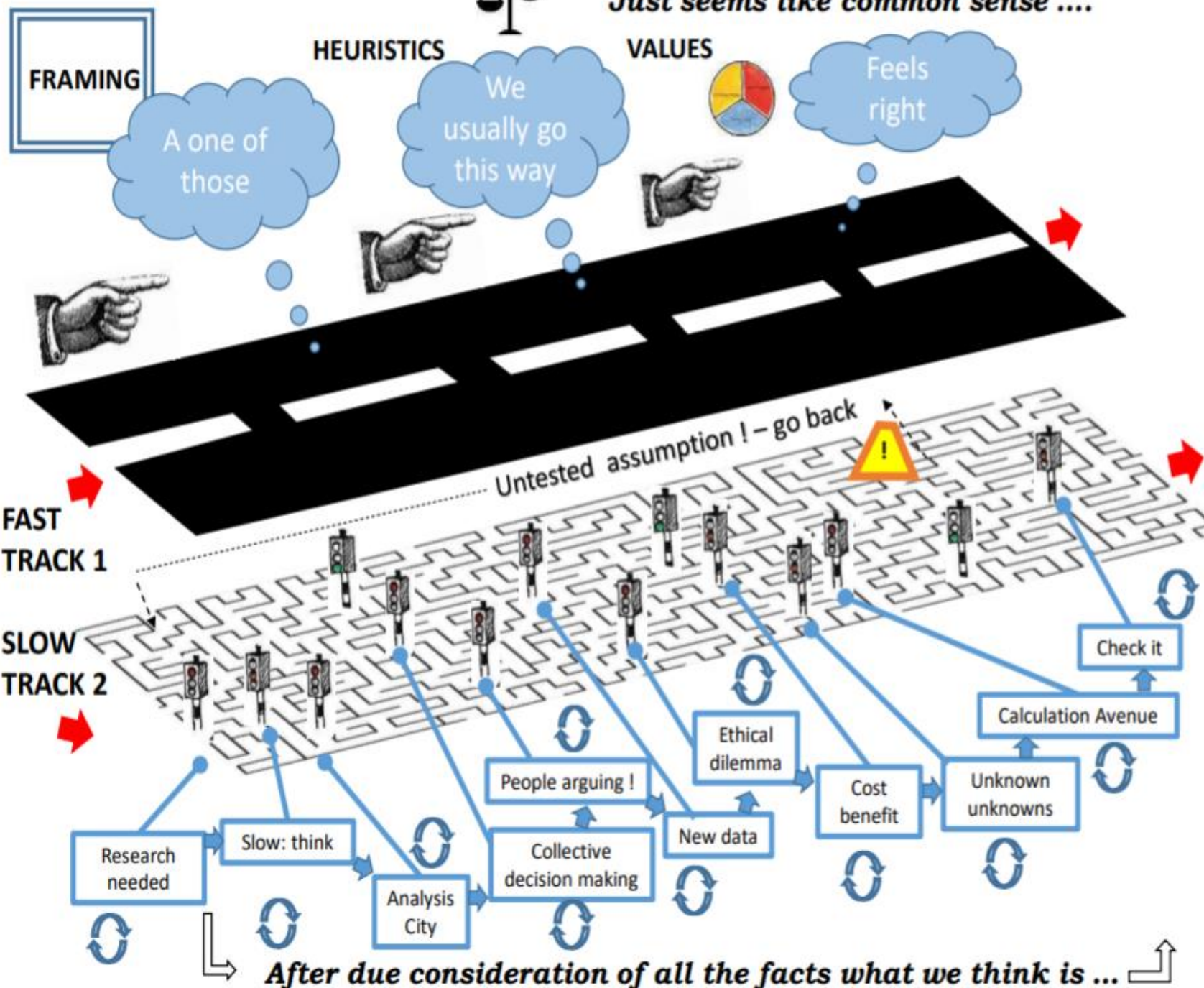
(download this blog as a pdf [here](#))

Public domain
Mainly unconscious communication:
daily life, advertising, politics, popular media
(System 1)

Analytical domain
Mainly conscious communication, science, law, disciplines, policy communities
(System 2)

<http://threeworlds.campaignstrategy.org/?p=1746>





1970: Thor Heyerdhal reports plastic and oil pollution from mid Atlantic to the United Nations. Oil is actioned but not plastic.

1987: 3kt waste barge at sea 112 days seeking dump. Spurs recycling in US

1988: 1st US national beach-clean. Spreads worldwide

1997: sailor Charles Moore finds microplastic 'soup' in Pacific gyre. **2001** Moore publishes study: plastic outweighs plankton 6:1

2004: Thompson shows long-term build up of microplastic in Atlantic, and ingestion

2011: Browne shows global microfibre pollution from washing machines/textiles

2013-7: microplastic found in food, beer, honey, salt, tapwater

2017: five trillion pieces of plastic estimated to be floating at sea; global calculation of fate of all plastic ever made. 8mt/yr into oceans

2017: scientists term plastic pollutant, call for action. UN holds conference, aims at ban on plastic sea pollution

2017: BBC Blue Planet 2 Attenborough

**FAST
TRACK 1**

**SLOW
TRACK 2**

1950 1960 1970 1980 1990 2000 2010 2020

Mass production of modern plastics starts

Albatross chicks dead + plastic, Midway
Seabirds found to ingest plastic, New Zealand

100k micro Fibres plastic Percubic metre North Sea water
Plastic in food chain, US birds

Plastic impacts whole ecological Community, Alaska
Plastic reaching seabed, Baltic

Plastic 'most prevalent' marine pollution

Plastic debris conferences convene

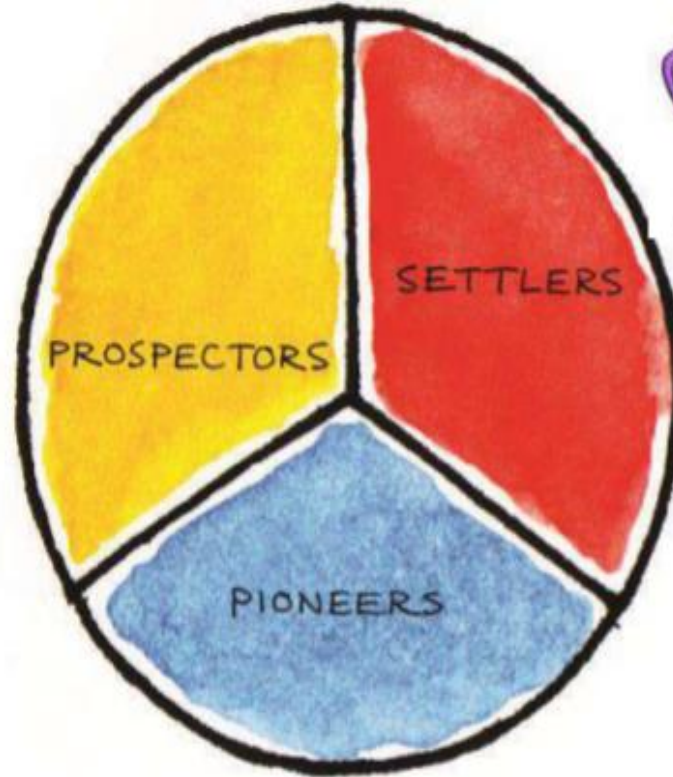
Plastic particles outnumber oil clots, Pacific gyre

Track 1. Communication is dominated by:
Intuitive, unconscious, easy.
Track 2. hard, conscious, analytical

Values: unconscious drivers and behaviours – unmet needs



Prospectors –
outer directed:
need for success,
esteem of others
then self esteem.
Acquire and
display symbols of
success.



