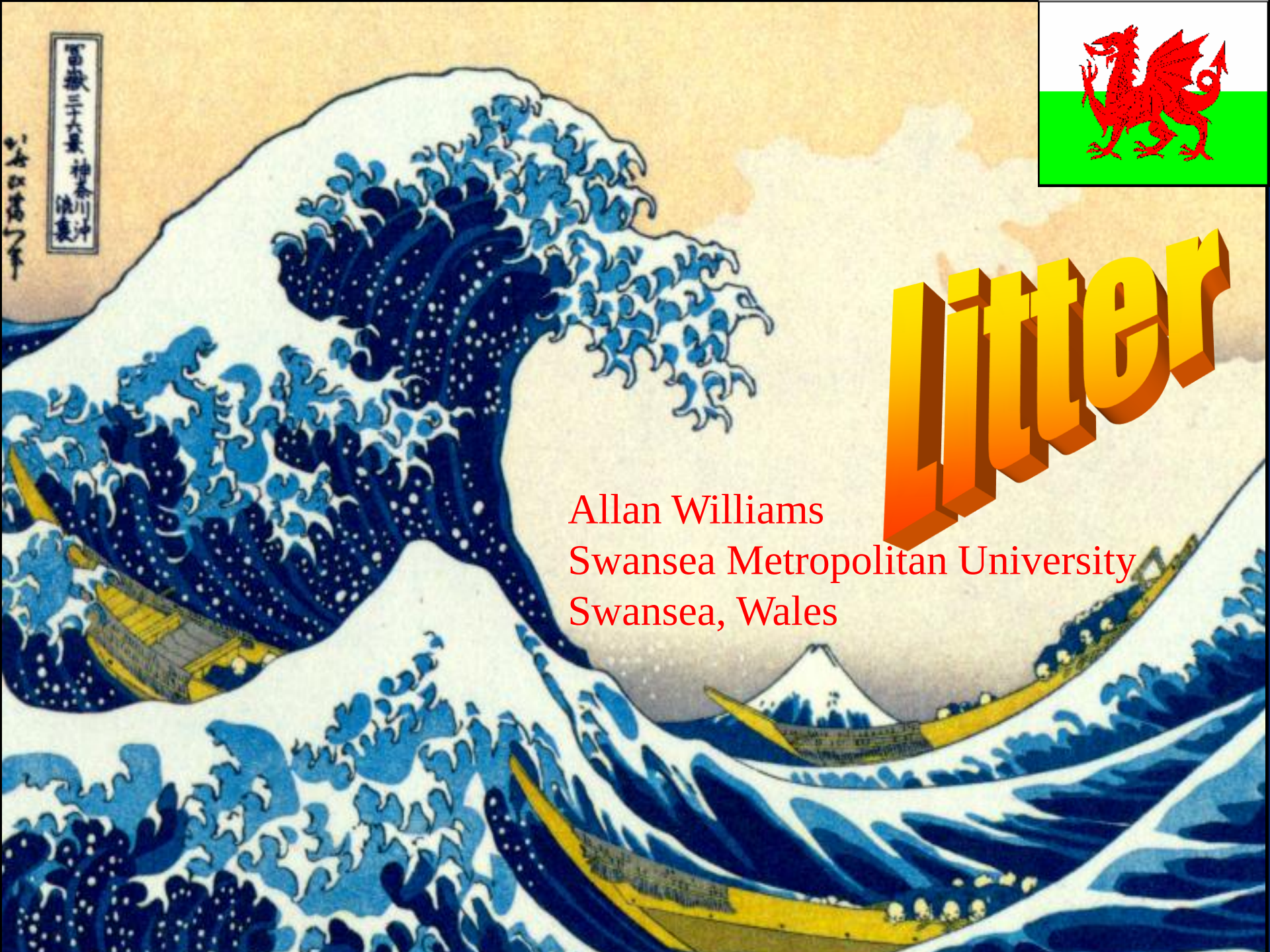




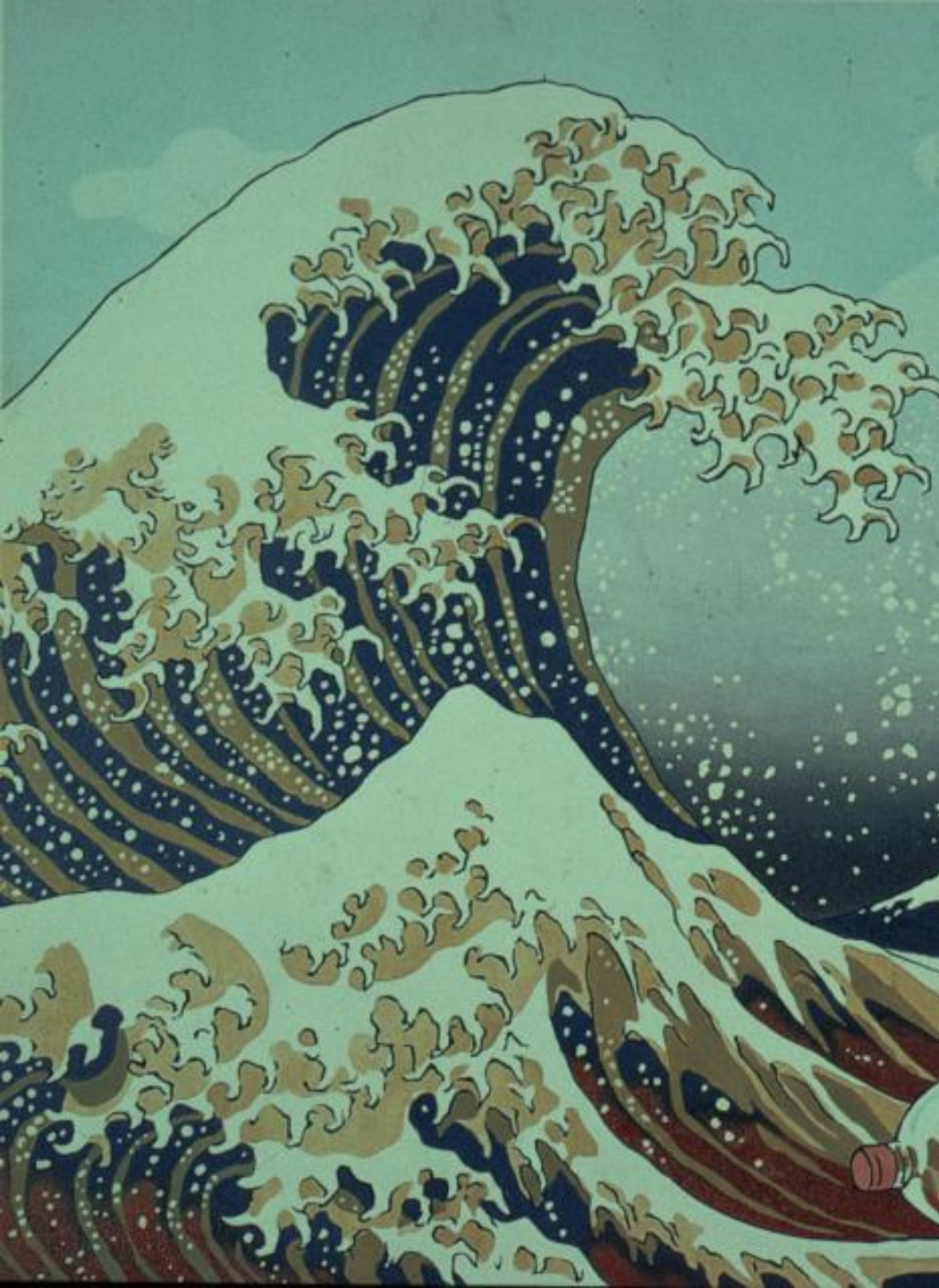
litter

Allan Williams
Swansea Metropolitan University
Swansea, Wales



富嶽三十六景 神奈川沖
浪裏

江戶時代
1831年



Expert in garbology?

Title Garbology officer

Skills required Ability to interest younger generation in old rubbish. Strong constitution.

Duties Helping schoolchildren explore their heritage by studying waste, through a variety of projects, including sieving of samples taken from waste sites; sifting of soil to look for seeds and animal bones; small-scale excavation; and, possibly, field trips to ancient rubbish sites. Also, using archaeological techniques to improve community awareness of changing waste patterns, and working with the elderly using retrieved objects as a focus for reminiscence.

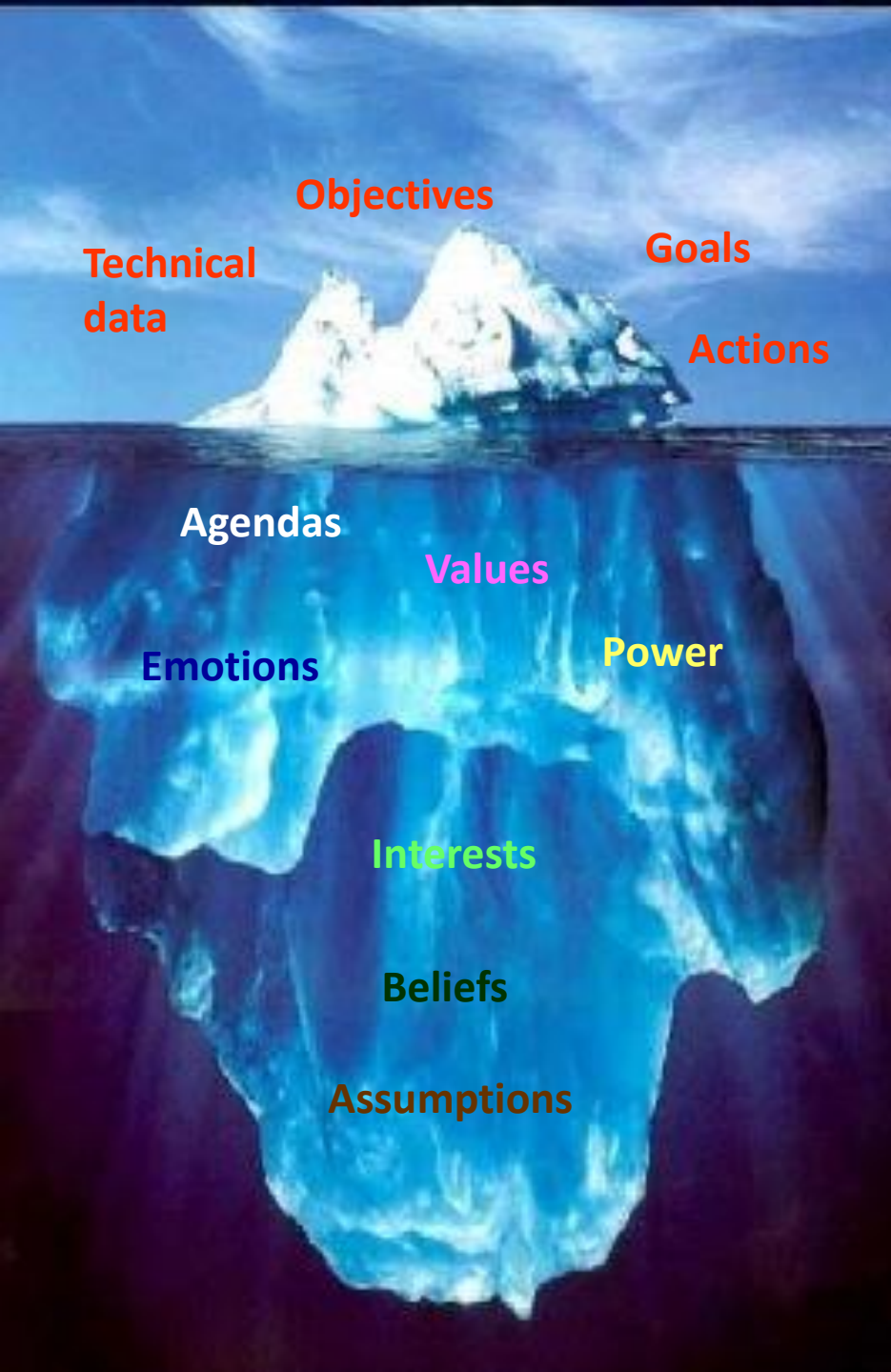
Reward Up to £23,313

A diver is seen underwater, illuminated by a bright light, exploring a large, rusted metal structure that appears to be a shipwreck. The water is dark and murky, with some bubbles visible. The diver is positioned in the upper left quadrant of the frame, looking towards the wreck.

'As we know, there are known knowns. There are things we know we know. We also know there are known unknowns. That is to say, we know there are some things we do not know. But there are also, unknown unknowns, the ones we don't know we don't know'.



Donald Rumsfeld, Pentagon briefing, 12 Feb. 2002.



Data does not = information

Information does not = knowledge

Knowledge does not = wisdom.

We have oceans of data, rivers of information, puddles of knowledge and the odd drop of wisdom

**The coast is a complex living entity.
Are we capable of predicting its
behaviour? Increased scepticism**

If you kick a stone, the result is predictable. In principle, one can calculate its trajectory pre kicking. Kick a dog - and it is a different matter! It may travel in a Newtonian trajectory, but it may turn and bite back!



*'All our
knowledge
has its
origins in
our
perceptions'*

Leonardo da
Vinci,
Codex
Trivulzi,
Castello
Sforzesco,
Milan. Pub.
Luca
Beltrami,
Milan, 1891.



**MACROSCOPIC
Cosmic**

**MESOSCALE
Global**

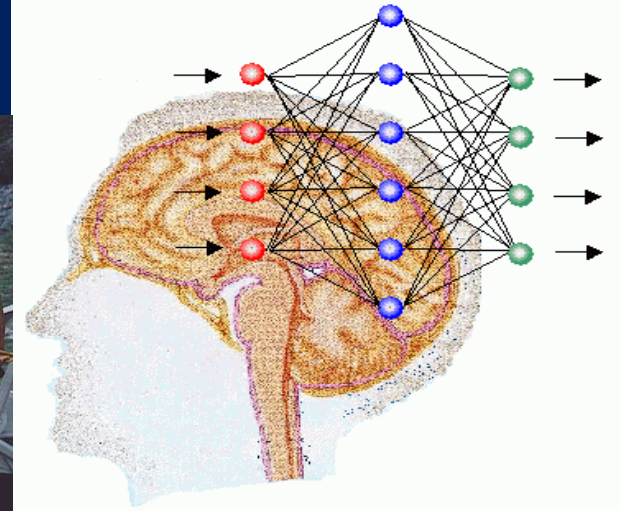


**MICROSCOPIC
Local**



PERCEPTION is Relative

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



The MIND. A vision that has captured the imagination of scientists (natural and cognitive) philosophers, economists, etc. A dispassionate mind that makes decisions by weighting evidence and reasoning to the most valid conclusions.

This bears **no** relationship to how the mind and brain works.

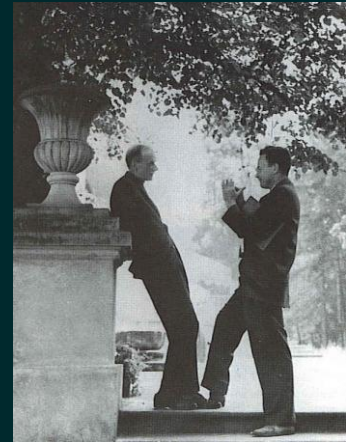
It is an emotional brain - a vast array of neurons that work together to generate our experience of the world. Associations of networks, bundles of thoughts, feelings, images and ideas become connected over time.

‘Dreams fertilise reality... The human creature cannot be restricted to common sense; he acts under the influence of sentiment’ M Godet. 1991.

‘De l’anticipation a l’action. Manuel de prospective et de strategie’, Paris.

PERCEPTION OF COASTAL HAZARDS/STRUCTURES

- **Perception of reality**
- **Approach**
 - Cartesian/Newtonian Paradigm of Thought
 - Scientific empiricism
 - Reductionism well suited to biophysical sciences



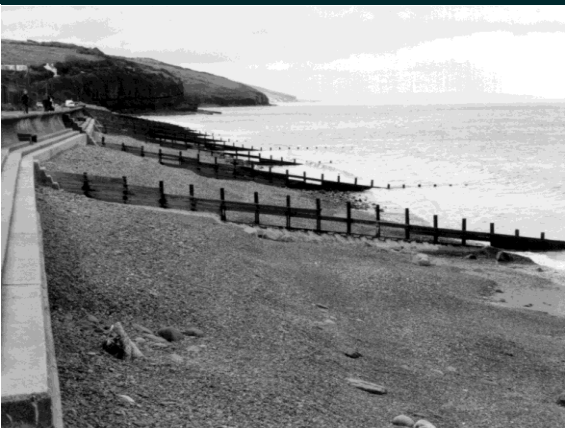
These approaches can not deal with non-linear form and space. Other approaches more appropriate when considering non-linear phenomena that involve society, economics, demography, agriculture, and ecosystem stewardship.

Lay people think that misfortune will occur to others and not them 'Optimistic Bias'

ACCEPTANCE OF THE UNACCEPTABLE

It is the center of what Neuhaust[†] said:
We've been primed by reasonable
argument to accept what was once
absolutely unacceptable...

What was once horrible has now become acceptable,
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



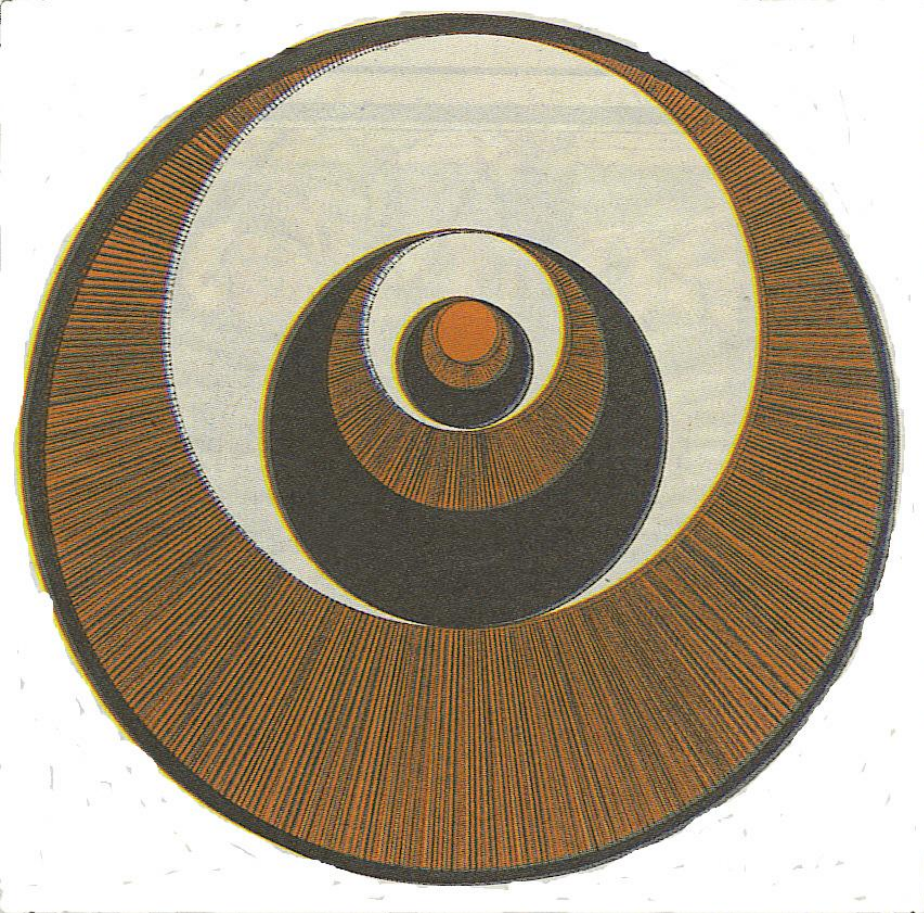
PROBLEM BEHIND THE PROBLEM

- **PERSONAL PERCEPTION**
- Perception is key to discovery of what is real and what is imagined
- Must consider degrees of obviousness in the range of what is seen and unseen

We need more 'Reality TV'!

*'Part of what we **perceive** comes through our senses, from the object before us, another part comes out of our own head,' Wm James*



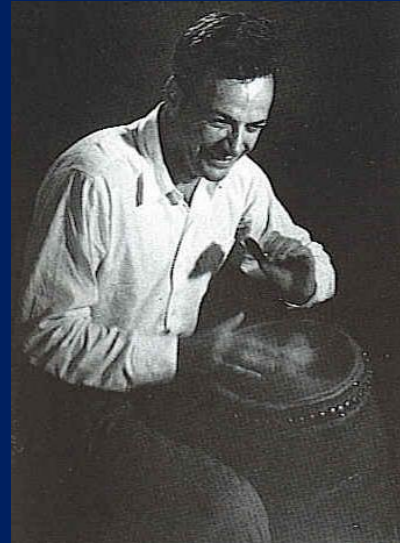


'Reality is **what is left** when one forgets what it is.' Philip K Dick,

'Reality is the **left over of virtual particles**. Everything in the Universe is made of quarks and electrons' Murray Gell-Mann

'**Reality is an illusion**' -Dirac

$$\gamma_{\mu} (i\delta_{\mu} - \epsilon A_{\mu})\psi = \mu\psi$$



Richard Feynman -
 'It explains shape, colour, texture. Nobody understands it, **I don't understand it**'

'Reality is doing things, not dreaming about them.'
 W. Somerset Maugham

John Zeleny, Physics Dept, Yale University, USA 'I feel that there is a **real** world corresponding to our sense **perceptions**.'

LITTER

UNESCO (OSPAR Pilot project on monitoring marine beach litter, 2007)

Marine litter consists of items that have been made or used by People and deliberately discarded into the sea or rivers or on beaches; brought indirectly to the sea with rivers, sewage, storm water or wind; Accidentally lost, including material lost at sea in bad weather (fishing Gear, cargo), or deliberately left by people on shores.

International Convention for the Prevention of Litter from Ships (MARPOL)

- Ordinary household waste such as cardboard boxes, empty glass and plastic bottles and other small containers, food waste etc.
- Waste from cargo holds such as dunnage, wire straps, and covering material (plastic sheets)
- Non harmful cargo residues
- Engine room waste which does not come under any other annex.
- Discarded medicinal and sanitary equipment
- Discarded fishing nets, ropes etc from fishing vessel

People who are waste wise and who realize that waste is a common problem and not one that "someone else" should take care of, will have the same responsible attitude towards the handling of waste that could end up as marine litter.

Merchant ships, offshore platforms, pleasure craft:

1. to reduce the generation of waste onboard ships and platforms. Waste management plans are needed for larger vessels and platforms, and preparations for proper waste management should be made in advance also by those onboard smaller vessels and pleasure craft.
2. Waste should be stored onboard and discharged ashore in a proper reception facility - needs adequate space onboard for storage, and the provision of reception facilities in all commercial harbours and marinas.
3. Harmonized regional and global regulations to avoid that harbours/marinas are not equipped to take care of the waste and/or that they cause ships undue delay in port.
4. Also, ships should not be deterred from discharging waste to port reception facilities due to high costs, complicated procedures, unnecessary paperwork, excessive sanitary regulations, customs regulations, etc.
5. Coastal municipalities must make sure that the waste left in reception facilities is properly taken care of on land, in a manner that is optimal in terms of caring for the environment and human health — the management chain must not be broken.

Fishing vessels: Efforts should be made to reduce the generation of waste onboard, and preparations should be made for storage of waste onboard until one comes ashore. Fishing gear, particularly drift nets, should be marked to make it possible to find them again if they are lost at sea. No fishing gear should ever be deliberately discarded but taken ashore for proper disposal.

Municipal landfills and sewage treatment: Coastal communities/municipalities and those along rivers should make sure that open landfills for household waste as well as industrial waste are eliminated, as part of their overall waste management strategy. Sewage treatment, in adequately equipped

Households: Sewage-related waste should *never* be flushed down the toilet but treated as any other kind of household waste. And household waste should be sorted and taken proper care of. Again, societal waste management begins at home.

Beach-goers, campers etc.: All beaches and camping grounds should be sufficiently equipped with waste bins to cater for the needs of visitors using these locations. However, people should preferably always take home their own trash and make sure that it is properly sorted and disposed of for maximum recycling. If you are capable of carrying the full containers and bottles with you to the beach, surely you can carry them with you home when they are empty.

CURRENT TRENDS

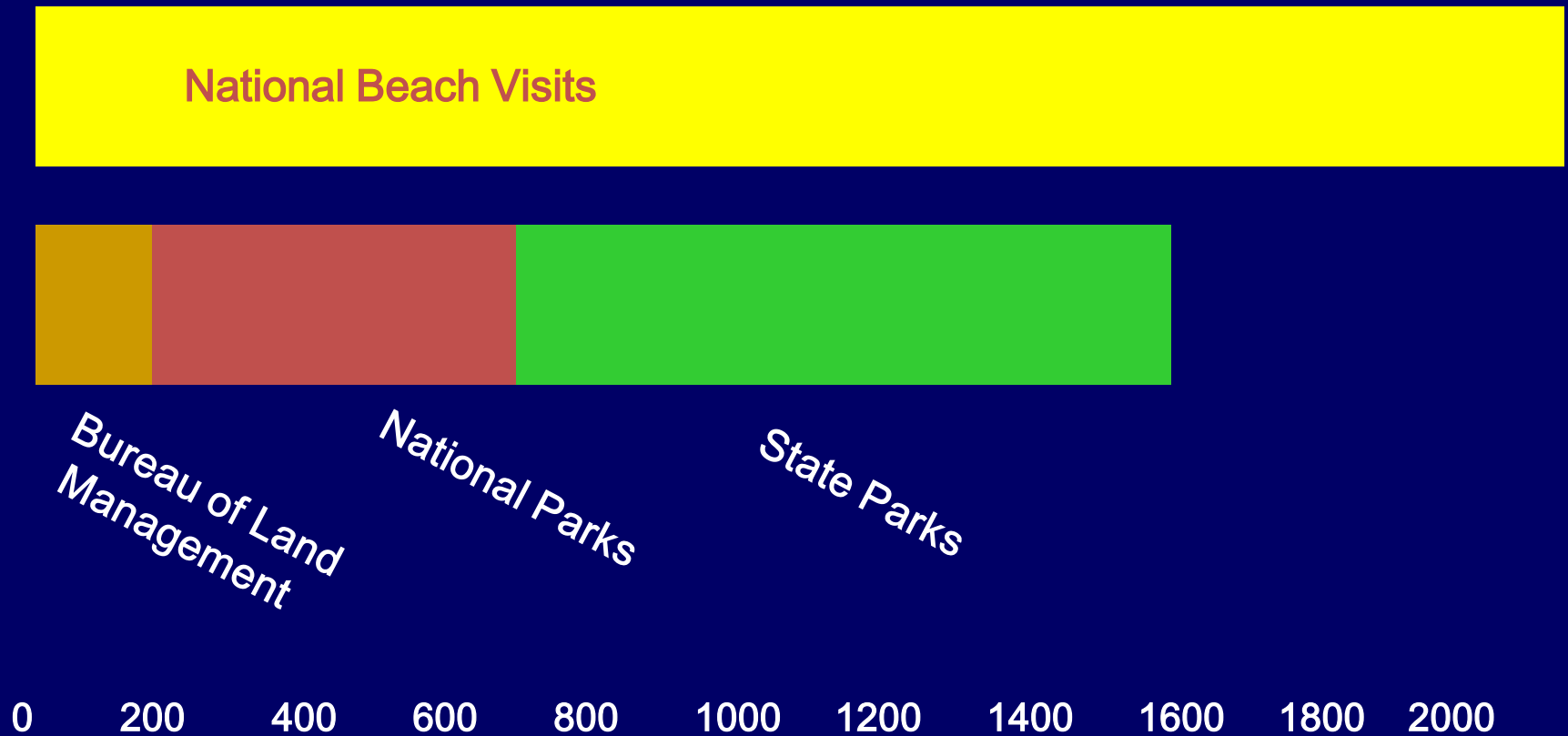
Why has the problem of marine litter become an issue?

- Public awareness and concern for environmental issues is increasing,
- Greater expectation by the public for action from local authorities,
- Increasing media interest,
- Growth in outdoor recreation,
- Growth in tourism, shipping and fishing/fish farming industries,
- Increased threats of litigation in relation to beach/water quality
- Increase and diversification of consumer products,



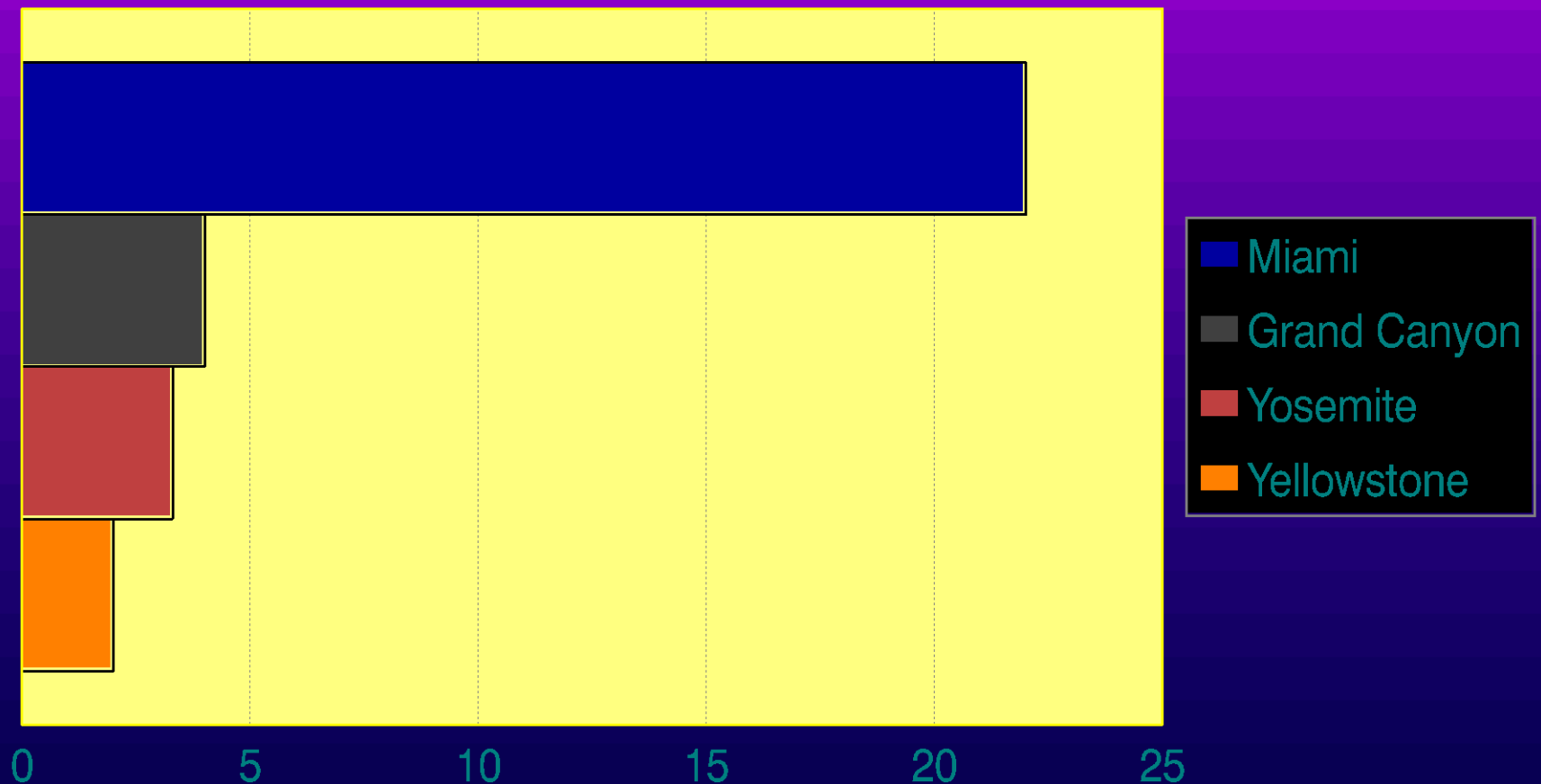
Annual Tourist Visits

(Millions)



*Clean Beaches Council, 2001
National Park Service, 2001
Bureau of Land Management, 2001*

Annual tourist visits (millions)



COASTAL USER ACTIVITIES

Development

Buildings, Landfill
Dredging, Drainage, etc

Recreational

SCUBA, Yachting, Jet ski
Surfing, Walking, Wildlife
Swimming, sun-bathing etc

Operational

Waste disposal, Energy
Marinas/parks, Defence,
Boating, etc.

(adapted from UNEP 1997)



The main land-based sources of marine litter:

- Municipal landfills (waste dumps) located on the coast.
- Riverine transport of waste from landfills or other sources along rivers and other inland waterways (canals).
- Discharge of untreated municipal sewage, including storm water (including occasional overflows).
- Industrial facilities: Solid waste from landfills, and untreated waste water.
- Tourism (recreational visitors to the coast; beach-goers).