Settlers - need for
security driven:
safety, security,
identity belonging.
Keep things small,
local, avoid risk

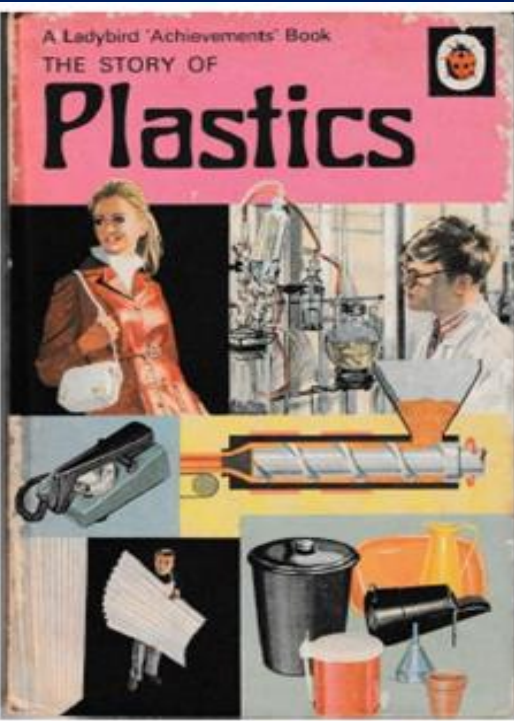


Pioneers – inner directed. Need to
connect actions with values, explore
ideas, experiment. Networking,
interests, ethics, innovation

'Accentuate the positive' by the Plastics Industry.



The 'throwaway' appeal of plastic celebrated in LIFE magazine in 1961.



Protecting Our Heroes

IMAGE



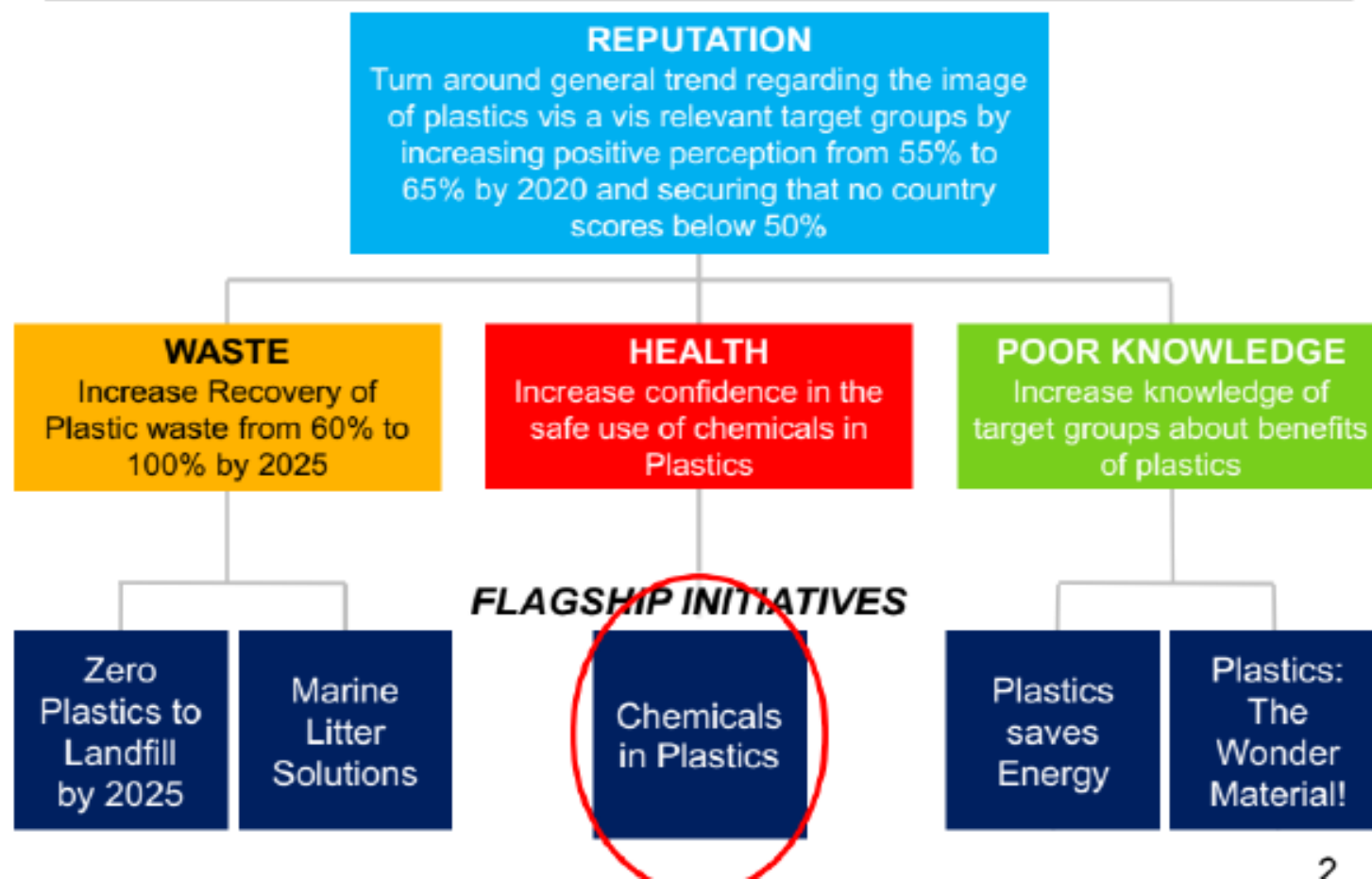
To do their jobs and keep us safe, these heroes rely on personal protective equipment made with innovative high-performance plastics.



Find Out More About Our Heroes

Routinely putting themselves in harm's way to protect us and our loved ones, our heroes have some of the most dangerous jobs in the world. Learn more about their heroic feats and how advanced plastic safety gear helps bring them home safely and make their achievements possible.





Plastics Save the Planet. Slide from a 2015 Plastics Europe strategy workshop. Their main concern (centre) was regulation against endocrine (hormone) disrupting chemicals but bottom right you have two public communications objectives, one (saving energy, less CO2) aimed at climate-concerned Pioneers. 'The Wonder Material' is what the industry has been claiming since the 1950s and is now probably evidence of self-delusion.

But it seems he took no pictures of plastic and he counted the sightings of oil: "I decided to make a day-by-day survey, dipping down with a dipper and taking samples of the oil clots. We found oil clots on 43 days of the 57".

https://www.youtube.com/watch?v=j9EIC_luicY



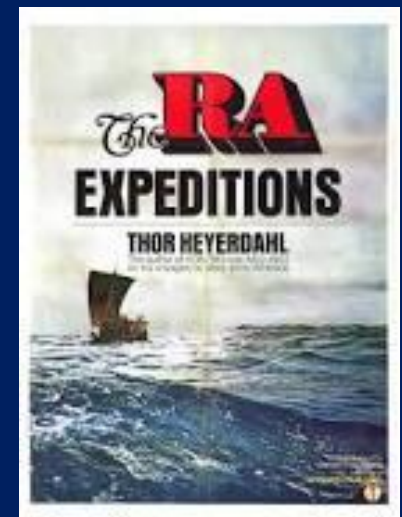
May 1970 Heyerdahl's papyrus boat Ra II proves the ancients could have crossed the Atlantic, and shocked the world with reports of mid-ocean pollution. Signed by the 8 crew members.

<https://www.bajanthings.com/the-ra-expeditions-thor-heyerdaahl/>

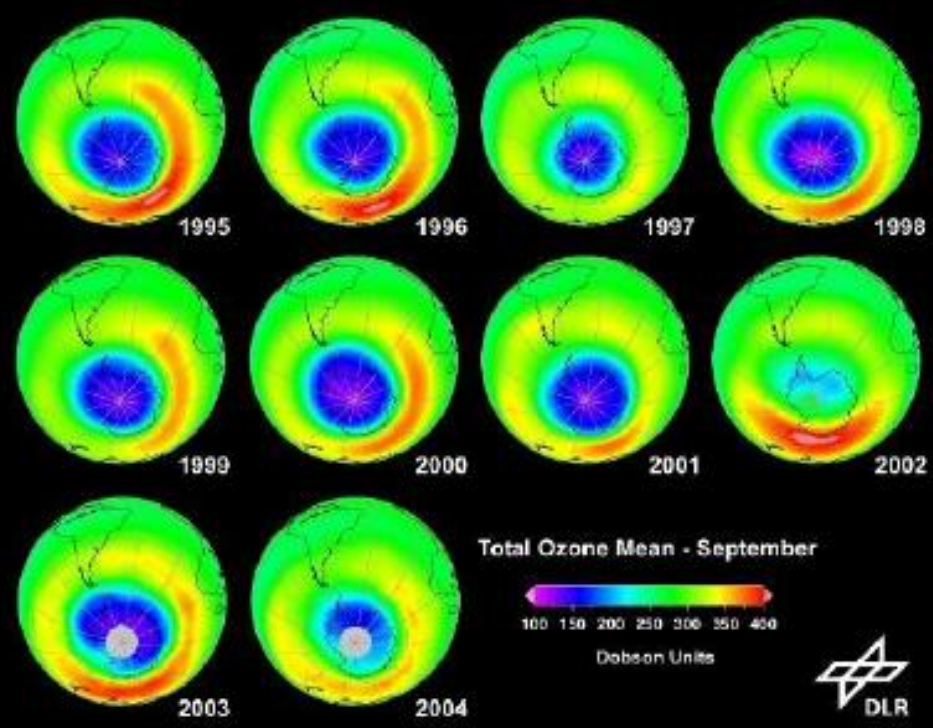


The Ra expedition 1970.