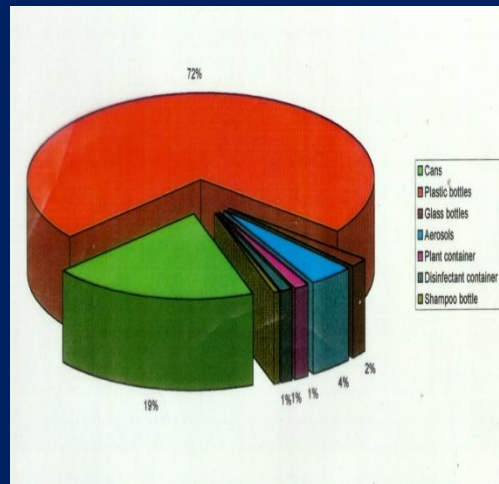
The main sea-/ocean-based sources of marine litter

Merchant shipping, ferries and cruise liners, fishing vessels, military fleets and research vessels, pleasure craft, offshore oil and gas platforms, fish farming installations



Damage to people, property and livelihood

- Fishing boats and gear
- Safety risks for people at sea
- Damage to cooling water intakes
- Contamination of beaches
- Contamination of harbours
- Health hazards to people
- Injuries to grazing cattle

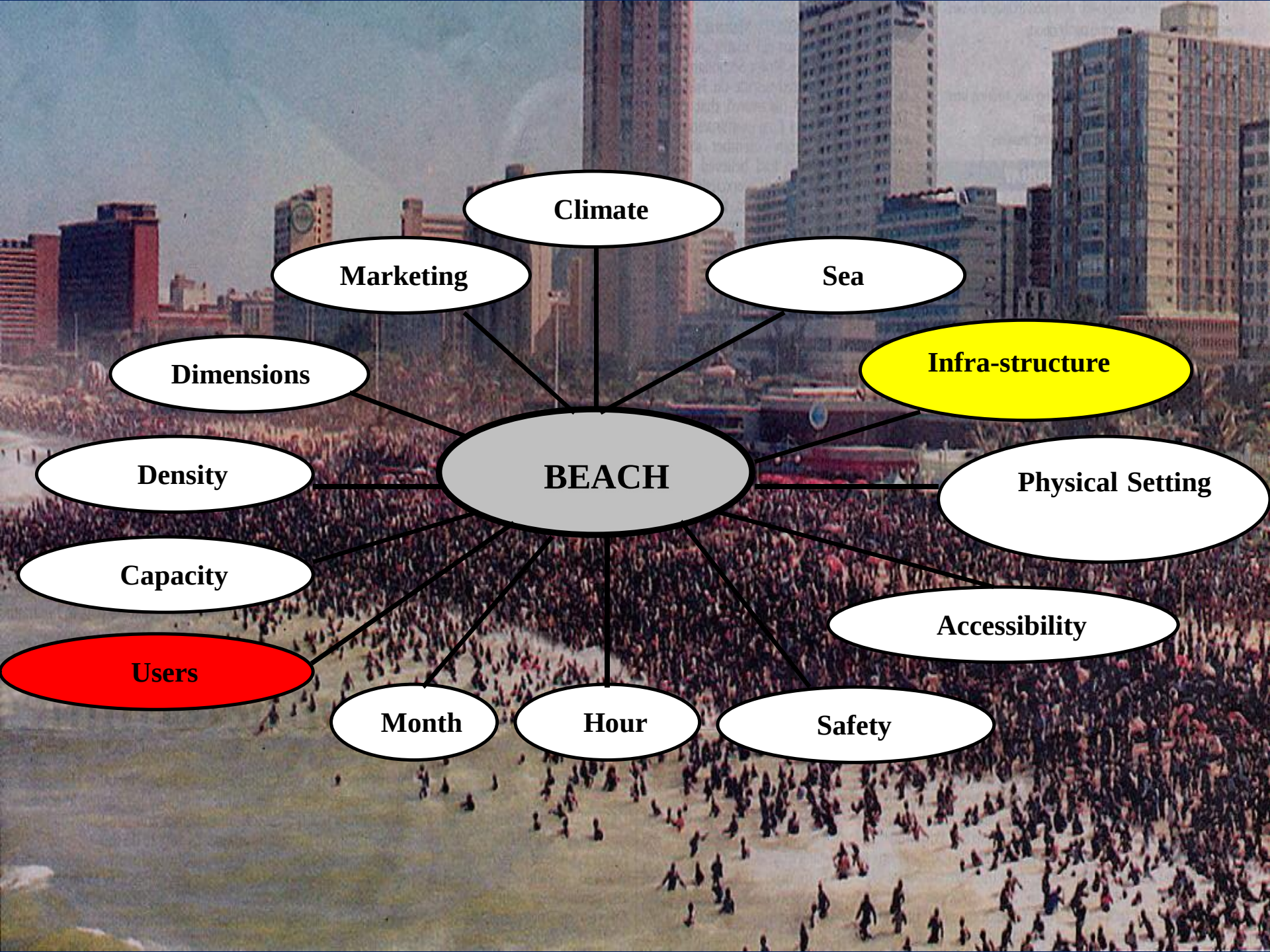




SOME PROBLEMS

- aesthetic, cosmetic, hygienic,
- entanglement and ingestion, death, injury, debilitation,
- 'quality of life', starvation.
- Ghost fishing,
- 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



Climate

Marketing

Sea

Infra-structure

Physical Setting

Accessibility

Safety

Hour

Month

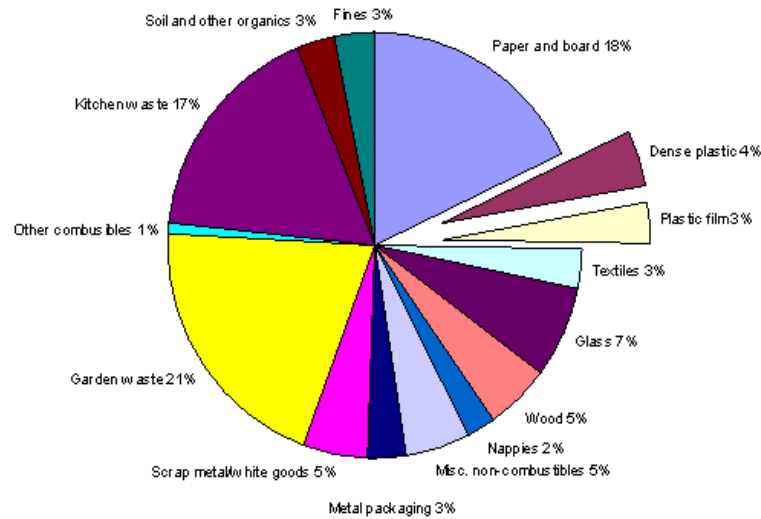
Users

Capacity

Density

Dimensions

BEACH



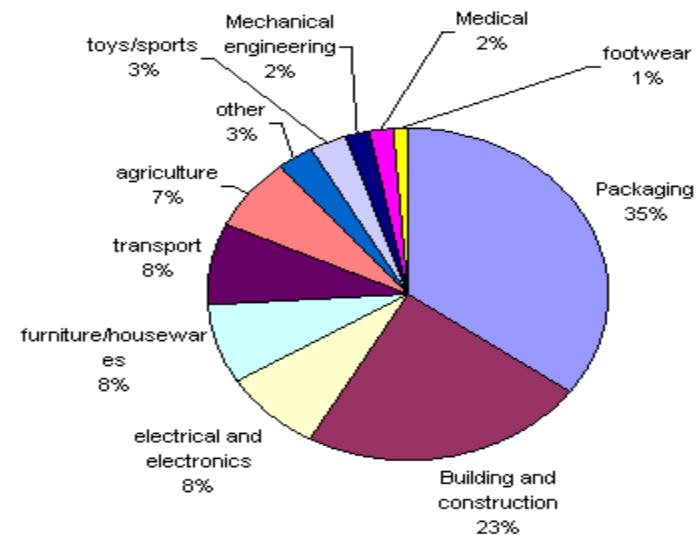
The world's annual consumption of plastic materials has increased from 5 m. tonnes in the 1950s to 100 m. tonnes. We produce and use 20 times more plastic today than we did 50 years ago! In the UK, a total of 4.7 million tonnes of plastic products were used in various economic sectors in 2009.

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

Household waste

- The amount of plastic waste generated annually in the UK is *circa 3 million tonnes*.
- An estimated 56% of all plastics waste is used packaging, 75% of which is from households.
- It is estimated that only 7% of total plastic waste is recycled.

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



- Extreme **versatility** and ability to be tailored to meet very specific technical needs.
- **Lighter weight** than competing materials, reducing fuel consumption during transportation.
- Extreme **durability** and relatively **inexpensive** to produce
- **Resistance** to chemicals, water and impact.
- **Good safety and hygiene properties** for food packaging.
- **Excellent thermal** and electrical insulation properties.

BRITISH PLASTICS FEDERATION

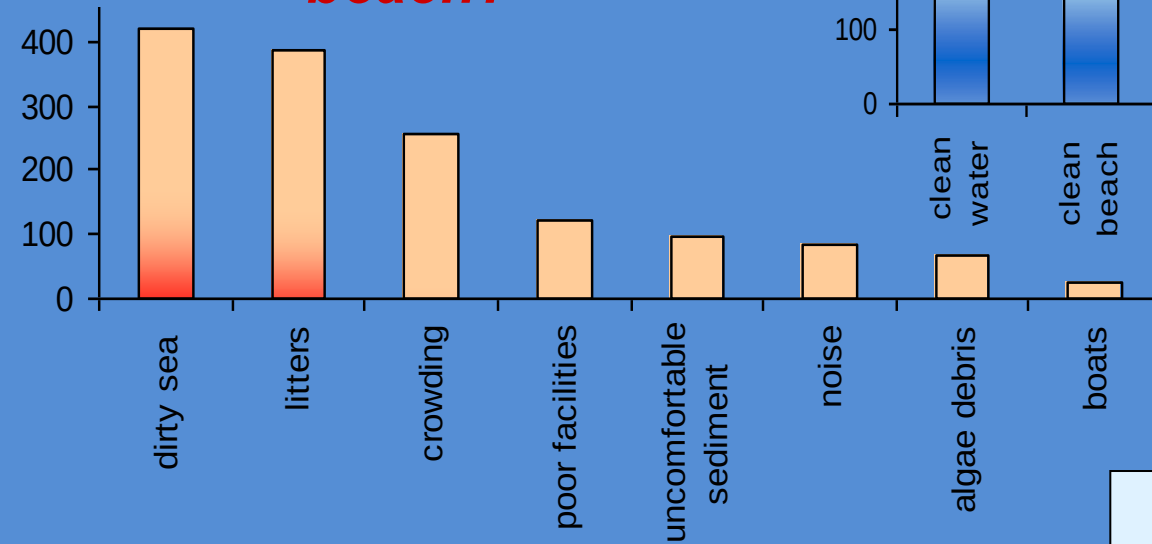
- 1 tonne of plastics is = 20k two litre drinks bottles or 120k carrier bags

In 1998, a pilot feedstock recycling plant went operational at BP's Grangemouth site in Scotland, with a capacity to process 400 tonnes of mixed plastic waste per annum. A feasibility study into its viability concluded that a **25k tonnes per annum plant could be supported from the area's municipal waste sources alone.**

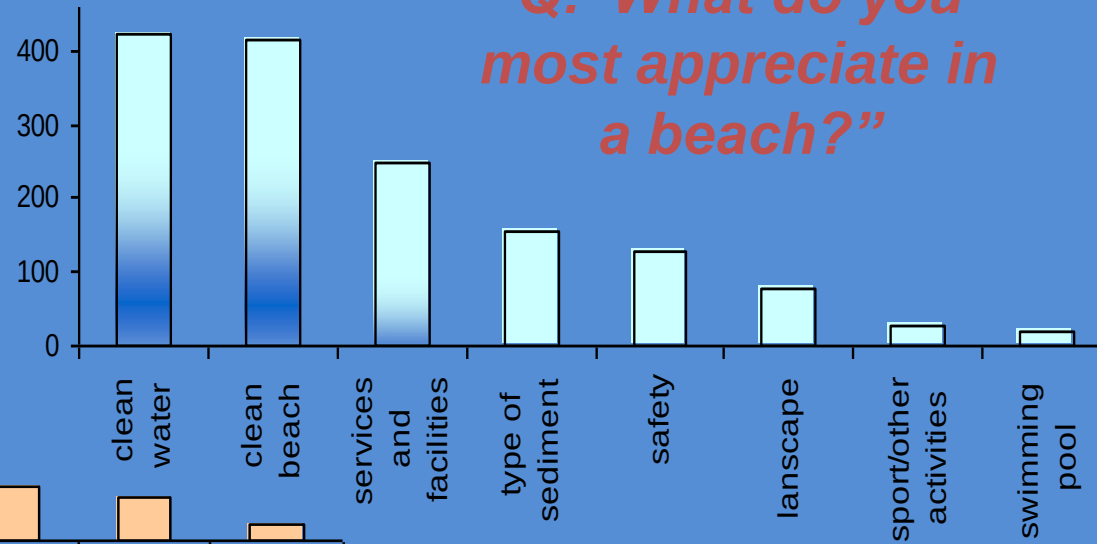
- In 1991, LINPAC Plastics Recycling opened a unique plant at Allerton Bywater, West Yorkshire, with the ability to recycle post-consumer polystyrene products. The plant, had a capacity of over 14,000 tones per year, which is now 25k tonnes

RESULTS: USERS' PREFERENCES

Q: "What annoys you most on a beach?"



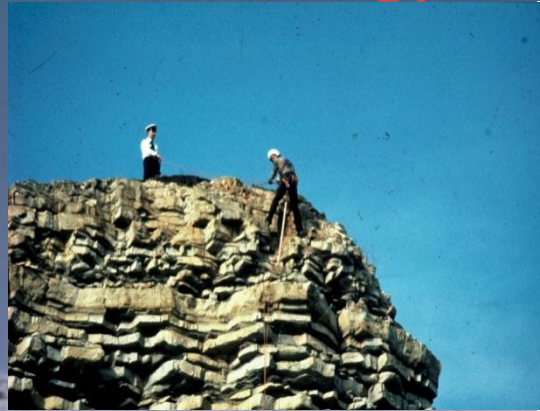
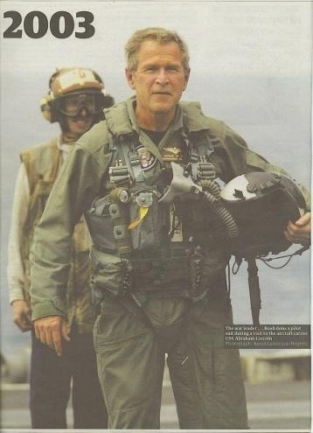
Q: "What do you most appreciate in a beach?"



2003

A beach management strategy needs four P's:

- Practitioners
- Public
- Professionals
- Politicians

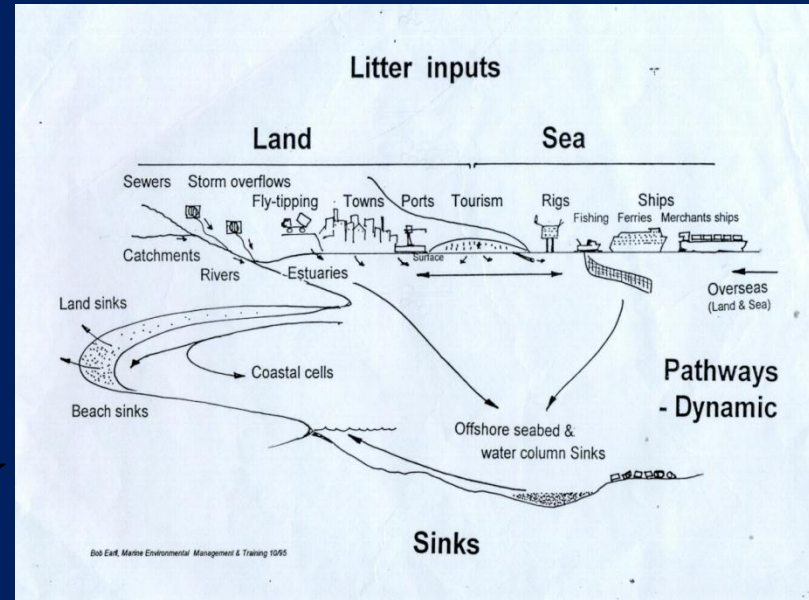


Organisation
Measurement
Conceptualisation

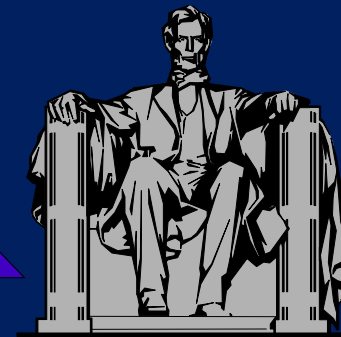
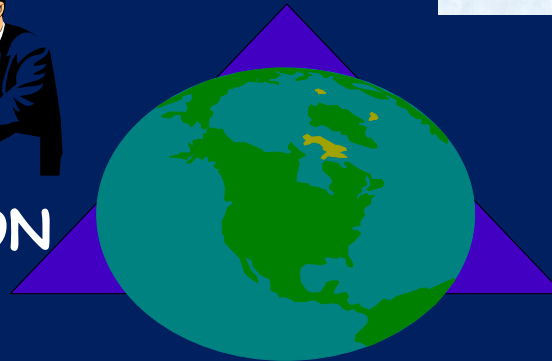
LITTER MANAGEMENT



GNOSIS

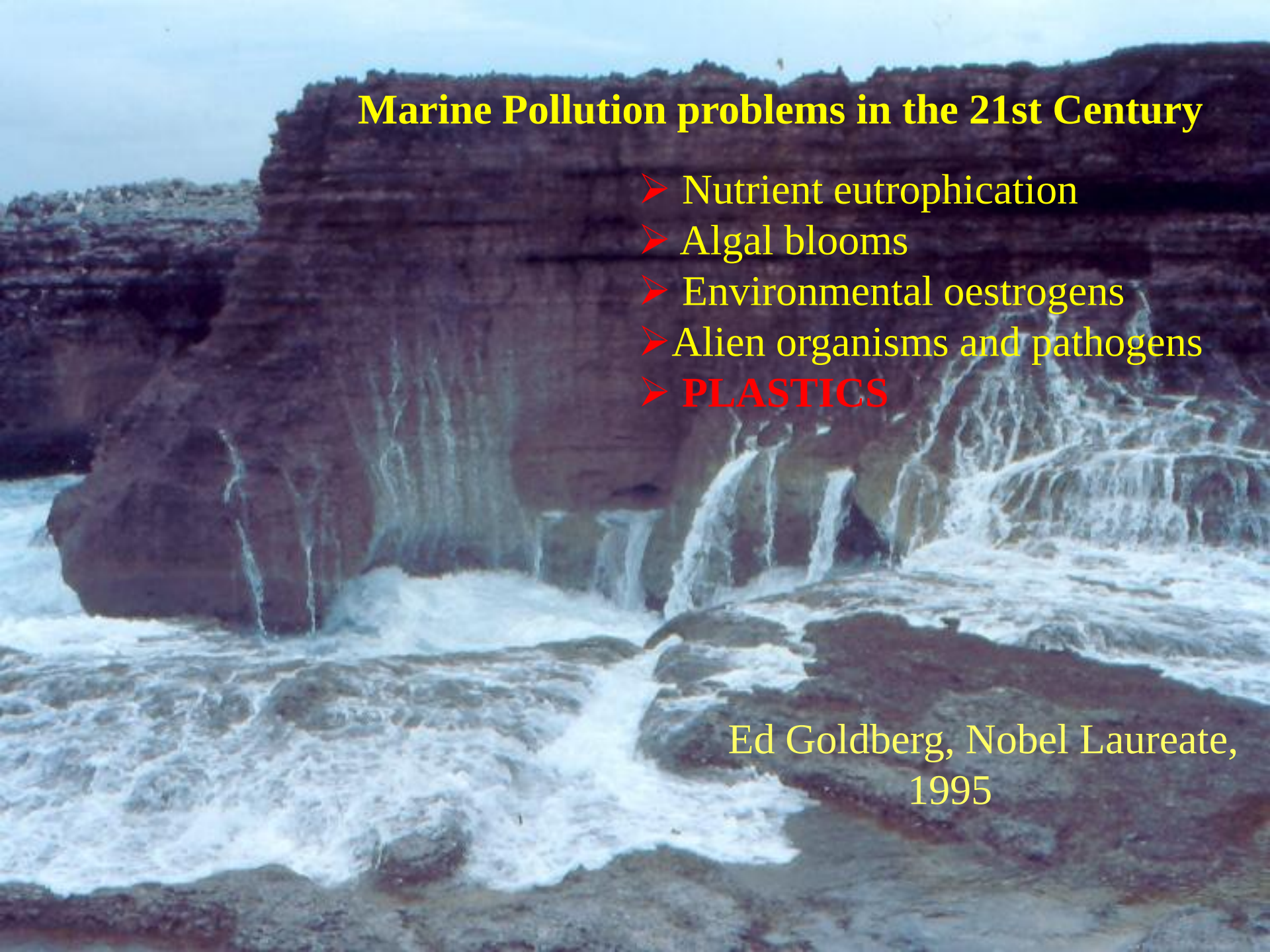


IMPLIMENTATION



JUDGEMENT

The Socrates Dialogue



Marine Pollution problems in the 21st Century

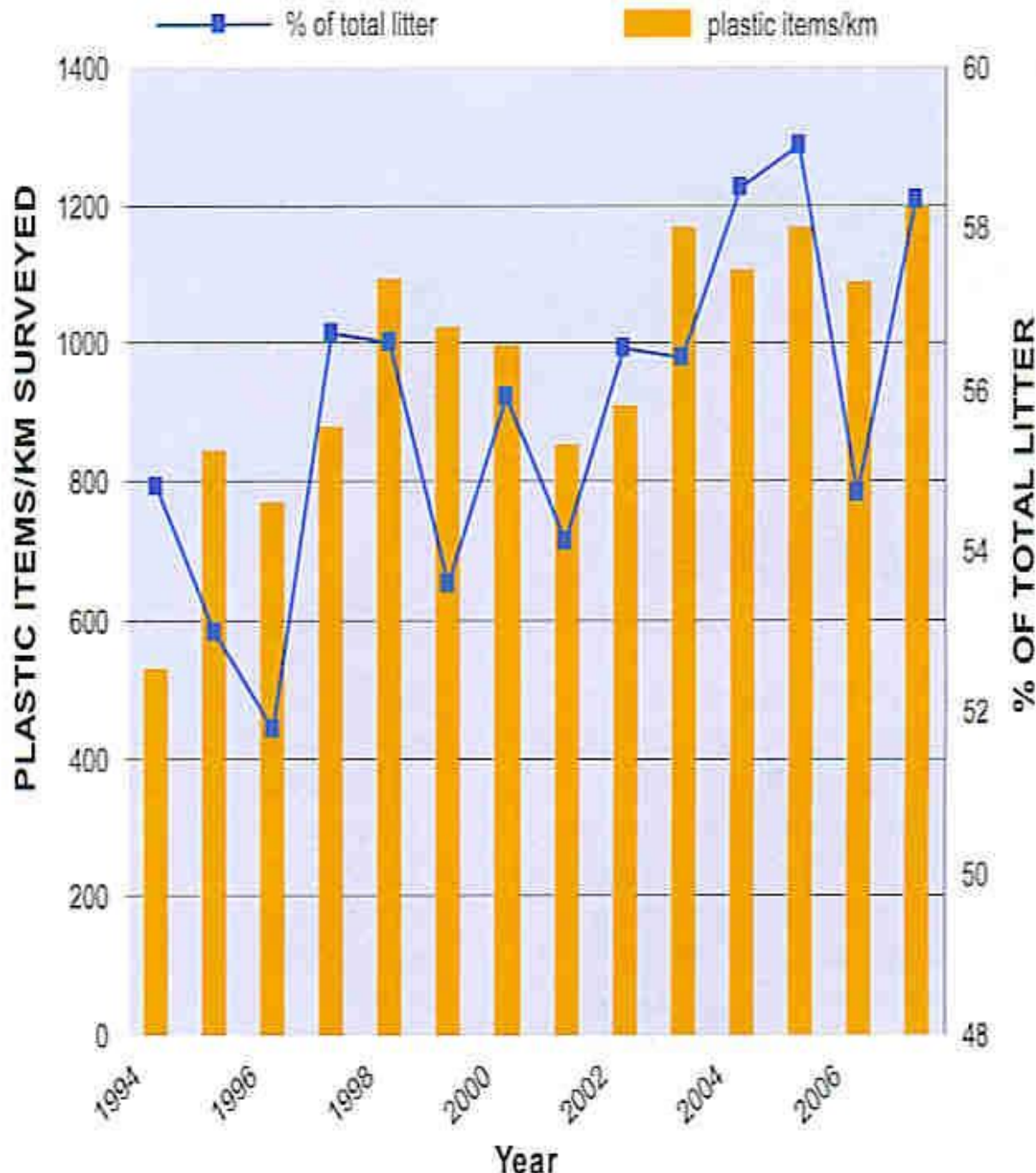
- Nutrient eutrophication
- Algal blooms
- Environmental oestrogens
- Alien organisms and pathogens
- **PLASTICS**

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**

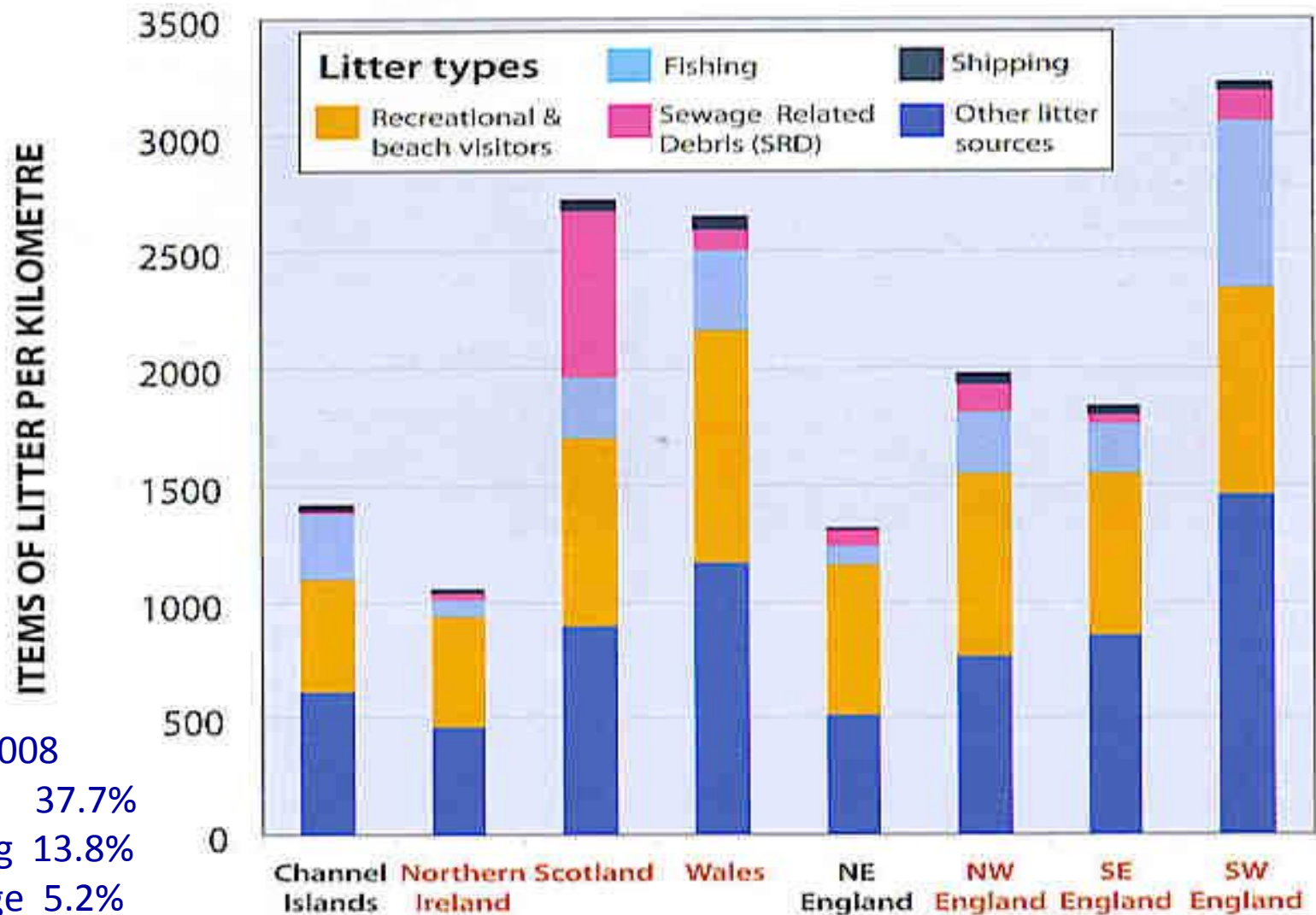


UNEP study
Indicates >46k
pieces of plastic
/mile² of ocean.

In UK the
density is 1189
items/km, an
increase of
126% since 1994.

Nb. pollutants
can be attracted
to plastic pieces
and ingested by
animals

Regional variations in sources and densities of litter



In 2008

Public 37.7%

Fishing 13.8%

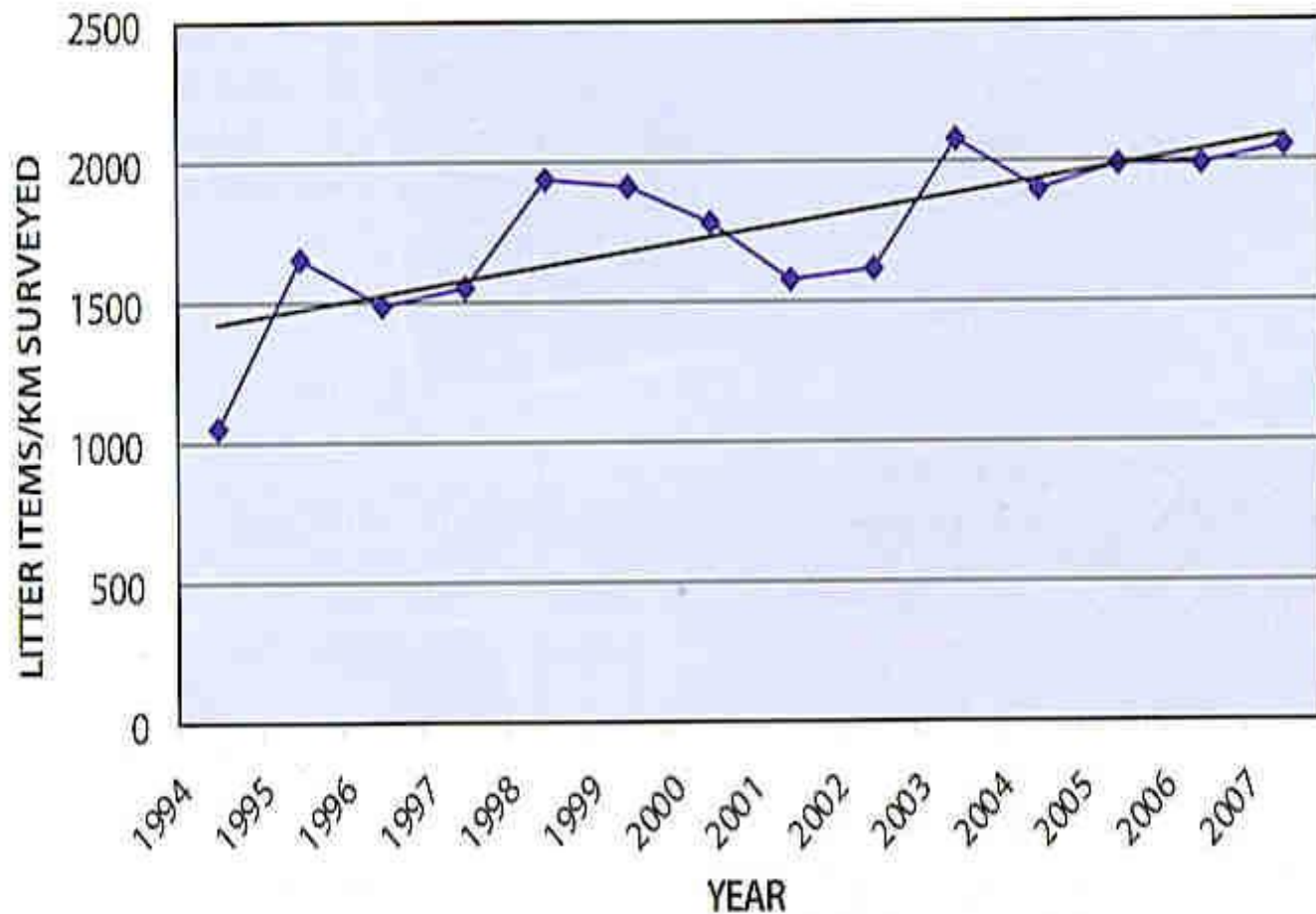
Sewage 5.2%

Shipping 1.8%

Regions where the number of litter items per km has INCREASED since 2006

Regions where the number of litter items per km has DECREASED since 2006

Annual trends in litter density



2195/km, 2008.
Average density
of litter on UK
beaches
(items/km):
2006-1989
2007-2054

Public 54.7%
Fishing 13.8%
Sewage 3.2%
Shipping 1.8%

Since 1995 it
has risen by 97%

The average density of litter recorded on UK beaches increased from 1,989 items/km in 2006 to 2,054 items/km in 2007.

Since MCS Beachwatch 1994 the density of litter found has risen by over 96.5%.

Don't let Go!



'Although nature begins with the cause and ends with the experience, we must follow the exact opposite course, namely, begin with experience and by the means of it investigate the cause'

Leonardo da Vinci, Notebooks, (1512).

Have you seen 130,000 blow-up rubber breasts?