UN. Sec Gen asked them to
make daily oil observations.



10 Years of Ozone Hole Monitoring by GOME and SCIAMACHY



The Ozone Hole
Nature, May 1985

Acid Rain,
pH 5.2 or below
Around the same
time as RA (the seventies)





'Next time try recycling': message from Greenpeace, 1987

'Waste' made a rare appearance in the international media in 1987, when the *Mobro 4000* with 3,000 tonnes of New York waste became a real-life 'Flying Dutchman' and 'the world's most famous barge'.

Travelled 5k miles from New York and back. Destination was South Carolina land fill.
Recycling = way of 'getting rid of waste' but today only 9% is recycled. Eventually burnt in Brooklyn incinerator.

Exxon Valdez March 24, 1989,

Released nearly 11 million gallons of crude oil into Prince William Sound. It was the worst oil spill in U.S. history until the 2011 Deepwater Horizon spill in the Gulf of Mexico.



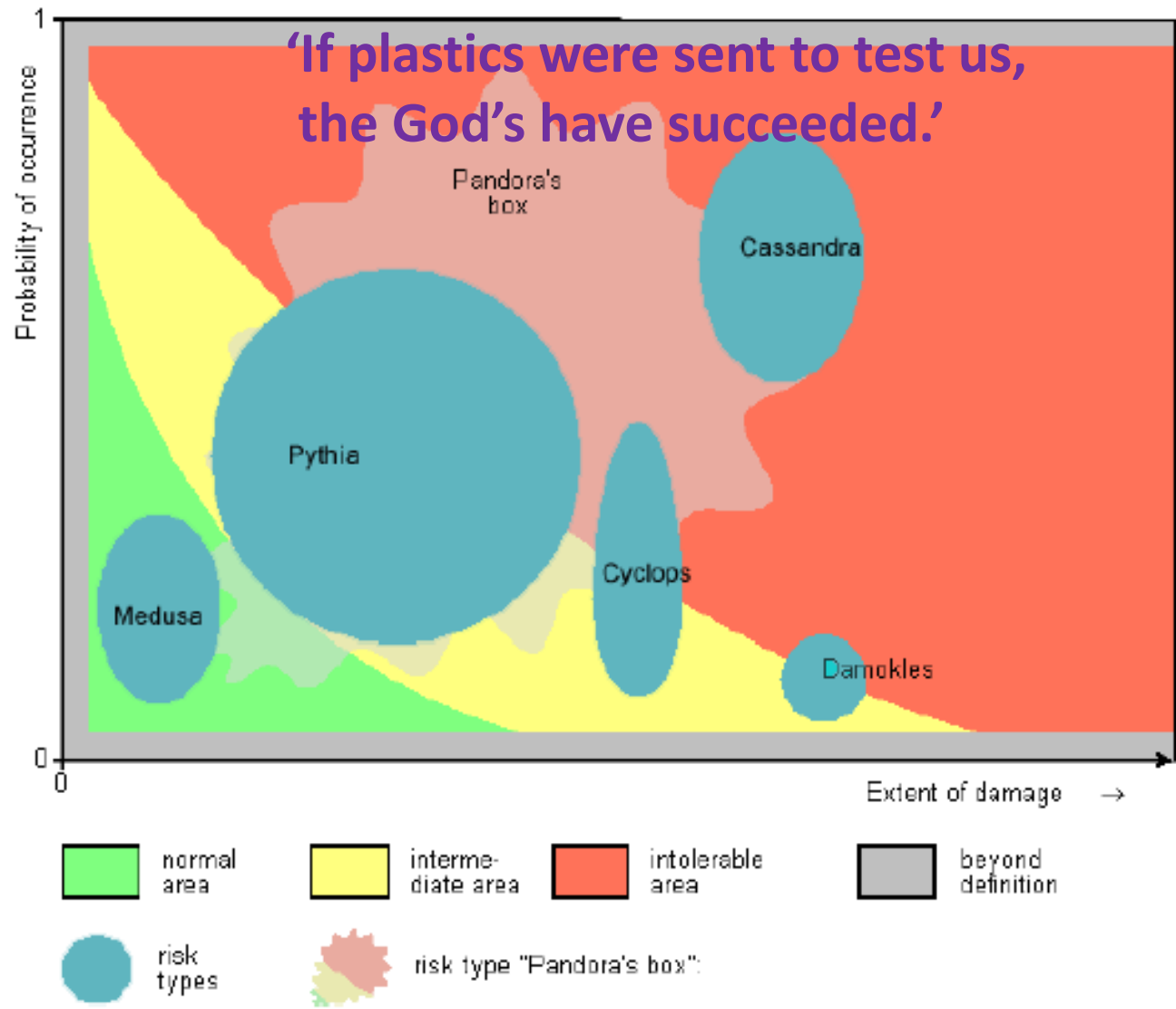


Climate Change

23.06.88

Jim Hansen told US SENATE
*'it was 99% certain that CC
was real.'*

UN IPCC set up.
In the cosmology of the
pollution apocalypse, CC took
over and has stayed on Track 1
ever since.
It has swamped all other
pollution issues.



EIGHT CRITERIA:

Occ. Probability.

Damage extent.

Assessment certainty.

Ubiquity.

Persistence.

Reversibility.

Delay effect

Mobilisation Potential
(Political).

1999 **German Advisory Council on Climate Change** recognised risk classes. Give then Greek God names

THE SOCRATES DIALOGUE



Gnosis

'Why is it so difficult to go from planning to implementation?'

van der Meulen, 2001.

'We are still battling to produce practical results.'

van der Meulen, 2005.

Action

Judgement

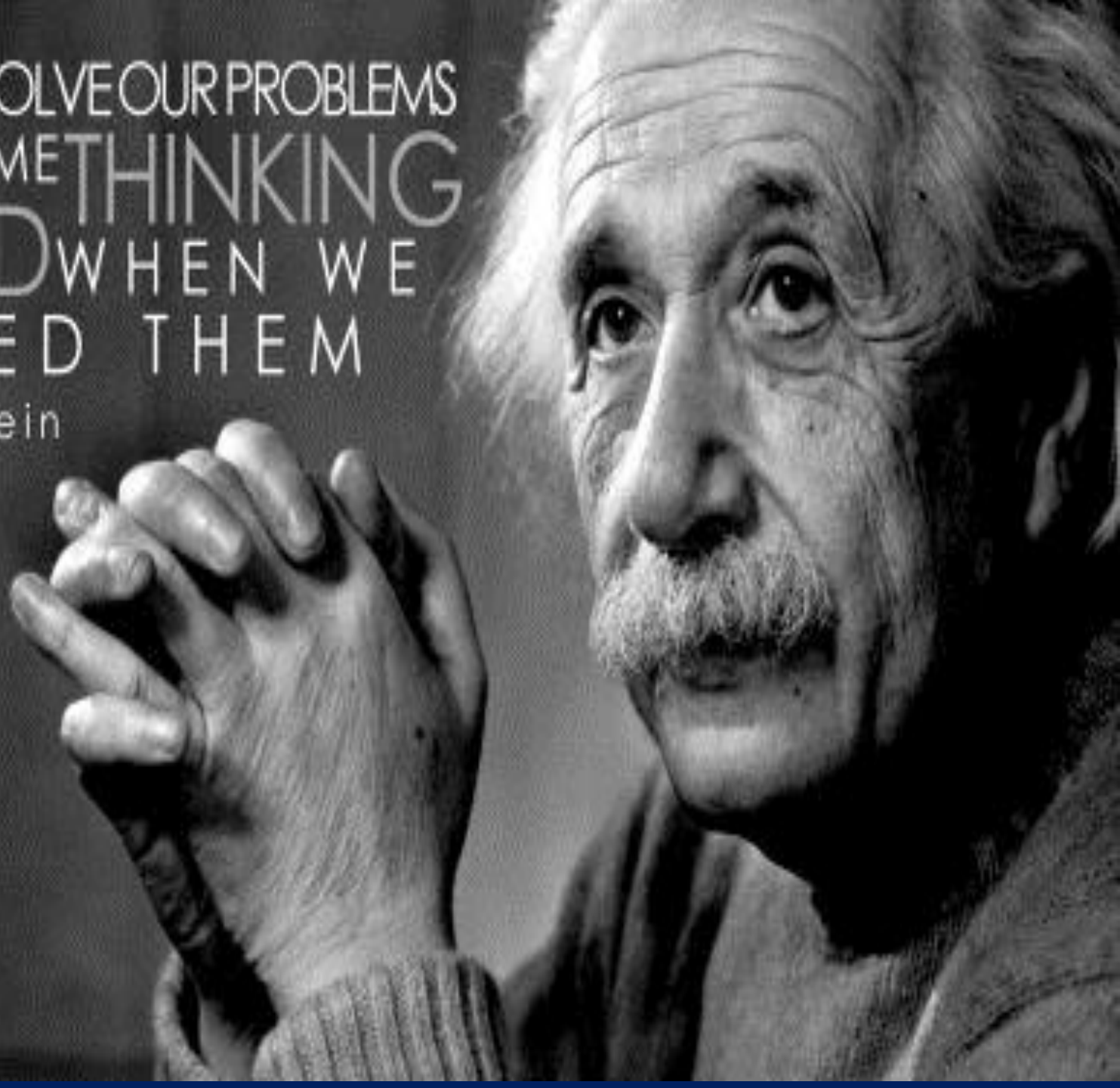


There is a solution for every problem...
BUT, some solutions are better than others.!



WE CANNOT SOLVE OUR PROBLEMS
WITH THE SAME THINKING
WE USED WHEN WE
CREATED THEM

- Albert Einstein



**Recycling Rates; Germany 64%, Wales 63%, England 42%.
Wales wants 70% in 2025.**



SOME KEY THEMES/POLICIES

Mandatory separation of dry recyclable materials.

Mandatory bio-waste separation.

Producers fund collection of key recyclables.

Landfill taxes.

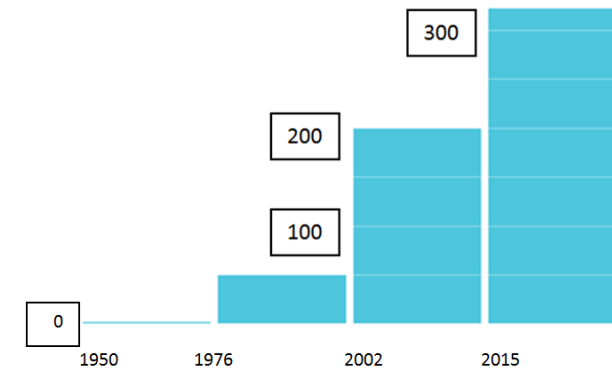
Deposit return systems (est. cost £1bn)

Statutory targets for recycling rates/waste reduction



1. A. REDUCE/RECYCLE plastic input & change **DEGRADABLE PLASTICS**

NB. Global PET plastic bottle production has risen:



Polylactic Acid (PLA).



- Produces 60% less greenhouse gases.
- Uses 50% less fossil fuels in its production.
- 100% of the bottle's material comes from plants, e.g. corn, cassava and sugar beet,..... so fully biodegradable.

Global plastic production (million tonnes).

Polyhydroxyalkanoates PHAs - **fully degrade** in seawater & marine sediments but have a negligible market share, & are **NOT** poised for rapid headway to a consumer plastics market.





1.B. Success of **plastic bag tax** .

Numbers dropped by 6 m in England (2015) due to 5p charge, next:

COFFEE CUPS.



Coffee cup problem is **plastic lining** (polyethylene resistant to degradation 30 years to break down??) makes cup impermeable.

Beverage cartons

2007. kerbside, banks, landfill

10% 65% 25%

2017. 67%, 26% 8%

Switching bank-kerbside increased recycling tonnage six times.



Why pull apart – why not join them?

Imperial College, is testing a resin 40% stronger than conventional plastics (melting polypropylene high impact polystyrene & introducing filler within the extrusion line).

Additives are added so cellulose fibres can bond with polymer.

'Nextcupcycle'

'Pret a Manger – 50p discount if reusable cup is used.

FRUGALPAC
developing a 100% recyclable cup.



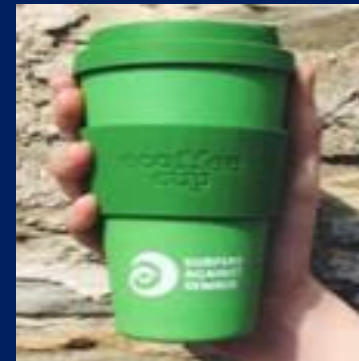
Teabags?



Rice way £18



Keep cup £10



SAS Bamboo cup £12

Gove (below) looking at a deposit return scheme (**DRS; 10-25p**), refunded when bottle/can returned.

In Feb. 2017 Coca-Cola announced support. Had previously lobbied the Scottish government against it! (*Unearthed*).

Starbucks gives a **25p discount** if re-usable cups brought
Costa gives a 25p donation to charities - **Keep Wales Tidy** - **£100k+** if people bring their own cup.

Cardiff researchers found this had **NO** meaningful impact. By contrast introducing a charge on disposable cups did.

Half a million cups/day **thrown away**..



Supermarkets pay c.£70 m /year

Local authorities c. £700

Govt. measures hopefully will increase this to £500m to £1bn!

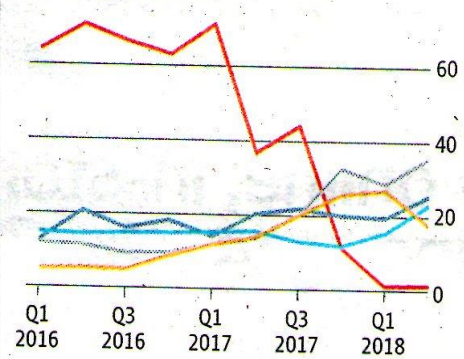
Much abuse- sent to other countries (2/3rds of waste exported).

Taking on plastic is taking on consumerism itself.

UK plastic exports to other countries have risen since China banned imports this year

Thousand tonnes

● China ● Malaysia ● Poland
● Netherlands ● Turkey



Source: National Packaging Waste Database, Environment Agency



not litter but something are more

(synthetic material using
from turning crude oil/coal to

1969 -moon landing. 1970 Pepsi/Coca cola replaced glass bottles with plastic, Shifted global economy to plastic

22.12.17. Env. Audit Comm. (Chair Mary Creag), Govt. Rept

Societal change: Recycle 7.7bn. plastic water bottles used /year.
13bn. used /year.



Called for a **Deposit Return Scheme (DRS)**.
Apart from Co-op and Iceland **NO** big retailer
has yet signed up. Could remove **700,000**
bottles from litter **EACH DAY**.

'The Polluter Pays' principle is called for.
Taxpayers pay **90%** of recycling costs.

By 2023, a minimum of **50%** plastic bottles
should contain **recycled** plastic.

Increase number of public water fountains.

2. The Circular Economy Package

can 'close the loop' of product lifecycles (recycling/reuse) to get max. value + use all materials, products & waste.