It's amazing what you find washed up on beaches these days, so watch out for some plastic breasts

Picture: PA

If you've recently found 130,000 inflatable breasts washed up on a beach, a men's magazine would like to hear from you. Australian lads' mag Ralph had planned to give away the comedy breasts with its January issue. But while the container left the docks in Beijing fully loaded two weeks ago, by the time it reached Sydney the mag's £88,000 cargo had mysteriously vanished. Editor

By **Tom Phillips**

Santi Pintado has launched an appeal for information on their whereabouts. 'Unless Somali pirates have stolen them, it's difficult to explain where on Earth they have got to. If anyone finds any washed up on their local beach, please do let us know.' However, it seems that even if a beachcomber does come across

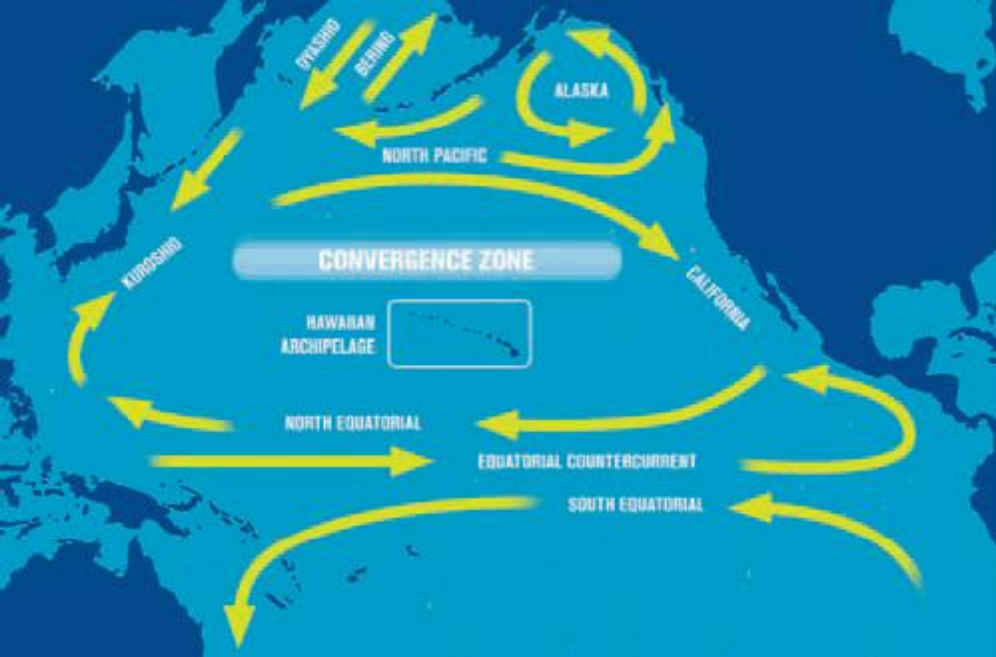
the breasts, it will still be too late for the magazine to include them in its next issue – leaving its readership deflated. In 1992, 30,000 Chinese plastic ducks en route to the US were washed overboard in a ferocious Pacific storm. It led to a 15-year 'endless odyssey' as the duck-slick roamed the currents of the world's oceans, before menacing the English coastline last year.

Weird fact of the day

There are about 10,000,000,000,000,000,000 – ten quintillion – insects alive on Earth at any time. In all, they'd weigh about 300 times as much as all us humans put together.



**PR
BREAK**
FROM *Tha*
SAVE
1/3



TOP 10 %

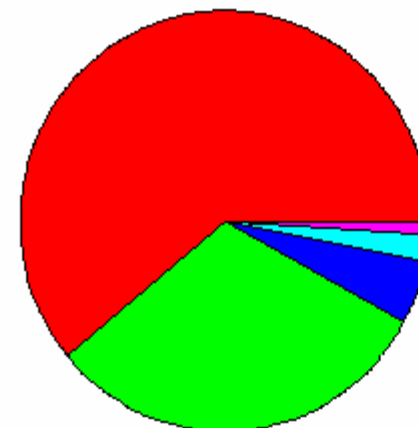
Cigarettes	28
Plastic bags	12
Food wrappers	8
Lids	8
Plastic bottles	6
Paper bags	5
Straws	4
Cups/forks etc	4
Glass bottles	4
Cans	4
Top 10 items	83
Total world wide	100

International Coastal Cleanup, 2009 (Ocean Con, USA)

Top 10 item number = 9,507,103
Total worldwide = 11,439,086

Worldwide Marine Debris

Recreation 61.0%



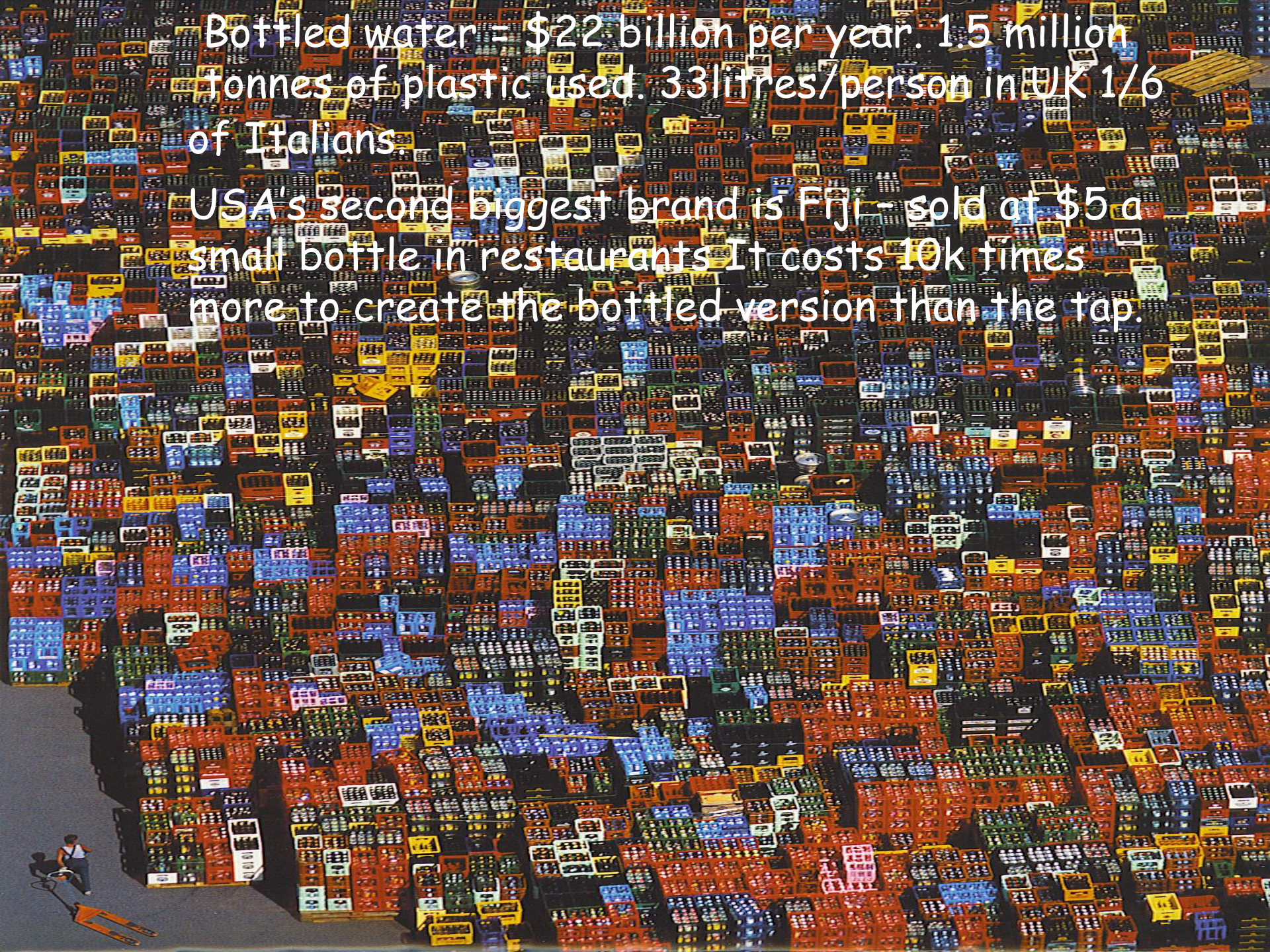
Smoking 31.0%

PLASTIC BAGS/BOTTLES

- **Tesco**- 2006 it will reduce number of bags given away by 1bn.
April 1, 2009. Trials at Guildford and Ilminster.
It has >3,500 recycling & reducing packages projects
- **Ikea** - Will charge 10p a bag- it gave away 32bn in 2005.
Ireland introduced a charge in 2002 and reduced demand by 90%.
- They tend to be used for some 20 mn. each (once) and can stick around for X years. No one can extrapolate
- Packaging and Industrial Films Association; 8bn/year
DEFRA: UK uses 10bn/year or 162/person.
Liberal Democrats say this is too low -12bn/year.
Consumption grows by 4%/year in Europe - uses 4% crude oil production.
- 35% UK plastic consumption is in packaging.
Packaging- 60% household waste -11% plastic (40% = bottles).
Each UK house uses 500 bottles per year-130 recycled (13bn/year)
80% plastics sent to tips, 8% incinerated, 7% recycled (EA).

Bottled water = \$22 billion per year. 1.5 million tonnes of plastic used. 33 litres/person in UK 1/6 of Italians.

USA's second biggest brand is Fiji - sold at \$5 a small bottle in restaurants. It costs 10k times more to create the bottled version than the tap.



Katrina

WASTE

Recycling mountain

An employee is dwarfed by a pile of plastic and paper from household recycling bins at a plant belonging to waste management firm Grundon
Photograph: David Levene

Nappies, 922k tonnes
Kitchen waste 640k



Impacts of marine litter



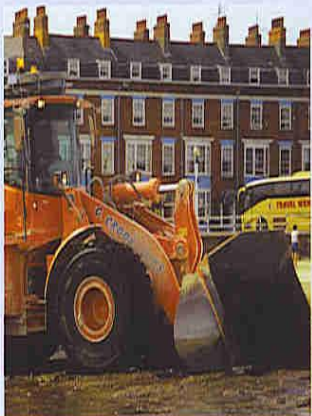
DAVID PEARCE

Entanglement



REBECCA HOSKING BBC

Ingestion



STEVE TREININELLA

Clean up costs



ALESON CONWAY INCE

Tourism



Fishing

Entanglement has been found in 144 marine animal species.

Ingestion " " " " 177

UK Clean up costs range from £14m to £157m (Environment Agency)



SOME FACTS

- 40% of the world's population (2.6bn) have no access to a toilet/latrine.
- 90% of sewage is discharged untreated into oceans, lakes, rivers.
- 10 million viruses and 1 million bacteria in each gram of faeces.
- Every 15 seconds a child dies of diarrhoea.
- WatSan (Water and Sanitation) big in the west!!!! No. In UK many sewer systems remain the same as when Joseph Bazalgette (19th C)) tried to improve them,
- Pakistan spends 47 times more on military despite 120 k deaths per year due to diarrhoea.

'The Big Necessity', Rose George, Portobello 2008.

Nappies account for 922k tonnes of waste /year in UK (c/p 1,264k tonnes of paper and card; kitchen waste of 640k; Friends of the Earth)

What do beach users want from a beach?

Water Quality

Safety

Facilities

Scenery

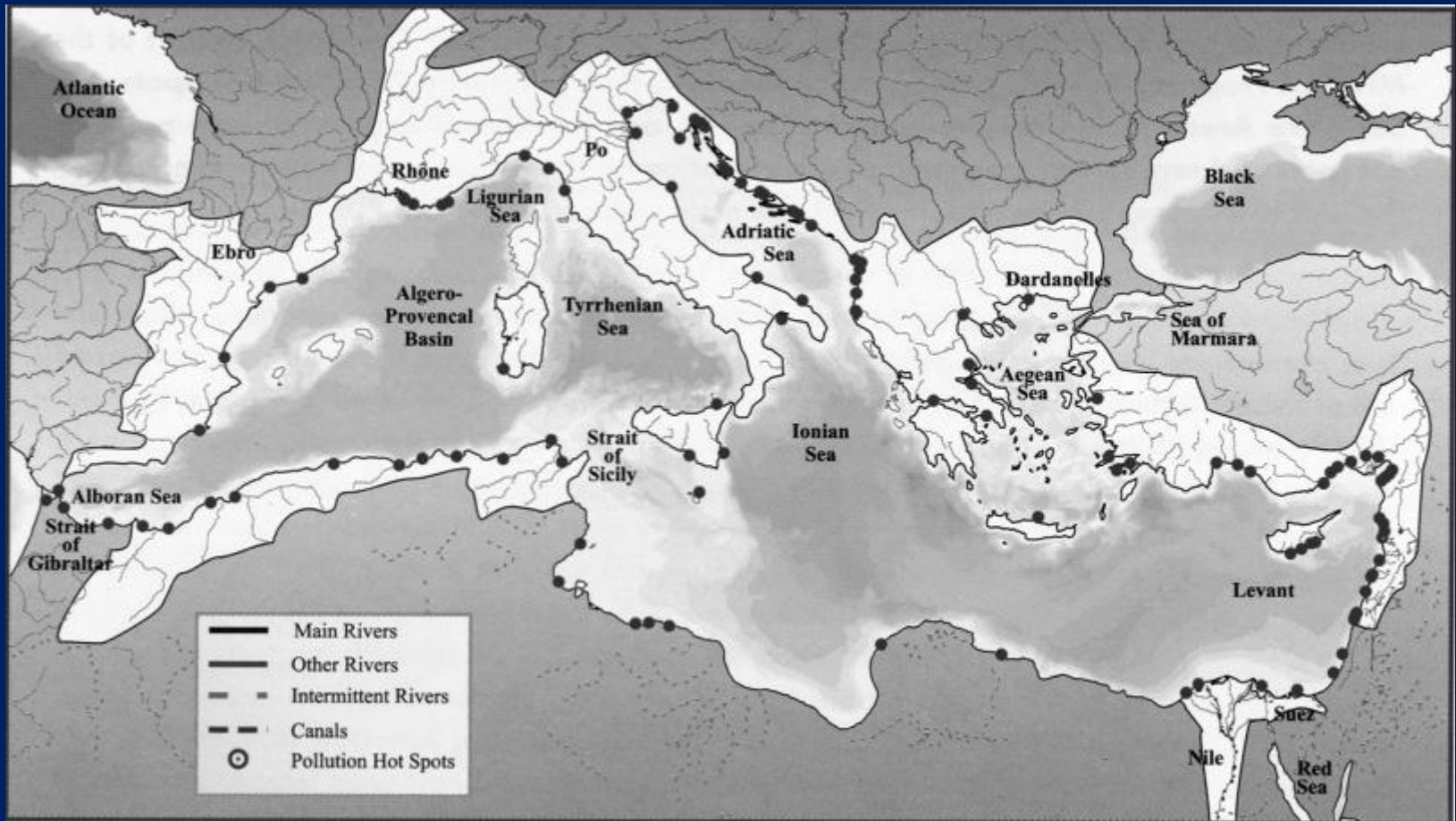
No litter.

Nb. At Tuvalu (South Pacific) 4k people live on 2.4 sq.km generating 20k cubic metres/year of litter. Licensed landfill is for 3,200 cubic metres!