TAKE



MAKE



DISPOSE

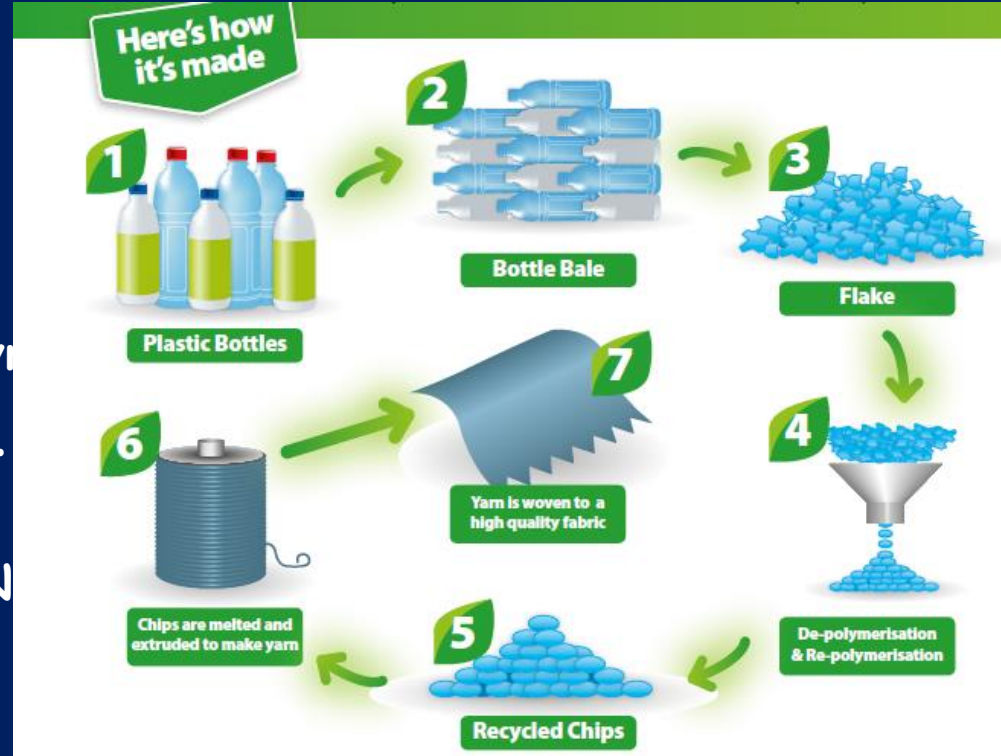
68% of 18-35y
OLDS NOT
AWARE THAT
PLASTIC
BOTTLES CAN
BE RECYCLED

Versus

**Circular
Econ.**

**TAKE, MAKE, USE
REUSE**

**Linear
economy**



TRUTEX: Polyester yarn, 3 l bottles in one blazer, 300,000 blazers a year, >9 million bottles saved from landfill.

Market Based Instrument	Explanation	3. ECONOMIC INSTRUMENTS
Effluent charges	Payment of fees to pollute	
Fines (law enforcement)	For littering	
Deposits-refund systems	Repay deposits for items returned (fishing nets)	
User and administrative charges	Product disposal and municipal charges	
Auction or tender	Of a right to create pollution	
Tax incentives/differentiation	Tax rebates for collection or litter prevention	
Sales taxes	Plastic bags / On specific items to restrict use or inputs	
Tradable permits systems	Right to trade with pollution outputs	
Port reception facilities	Low or no cost to encourage disposal	
Tourist taxes	‘Voluntary’ by tourists but imposed by authorities	
Award based incentives	To encourage local communities	

4. CLEAN BEACHES. 10m. viruses, 1m. bacteria in 1 gram of faeces. 1m eggs, infectious 2-3 week post deposition. 2014. GENeco Bio bus (sewage & food waste). **Bristol bus No 2.** -185 miles. Also bio-methane - enough to heat 5,000 homes & nitrogen/phosphate fertilisers.



← **The problem**
The Dogs (Fouling of Land) Act, 1996.

- **91%** local councils employ a dog warden.
- **86%** run anti-fouling campaigns.
- **50%** issued **5,500** verbal warnings & gave **2,400** fixed penalties, **600** taken to court.

Malvern Hills, 10 bags of dog poo gives 2 hrs of street lighting.



DAVID DE ROTHSCCHILD.

Plastikj- a boat kept afloat by 12,500 discarded plastic bottles lashed to its sides.

5. INNOVATION

srPET- self-reinforced polyethylineterephthalate recycled plastic formed of layers of cloth like Plastikisheets - are the arched supports of the twin hull.





Plastics en route to China.

CHINA, July 2017 clamp down in 'foreign garbage' esp. paper and plastics.

UK exported 2.4 million tonnes since 2012.

2016 China imported 7.3 million tonnes from world.

5. INNOVATION

a) The Plastic Pollution Coalition' with >500 members; and 90 NGOs under the 'Surfrider umbrella.'

c) Concrete strengthening with irradiated plastic.

Increased by 15% -treat pl. flakes with gamma radiation, process to a powder, mix with cement paste (Portland cement/fly ash /silica fume).

b) **THE CREATIVE METALLURGY CONCEPT**
The 'Fishy Fisheries' project at Newlyn, Cornwall UK.

- 1 Collect used nets.
- 2 Sorted & non recyclable nets removed
- 3 Shredded and washed.
4. Thermally reformed to larger diameter filaments for **high value 3D** printers.



5. INNOVATION

g) The world of 'Fashion'



e) HENRY HOLLAND. % of profits to MCS, UK. Cotton + recycled plastic.

d) 'Smoothshell' OCEAN DISCOVERY UNDERWEAR (Flotsam, jetsam, nets).



f) (recycled plastic) , e.g. **IKEA** .chairs, garden furniture

5. INNOVATION

h). 'Others'

Tide, Stuart Haygarth 2004

edition 1 of 10.

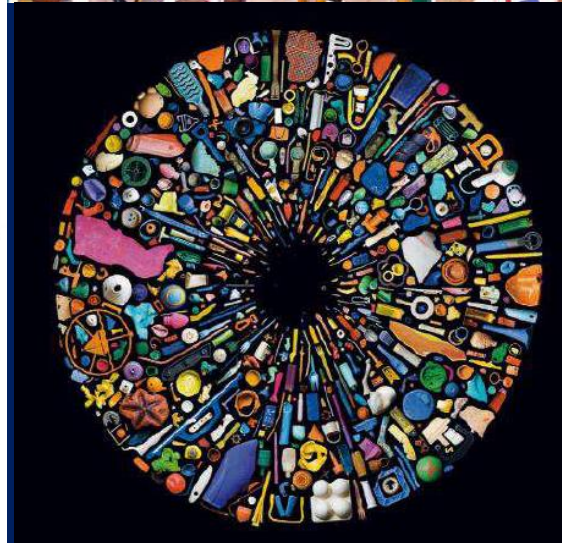
'Iced 'lollies'
Univ. of Taiwan



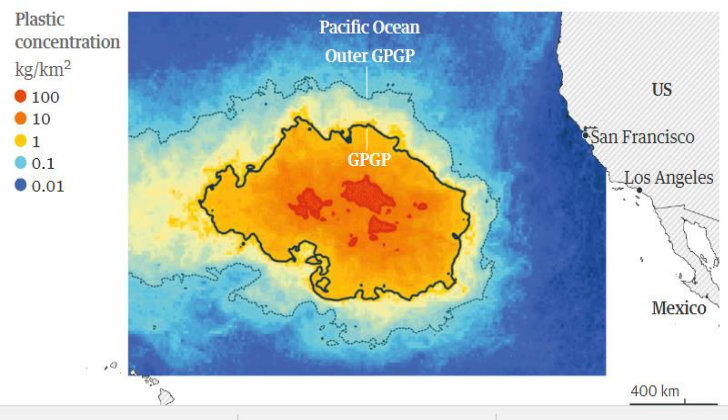
Filthy snack



Bottleton End
£395



Campbell Hey



OCEAN CLEANUP, 2018

Area: 613k sq. miles - 3x the size of France.

1.8 tn. pieces bulk being micro plastics (<5mm.) Half the weight - fishing nets. Other items bottles, buoys, ropes and toilet seats.

Barriers with underwater screens capture and concentrate litter (>1cm) into one area - scoop up 5 tonnes/month.



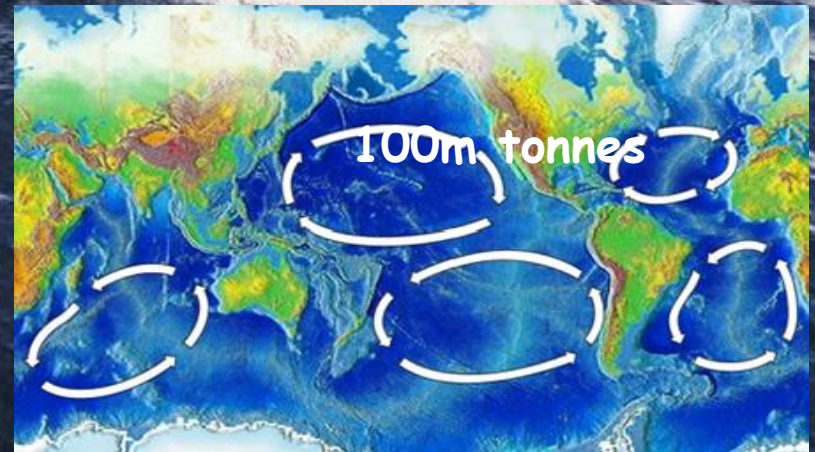
h) BOYAN SLAT

<https://www.youtube.com/watch?v=ROW9F-c0kIQ>

7.25 million years to clean up Pacific garbage patch. Slat states 5 years! 62 mile V shaped barrier, 24 platforms (manta ray shapes) by 2020. Can obtain & sell plastics found - \$500 m (55 ship containers /day).