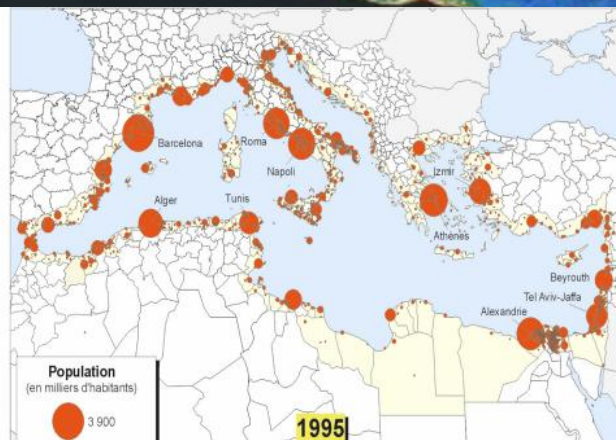
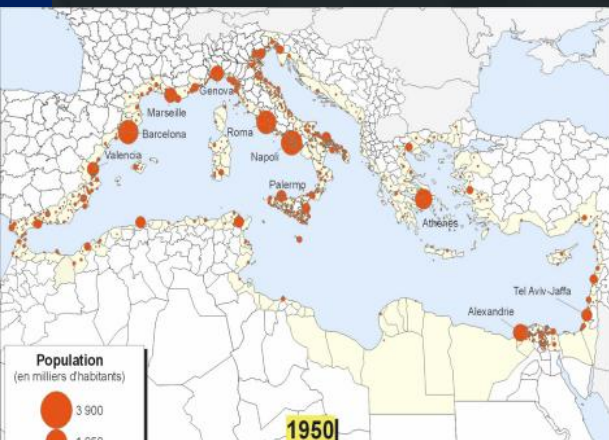
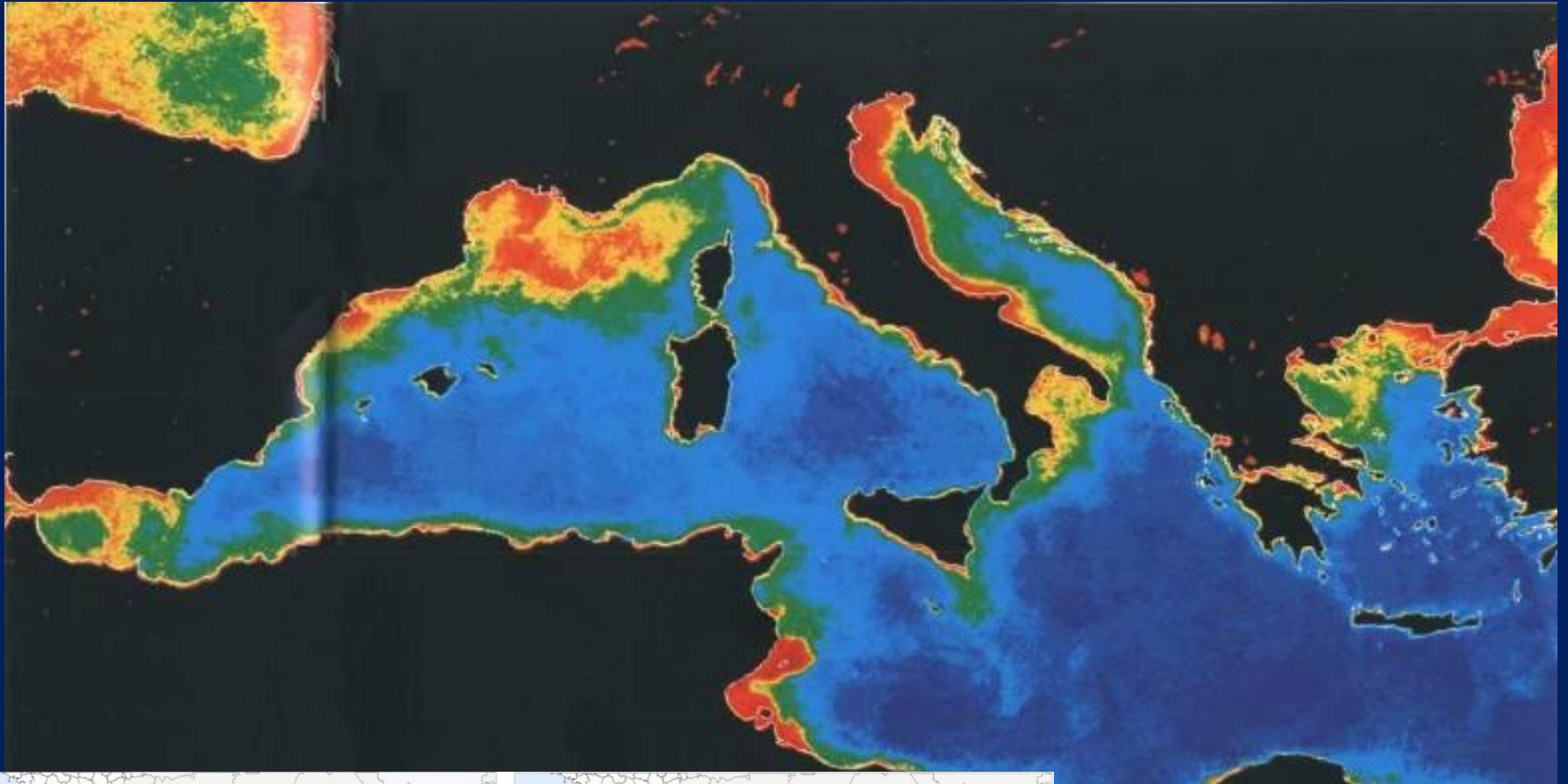
Kiribati's is the capital of South Tarawa (40k people on a string of islets some 30km long). Generates 6,500 tonnes of waste /year, It has 33 landfill sites only 1 with a sea wall, so waste is swept away. Density >Tokio.



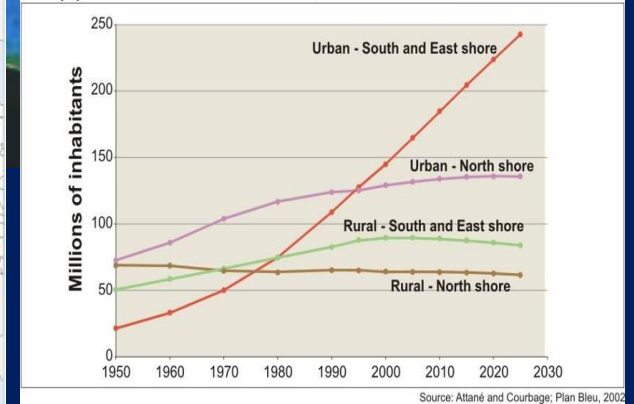
MEDITERRANEAN “HOT SPOTS”



THE PROBLEM AREAS



Urban population in the Mediterranean countries, trends and forecasts



- The Campania region has >1,200 illegal fly tipping sites, and in Italy there are >5,000.
- Donato Ceglie, the Caserta prosecutor, has estimated that an area the size of Wales has been contaminated.
- 30 million tonnes illegally dumped –profit of E50 million.
- In 2002, >10k animals were slaughtered and > 9k tonnes of contaminated milk destroyed.
- Cancer deaths are 3 times the national average (Alfredo Mazza, writing in The Lancet).
- 130 waste traffickers have been arrested and 147 companies are being investigated.
- Once toxic waste has passed into Mafia hands, the label is removed. People who see it dumped (rivers, seas, land) are intimidated into silence. The Ndrangheta Mafia (Calabria) is alleged to have shipped to Somalia 500 drums of radio-active waste. The state agency ENEA paid the clan to remove 600 drums of waste. 100 was buried near Basilicata, - no space on the boat.

ITALY

Caserta, north of Naples, Italy - centre of the mozzarella industry.

ITALY

- 33% of Italian waste is disposed of illegally, and 80% is deposited in the 'triangle of fire' between the towns of Qualiano, Giuggliano and Villaricca, on the lower slopes of Vesuvius.
- The Camorra Mafia (Naples).
- The Environmental campaign group 'Legambiente', estimated that in the past 10 years, the *Ecomafia*, has made E132 bn *circa* 10% of the Italian GDP. Non sustainable.
- With respect to profitability, toxic waste disposal comes after drugs and arms trafficking, and is much less risky!
- 152 contaminated 'lakes' occur in Caserta, Sand is extracted for illegal construction, chemical waste dumped in the pits.
- Farmers spread sludge thinking it a free fertiliser trial; asbestos laid on tracks thinking it was gravel.
- Branching out in fake handbags, DVD's (E6bn), bakeries etc.

Some Sources

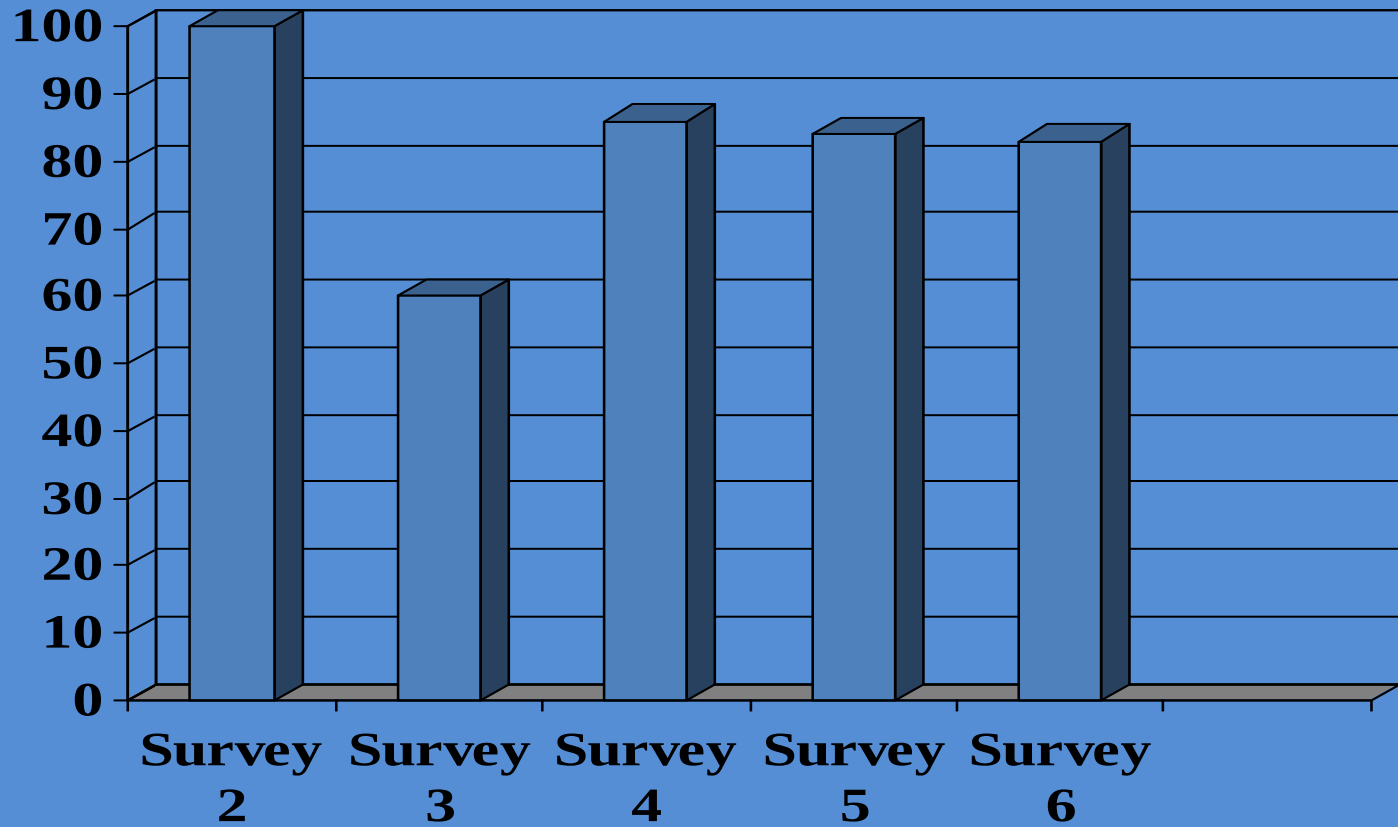
Litter mixture
Hazard and risk

Management





Rising landfill tax.
Local authorities charge for collection of bulk waste
More goods e.g. refrigerators, TV sets, computers defined as 'special or hazardous waste'



Blue survey. % of plastic drink bottles remaining

Sampling size unit - function of aims.

- Beach survey from water's edge to splash zone (Dubsky, 1995)
- Varying width transects to find the optimum.
- Transect line quadrats (Dixon and Hawksley, 1980)
- Strand line counts (Williams and Simmons, 1997)
- Postal surveys (Dixon, 1992)
- Offshore water column (Williams et al, 1993)
- Number of plastic bin bags/trucks etc.
- NALG 2000



	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

% 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

A:

B:

C:

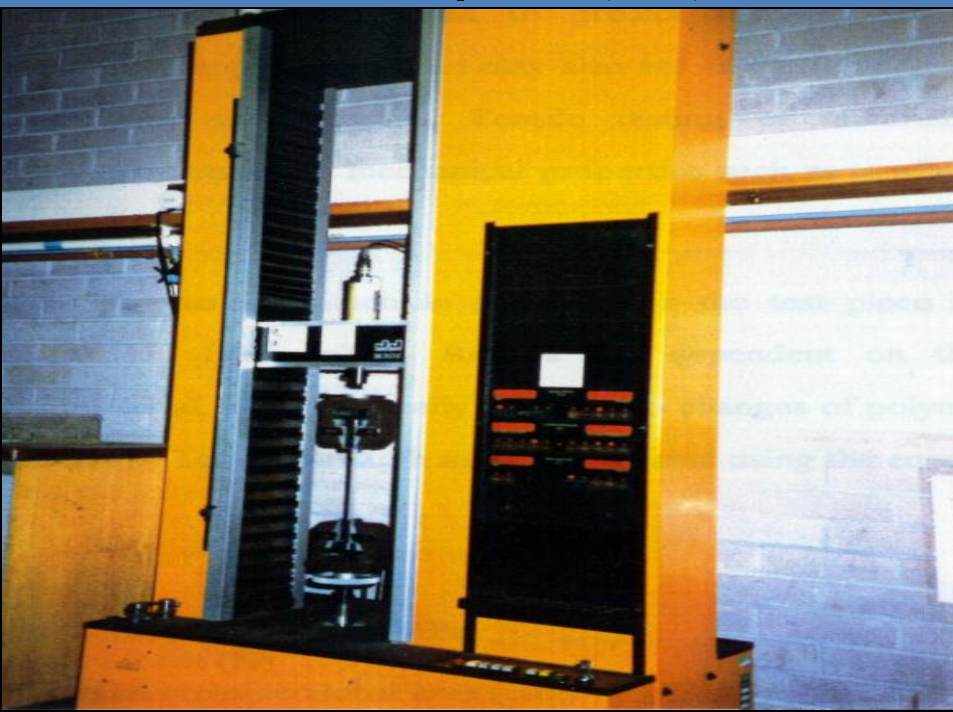
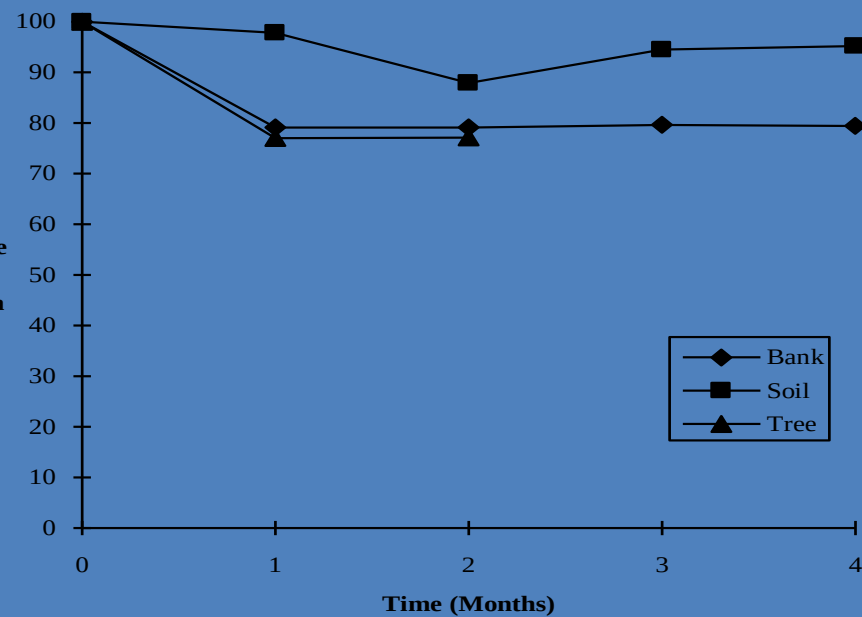
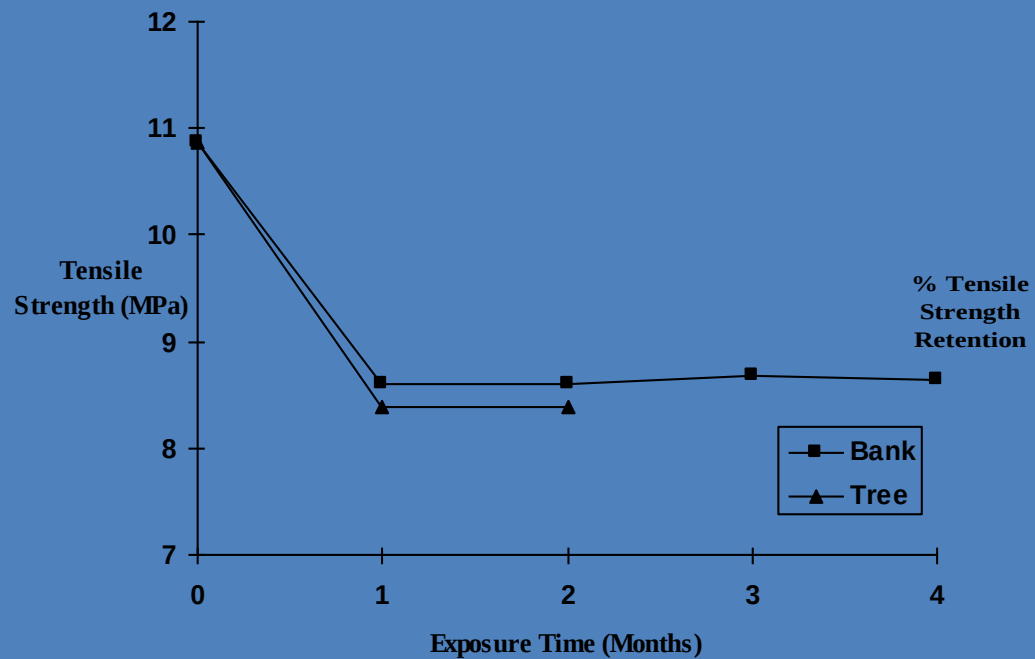
D:

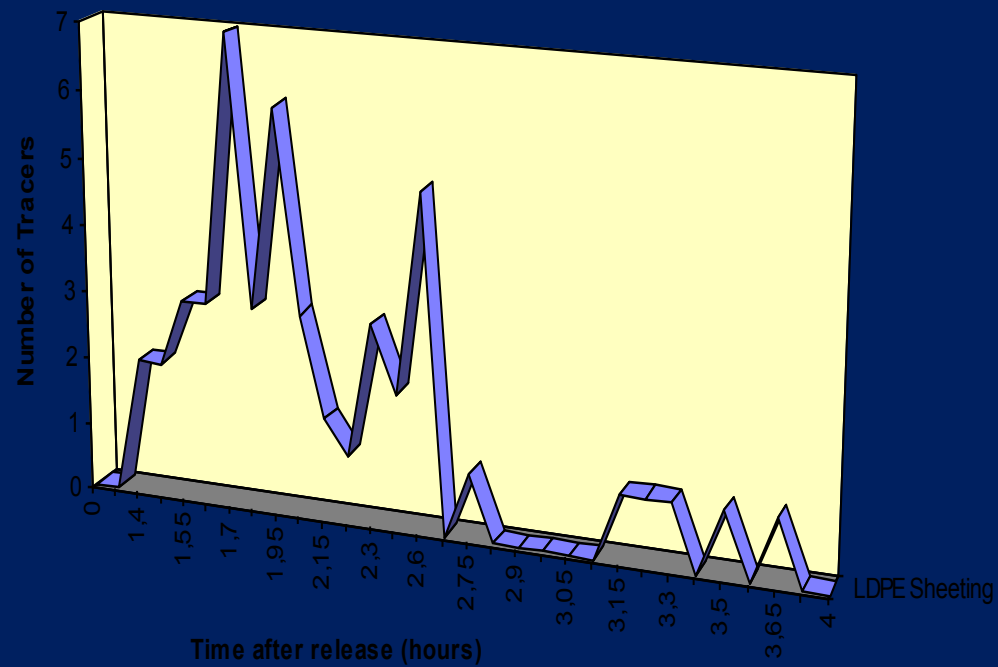
Very Good

Good

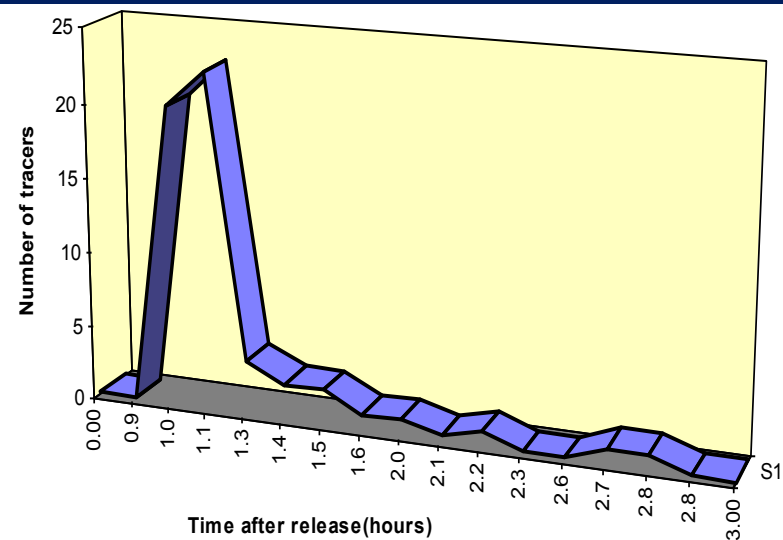
Fair

Poor





Plastic Tracer Movement



- A shelf survey of the **Southern California** Bight, ranked quantities of anthropogenic and natural debris as: trace, low, moderate, high based on number and weight of items determined from standardized trawl times between depths of 20 and 200 m. Anthropogenic debris increased with increasing distance along a broad offshore front, from inner to outer shelf, suggesting boating activities sources
- The most comprehensive and thorough reports seem to be those from **European** and **western Mediterranean** waters. Densities found were highly variable between and within separate sampling areas. Near metropolitan areas they could be $>100,000 \text{ items/km}^2$ but elsewhere maximum values were lower ($50,000 \text{ items/km}^2$ in the **Bay of Biscay**; 600 items/km^2 in the **North Sea** 200 km west of Denmark).
- Concentrations of debris ($>50,000 \text{ items/km}^2$) were found at $>2000\text{m}$ on canyon floors along the Mediterranean coast of **France**. Distribution pattern variations were attributed to local anthropogenic activities, geomorphology and land - based river inputs.
- A fleet of flimsy, white, supermarket shopping bags upended and suspended at depths of 2,000 m. -drifting like an assembly of ghosts.

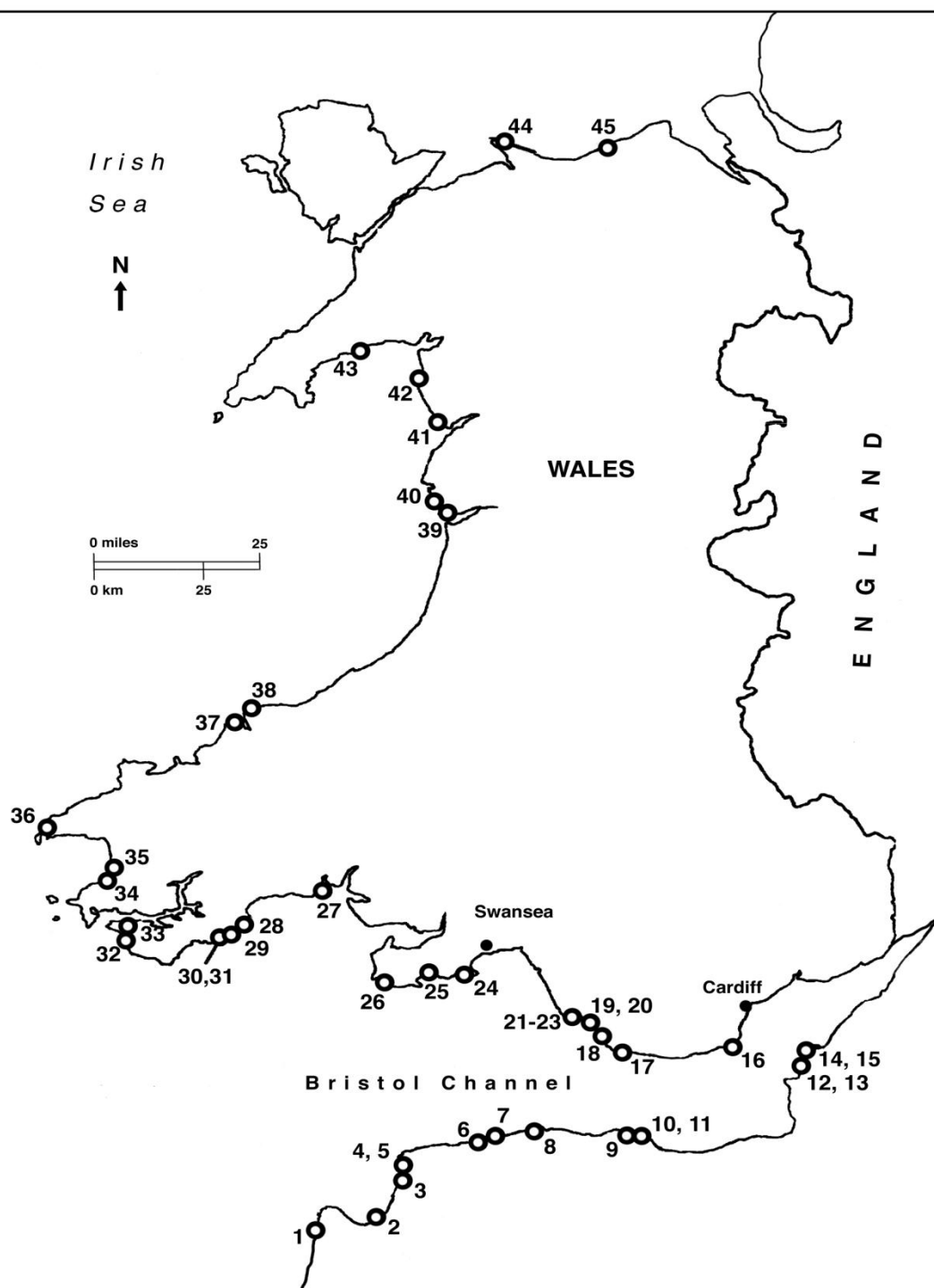
- Morgan and Williams (1995): rural beaches in Gower, UK, 75% of beach users were against the motion of allowing dogs on beaches
- Breton *et al* (1966), Barcelona: most users wanted dogs banned in the metropolitan Barcelona beaches of Spain.
- Morgan *et al*, (1996) at above beaches, 85% (n = 157) wanted dogs banned
- Unal and Williams, (1999). Cesme peninsula, Turkey: 95% (n = 245).
- Santos *et al* (2005), Cassino beach in southern Brazil: third most important issue encountered.
- Ruyck *et al* (1995), working on South African beaches: the more rural and undeveloped the beach, the more relaxed people were about the dog; as against resort beaches (e.g. Joorst Park and Kings) where people were firmly against the idea. People were prepared to travel long distances for the 'nature experience' and to walk their dogs.

Response by interviewee	ALL BEACHES (N = 2,727)					
	Should dog access be permitted on Resort beaches? (%)			Should dog access be permitted on Rural beaches? (%)		
Yes	8	12	14	31	39	31
No	85	80	78	54	47	55
Unsure	6	6	5	11	10	11
Blank	1	2	2	4	4	3

Access of dogs to beaches, percentage figure of responses:
(Modal figure in bold)

South Wales Survey.
South shore Bristol Channel
Mid and north Wales





The Dogs (Fouling of Land) Act, 1996

Section 119 of the Local Government Act (2003) was a proactive approach to local environmental management (Improvement & Development Agency, 2004), which can become self funding.



- 91% of local councils employ a dog warden
- 86% run anti-fouling campaigns.
- Some 50% of councils issued some 5,500 verbal warnings, handed out 2,400 fixed penalties and took 600 people to court.
- Men are more reluctant than females to pick poo up.
- Residents of social housing are more likely to leave it.
- If you see someone else's, you are less likely to pick your own dogs up.
- You are unlikely to get caught – esp. at night!

The Dogs (Fouling of Land) Act, 1996

Toxicara canis is the problem. Faeces of an infected animal can have one million eggs, which become infectious some 2-3 week after deposition, but can remain dormant in Soil for 3 years. North East: 30% households have a dog(s); South west; 29% South east: 17%; London: 7%.



← The problem



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Litter (Animal droppings) order 1991 of the Envir. Prot. Act 1990 obliged local authorities to keep public walkways, recreational areas etc free of fouling. The Dogs (Fouling of land) Act 1996 made it an offence - Fixed penalty £50 or in court up to £1,000.

8.11 2003, Section 119 of the Local Government Act (2003) became law relating to fixed penalty notices for littering and dog fouling. Section 119(m) of this Act gave guidelines regarding procedures. With this act, Section 88(6)(a) of the Environmental Protection Act, 1990 and section 4(2) of the Dogs (Fouling of Land) Act, 1996, ceased.

Clean Neighbourhoods and Environment Act 2005, Council's can designate land 'Dog Control Areas.'

The problem →

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



Dog mess

Edinburgh: **mobile vans**

Lincolnshire: agents on **650cc motor bikes**

Kennet, Wilts, UK: **500,000 free bags**

Liverpool: **undercover agents** (courting couples)

Hinkley, Leics: **private detectives.**

Cheltenham: painted **coloured circles.**

Koln, Germany; Vercelli, Italy; Tel Aviv, Israel; **DNA testing**

Geneva. £1,700 first **fine**, then £8,000

It has dropped by some 40% in the past few years, but...



MERMAID'S TEARS :

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

What are plastic resin pellets?

- 
- Raw materials that are melted and moulded to create plastic products.
 - Shape: spherical, ovoid, cylindrical
 - Size: typically 1-5mm in diameter.
 - Colour: clear or off-white but can come in any colour.
 - 60 billion lbs produced/yr in USA
 - 1 pound of plastic = approx. 22,000 pellets

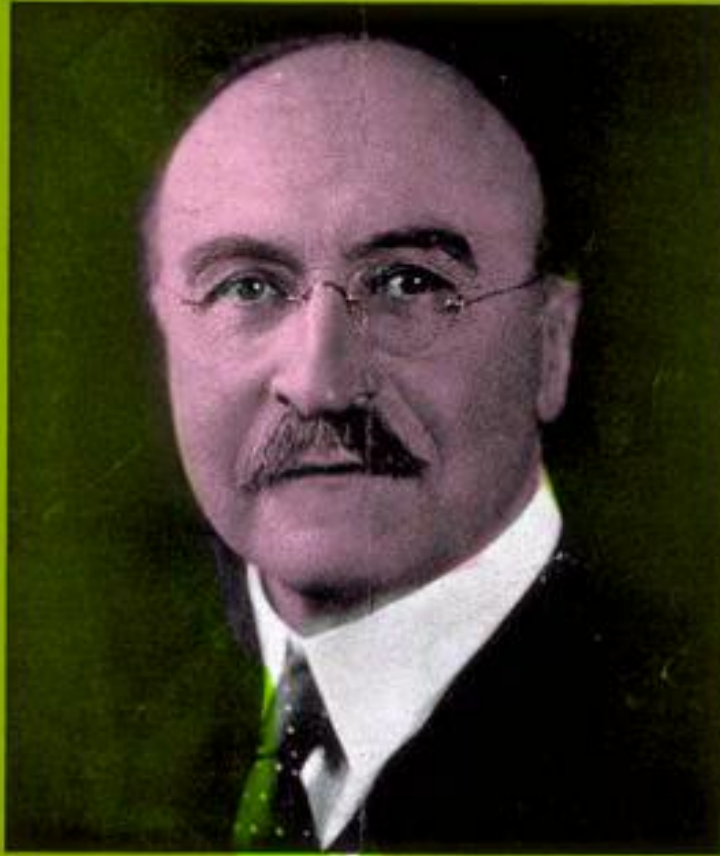
Prevalence: some numbers

- Ubiquitous on shores, in oceans, and on water surfaces across the globe (Mato et al. 2001)
- By mass 60-80% of marine litter is plastic (Derraik, 2002)
- 300,000 items of plastic per square kilometre of sea surface, and 100,000 per square kilometre of seabed (Thompson, 2006)
- World plastic resin pellet consumption is expected to rise from the 2006 figure of £451.9 billion pounds to £562.2 billion in 2010.