100m floating dam to trap litter late 2017 off Dutch Coast.

5. INNOVATION



‘Trash Isles’

5. IN NOVATION: EDIBLES

Skipping Rocks Lab, UK. Ooho water pouch (seaweed).

Herald's edible straw; lasts 40 mns. pre dissolving (sugar, corn starch and jelly).

Narayana Peesapaty, Hyderabad- edible cutlery (millet flour).

BAKEYS, India cutlery from sorghum blended with rice and wheat, i.e. no chemicals/preservatives/emulsifiers etc., 100% natural, biodegradable vegetarian and even Vegan.

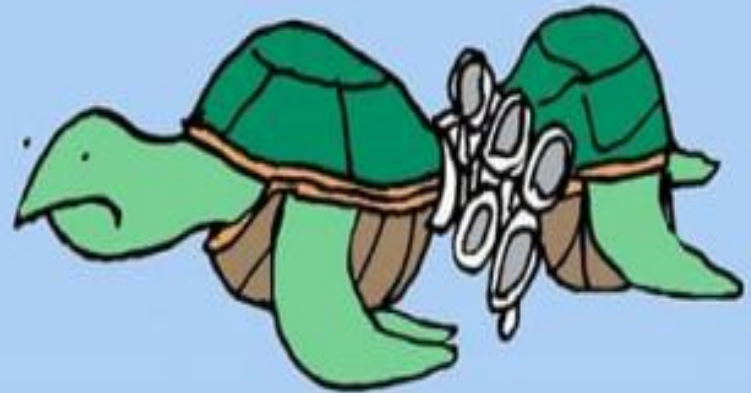
Loliware now makes edible straws with various flavours e.g. vanilla, the UK throws away >8.5bn of standard straws per year.

COLPAC compostable ovenable tray 100% sugarcane

(ICELAND) bamboo/sugarbeet ready meal trays,

COOP packaging with one polymer only; replacing polystyrene

GREAT NEWS
EVERYONE THEY'RE
BANNING STRAWS!



5. INNOVATION

ENZYMES, CATERPILLARS AND BIOPLASTICS

Enzymes. (*Ideonella sakaiensis* 201-F6), 'eats' polyethylene terephthalate (PET) as its major energy and carbon source. Univ of Portsmouth and US Department of Energy's National Renewable Energy Laboratory (NREL).

Bioplastics are either made from a renewable resource, e.g. corn or sugarcane (bio-based); break down completely via a natural process (biodegradable), or are both bio-based & biodegradable.
Production cost >50% of conventional plastics.



The larvae of the greater wax moth (*Galleria mellonella*) that devour plastic bags; one worm eats 2 milligrams a day, so billions would be needed. Perhaps the answer lies in the bacteria that enables the moth 'to eat' plastic, so could a future answer be large fermenting vats of bacterial froth into which plastic litter is poured? Who knows?



**Do you really think it
can't happen to you?**

Chunk Click every trip.



Clunk Click.

Even on the shortest trips.



6. A CULTURE CHANGE

**DON'T
DRINK
AND 
DRIVE**

7. METHODOLOGY Sampling size unit - function of aims.

- Beach survey from water's edge to splash zone (Dubsky, 1995).
- Varying width transects to find optimum.
- Transect line quadrats (Dixon and Hawksley, 1980).
- Strand line counts (Williams & Simmons, 1997).
- Offshore water column (Williams et al, 1993).
- Number of plastic bin bags/trucks etc.
- NALG 2000.
- OSPAR/Ocean Conservancy.



Survey	5m	15m	25m	50m
➤ 1	29%	61	65	84
➤ 2	28	62	75	81
➤ 3	28	51	62	80
➤ 4	53	65	74	82
➤ 5	33	61	66	75
➤ 6	46	76	62	92

Beach cleans

-UK 18m euros a year, Belgium 10.4 .

% litter in different sized transects.

Categories for Grading a Beach:

Category		Type	A	B	C	D
1	Sewage Related Debris	General	0	1-5	6-14	>15
		Cotton Buds	0-9	10-49	50-99	>100
2	Gross Litter		0	1-5	6-14	>15
3	General Litter		0-49	50-499	500-999	>1000
4	Harmful Litter	Broken Glass	0	1-5	6-24	>25
		Other	0	1-4	5-9	>10
5	Accumulations	Number	0	1-4	5-9	>10
6	Oil		Absent	Trace	Noticeable	Objectionable
7	Faeces		0	1-5	6-24	>25

(ENV. AGENCY/ NALG)

A:

B:

C:

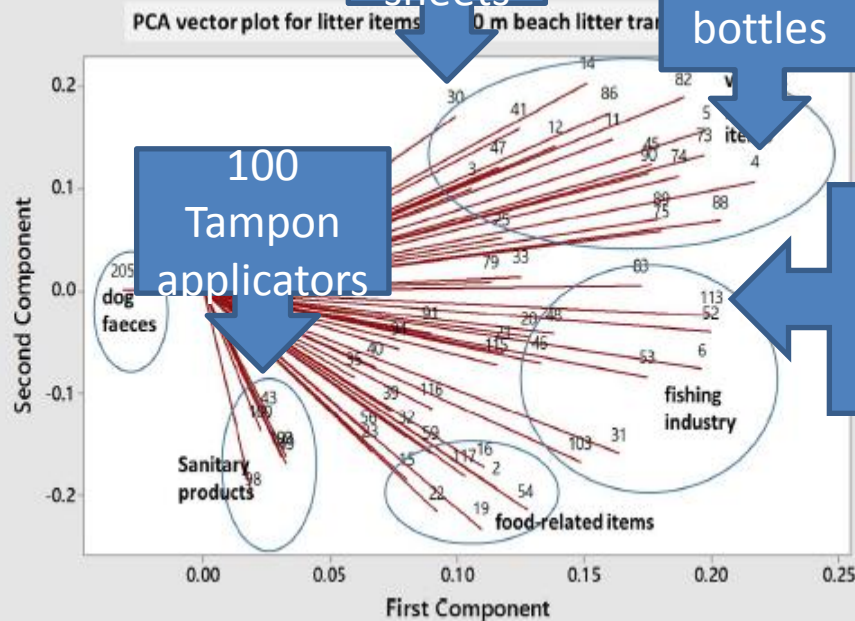
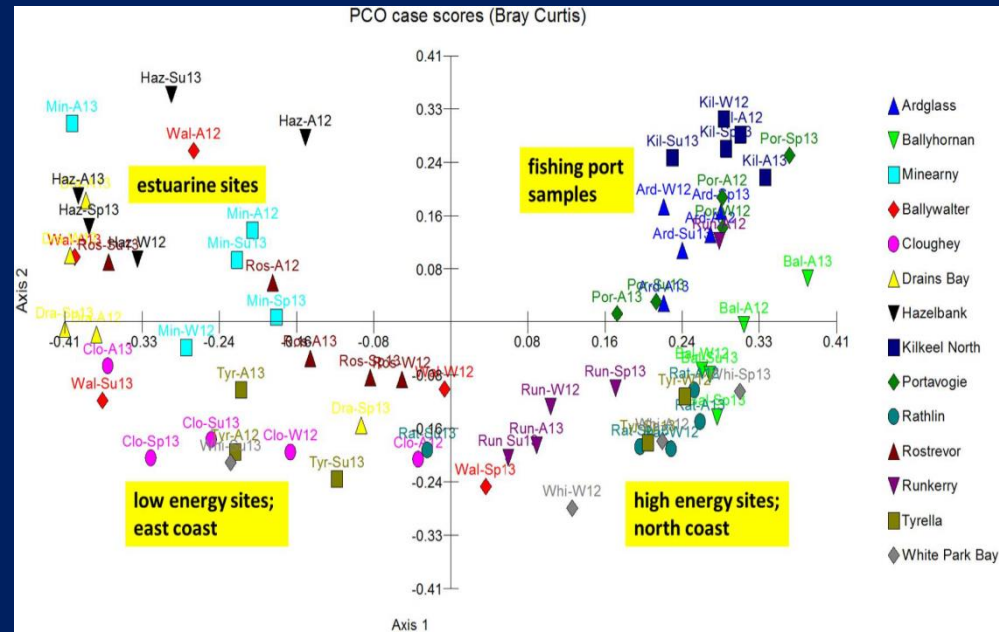
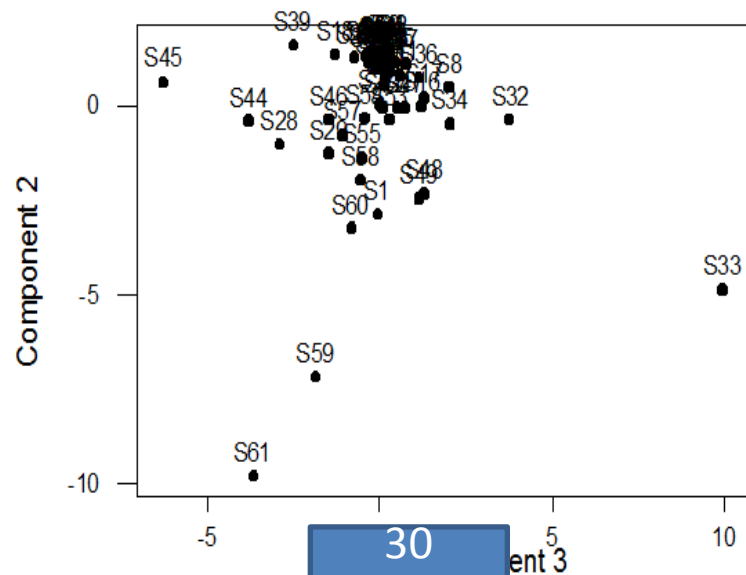
D:

Very Good

Good

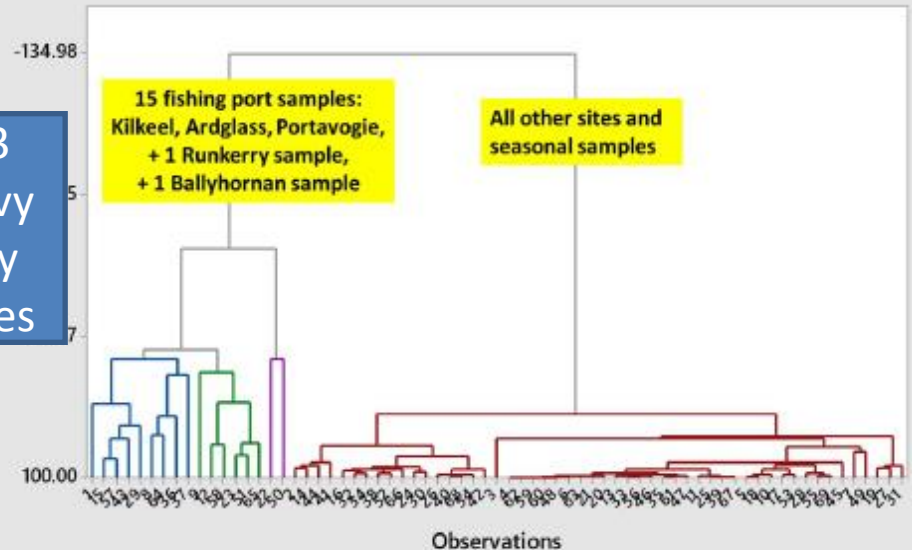
Fair

Poor

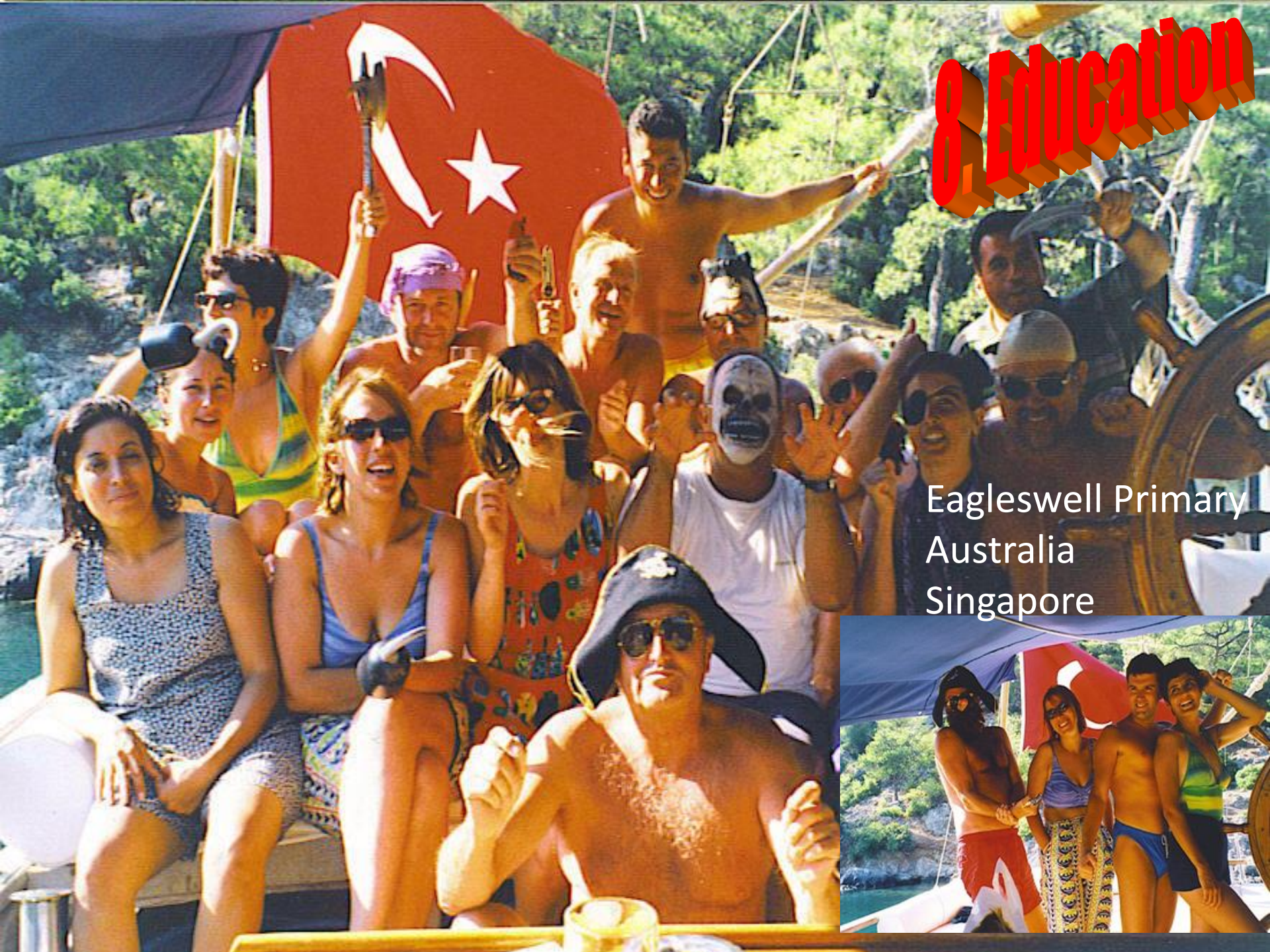


PAR

Dendrogram of Samples (Observations)
Ward Linkage, Squared Euclidean Distance, Reduced Vars, Standardized



8. Education



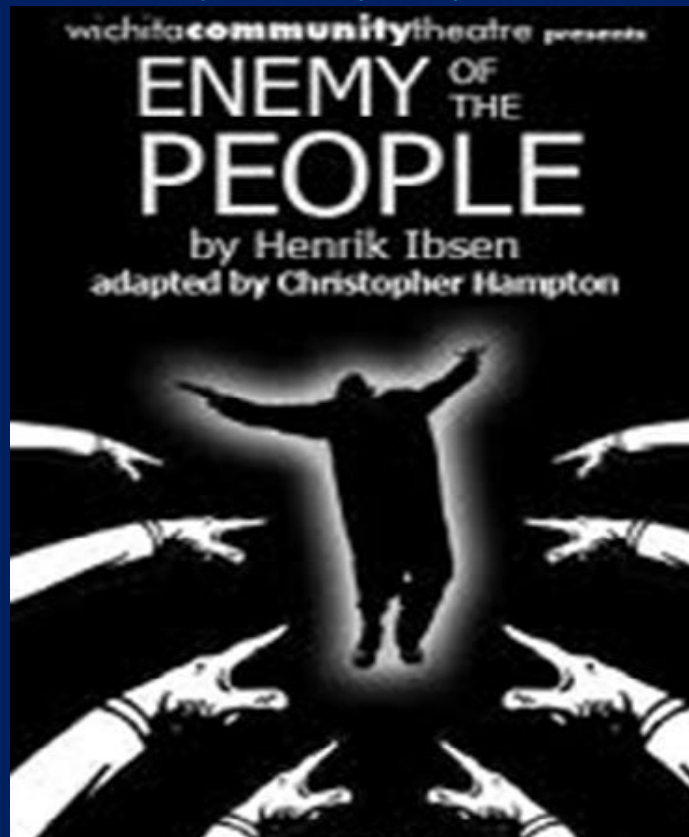
Eagleswell Primary
Australia
Singapore



'Party programmers strangle every young and vigorous truth - that considerations of expediency turn morality and justice upside down.'

10. POLITICS

'Are choices leaders make made in the interest of the people or made in the interest of a few who, armed with the tools given them by the people, make the people believe the reverse?'



'With control over the media, & consequently public opinion, today's political leaders do whatever they want and get away with them....'

'There is a gulf of space between those who get into political positions and the masses. Power and wealth have become the true end of politics, the majority are made to support the ideas of the few that benefit fewer.'

CONCLUSIONS



Co-ordination of existing activities to enhance effectiveness.

Redesigned/recycled & end-of-life items accumulating as waste - use as a resource for **new product production**.

A **circular economy** will reduce reliance on non-renewable resources & also reduce the waste quantity requiring disposal.

Better **enforcement of existing laws**.

Education: industry, public, seafarers (port, on board facilities),

More **chemistry** studies on the many varieties of polymers.

'General.

Should we do this?

Allan, take
this, for
dropping litter



D-DAY 1944



*“ Want of **foresight**, **unwillingness to act** when action would be simple and effective, **lack of clear thinking**, **confusion of counsel** until the **emergency comes**, until self-preservation strikes it’s jarring gong - these are the **features which constituted the endless repetition of history.**”*

WINSTON CHURCHILL, speaking to the House of Commons before World War II.

Cassini Huygens probe, 2004 at Saturn's rings



We are all in this little blue point.

All our wars...

All our problems...

All our greatness
and misery...

All our technology,
our art, our advances...

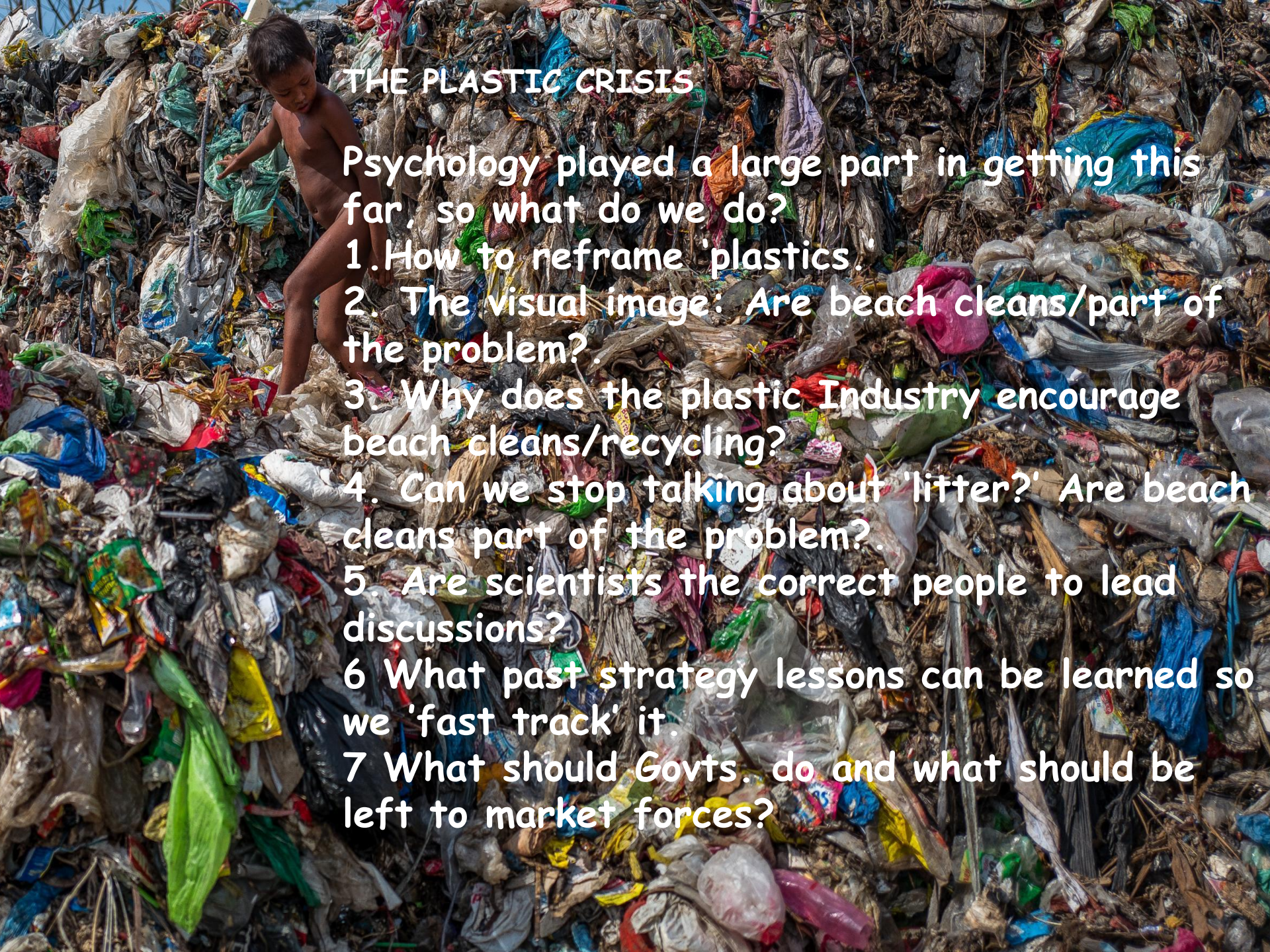
All our civilizations,
all our wildlife and flora...

All races, religions...

All governments, countries and states...

All our love... and hate...



A young child is standing amidst a massive, sprawling pile of plastic waste. The child is shirtless and appears to be looking down at the trash. The waste is a chaotic mix of various plastic items, including bags, bottles, and fragments, in many colors like white, blue, green, and red. The scene is a stark representation of environmental pollution.

THE PLASTIC CRISIS

Psychology played a large part in getting this far, so what do we do?

1. How to reframe 'plastics.'

2. The visual image: Are beach cleans/part of the problem?

3. Why does the plastic Industry encourage beach cleans/recycling?

4. Can we stop talking about 'litter?' Are beach cleans part of the problem?

5. Are scientists the correct people to lead discussions?

6 What past strategy lessons can be learned so we 'fast track' it.

7 What should Govts. do and what should be left to market forces?



***‘Those who do not learn from the lessons of the past,
are condemned to repeat them’ - Santayana***

Thank you

So let us have a coffee break! OR

SHADY SIDE ACADEMY
GARGOYLE SOCIETY

proudly presents



An
ENEMY
of the
PEOPLE

AN ADAPTATION

ORIGINAL PLAY BY HENRIK IBSEN

DIRECTED BY DANA HARDY-BINGHAM

NOVEMBER 1ST - 3RD

FRIDAY AT 7:00 PM | SATURDAY AT 7:00 PM & 9:30 PM | SUNDAY AT 2:00 PM

SHADY SIDE ACADEMY

HILLMAN CENTER FOR PERFORMING ARTS