TIME

The Weekly News-Magazine



VOL. IV NO. 12

DR. LEO H. BAEKELAND
"It will not burn. It will not melt."
(See Page 20)

SEPTEMBER 22, 1924

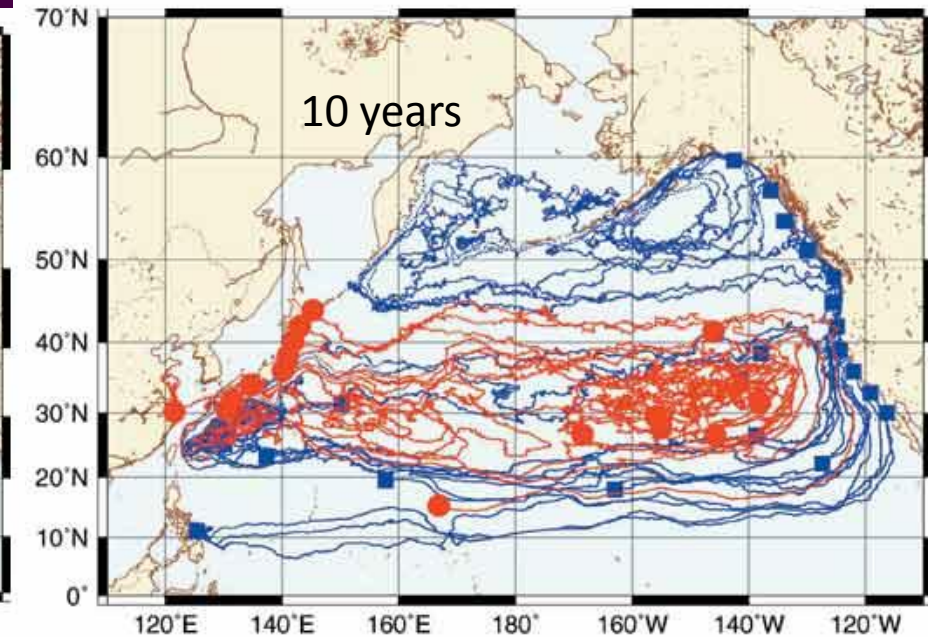
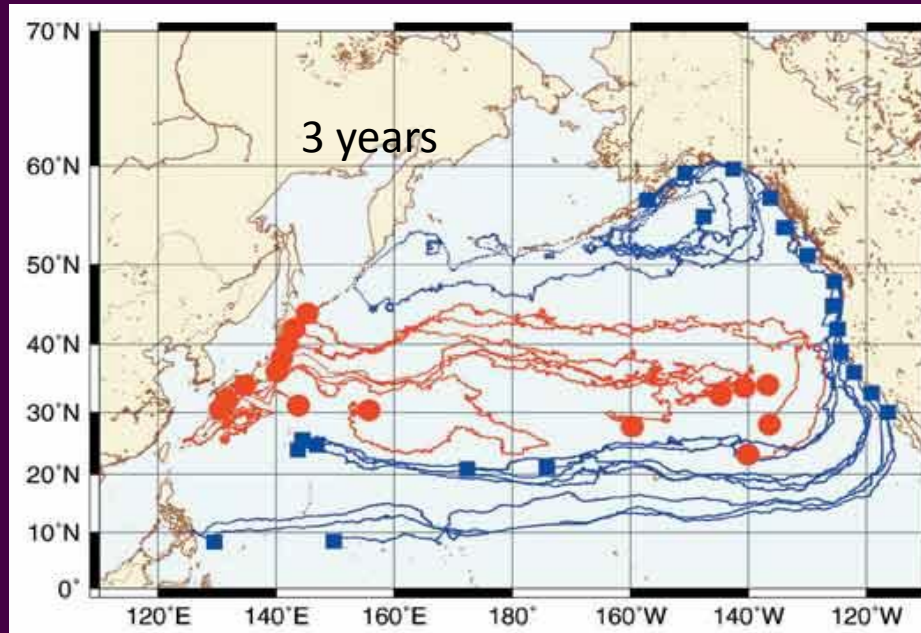
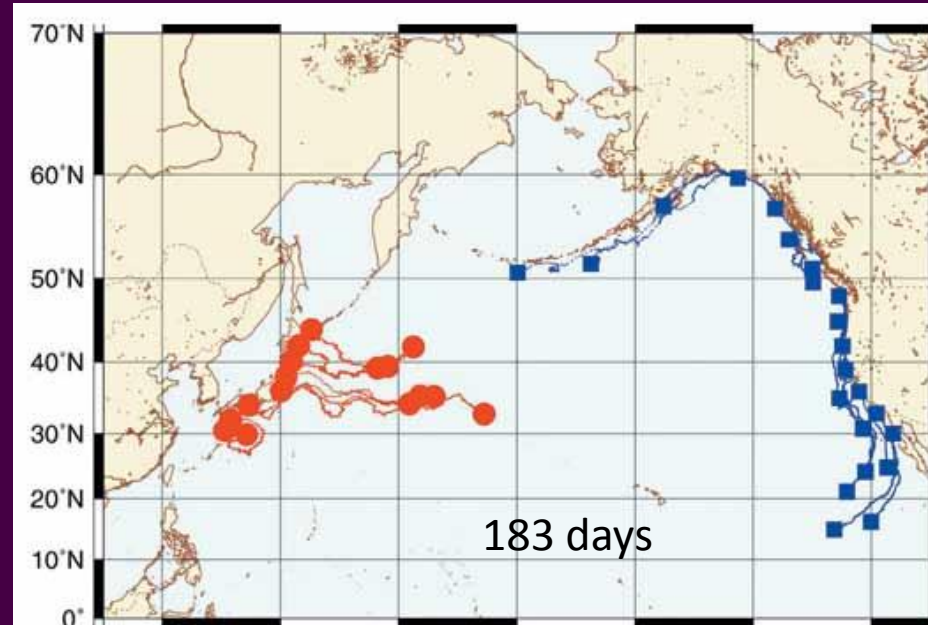
Plastic primer: Invention

- Plastic celebrated its 100th birthday in 2007.
- Invented in 1907 Leo Baekeland: **Bakelite**. It was a mixture of formaldehyde and phenol. And the first purely synthetic material.

Ocean Surface Current Simulator
(OSCURS) model developed by W.
James Ingraham Jr., an
oceanographer at the National
Oceanic and Atmospheric
Administration (NOAA),

It predicts the trajectory of drift
originating along the coasts of the
North Pacific rim. Drift from Japan is
shown in red; drift from the United
States, in blue.

(<http://www.naturalhistorymag.com>)



David de Rothschild.

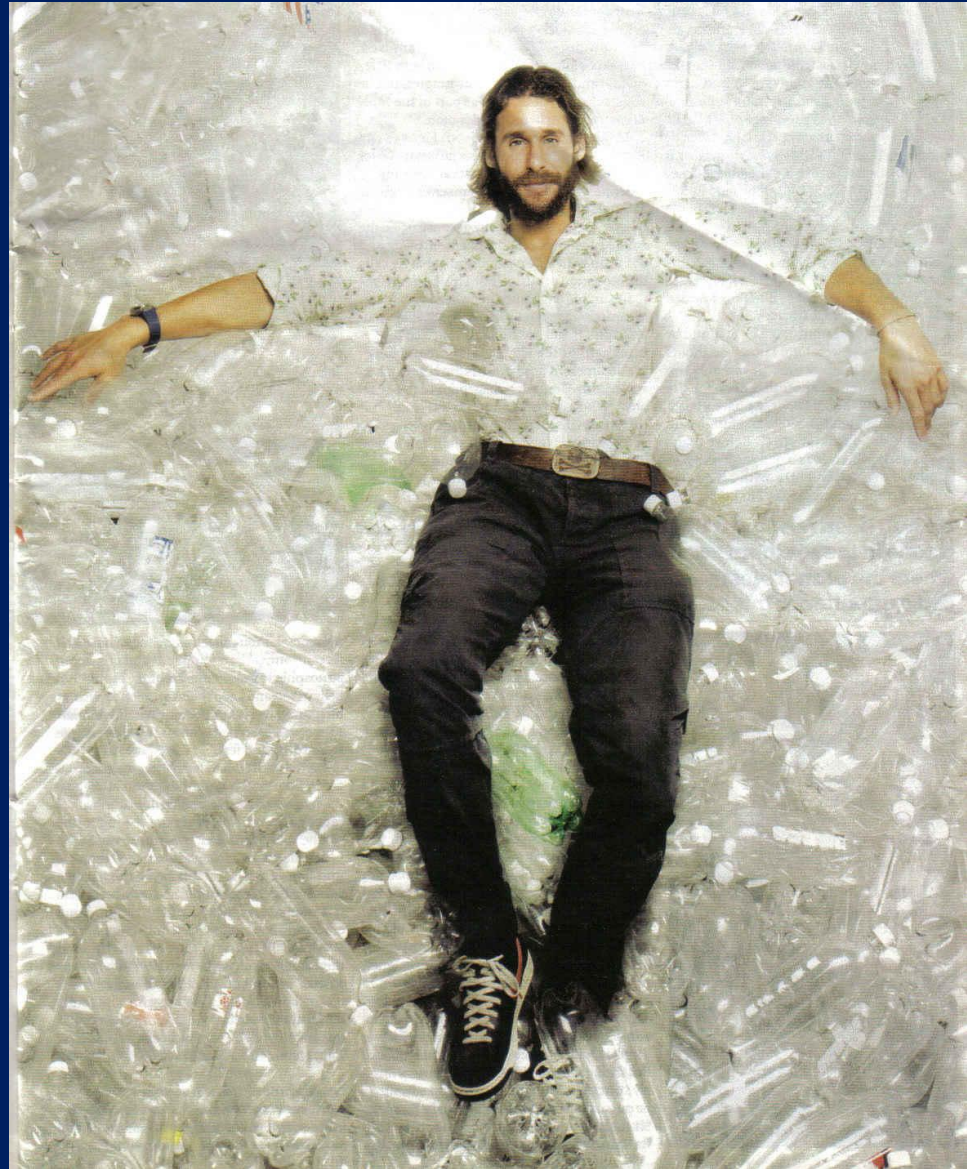
Plastiki- a boat kept afloat by 12,500 discarded plastic bottles lashed to its sides.

The Eastern garbage patch –twice the size of Texas –an island of trashed garbage.

srPET – self-reinforced polyethylene terephthalate –recycled plastic formed of layers of cloth like sheets – are the arched supports of the twin hull.

A frame with 12,500 mini hulls and the bottles give displacement.

5.8 million pieces of debris go each day into the sea!





- ◆ Much plastic remains in an organism's stomach resulting in loss of stomach volume and nutritional 'dilution' of diet.
- ◆ Study of logger head turtles (*Caretta caretta*) show they do not compensate by eating more, leading to slower growth rates, longer developmental periods, depleted energy reserves, reduced reproductive output, and reduced survival rate. (McCauley and Bjorndal 1997)

["Message in the Waves" by Morgan Hoesterey](#)

Toxicity

(1) Additive derived pollutants

- Plastic polymers contain additives to give the plastic marketable qualities.
- These additives are able to leach out of the polymer matrix into the environment. (Browne et al. 2007)

Examples:

- DEHP a phthalate "plasticizers" used in PVC.
- PBDE used in flame retardants.

(2) Monomer release

- Certain polymers have been shown to release toxic monomers linked to cancer and reproductive abnormalities in humans, rodents and invertebrates.

Examples:

- PVC, polystyrene, and polycarbonate



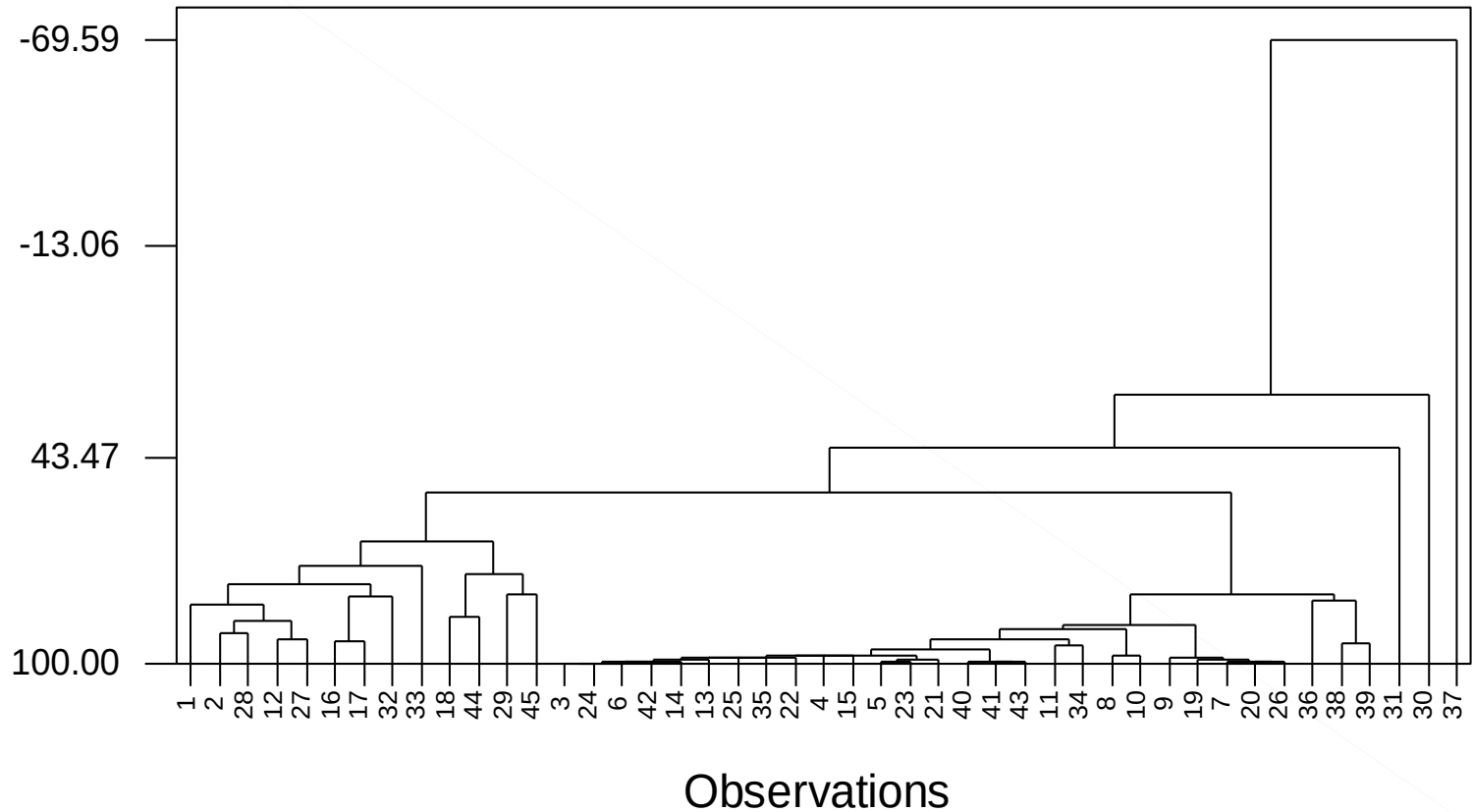
Degradation

1. Photolytic
2. Mechanical
3. Biological
 - Microplastics (less than 1mm in diameter)
 - The smaller the particle, the more potential for ingestion by organisms further down the food chain.
 - Shown to be ingested by amphipods, barnacles, and lugworms (Thompson et al. 2004)
 - They have greater surface area to volume ratio and therefore have greater potential to transport contaminants.



“Tide”, Stuart Haygarth, 2004, edition of 10

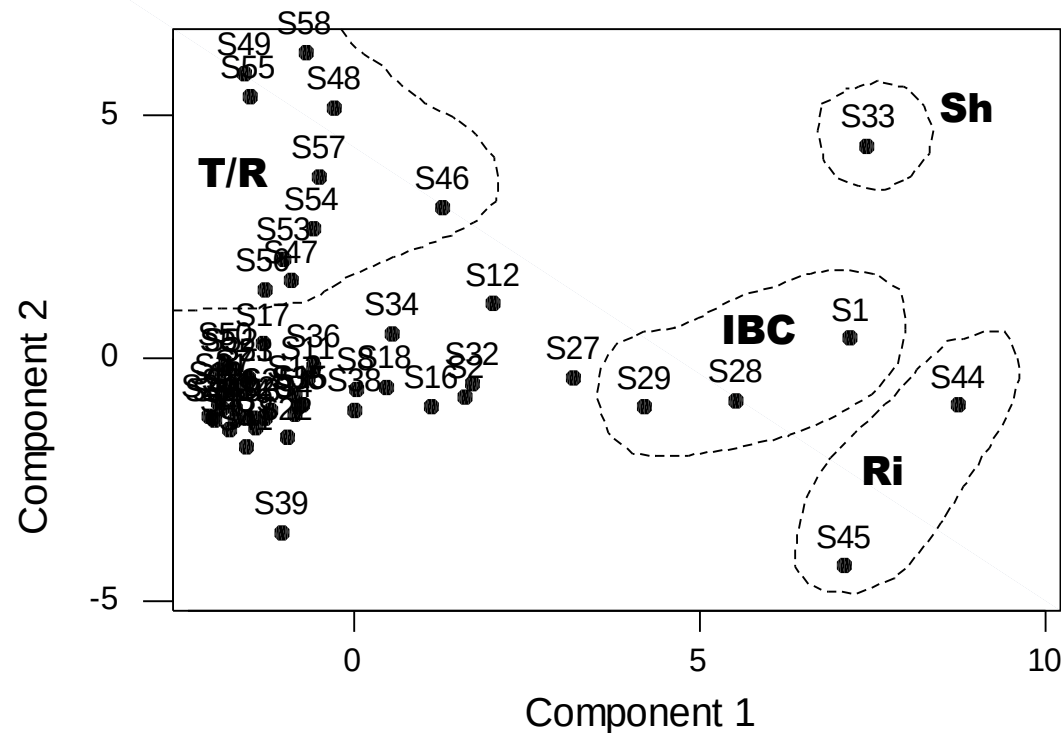
Similarity



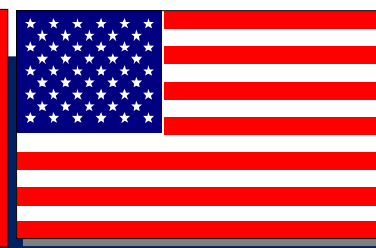
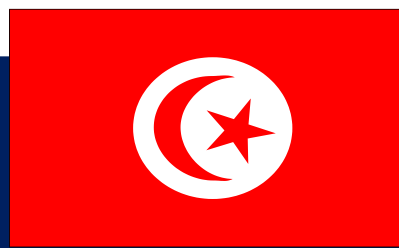
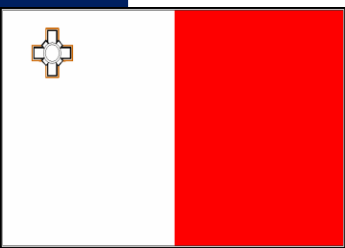
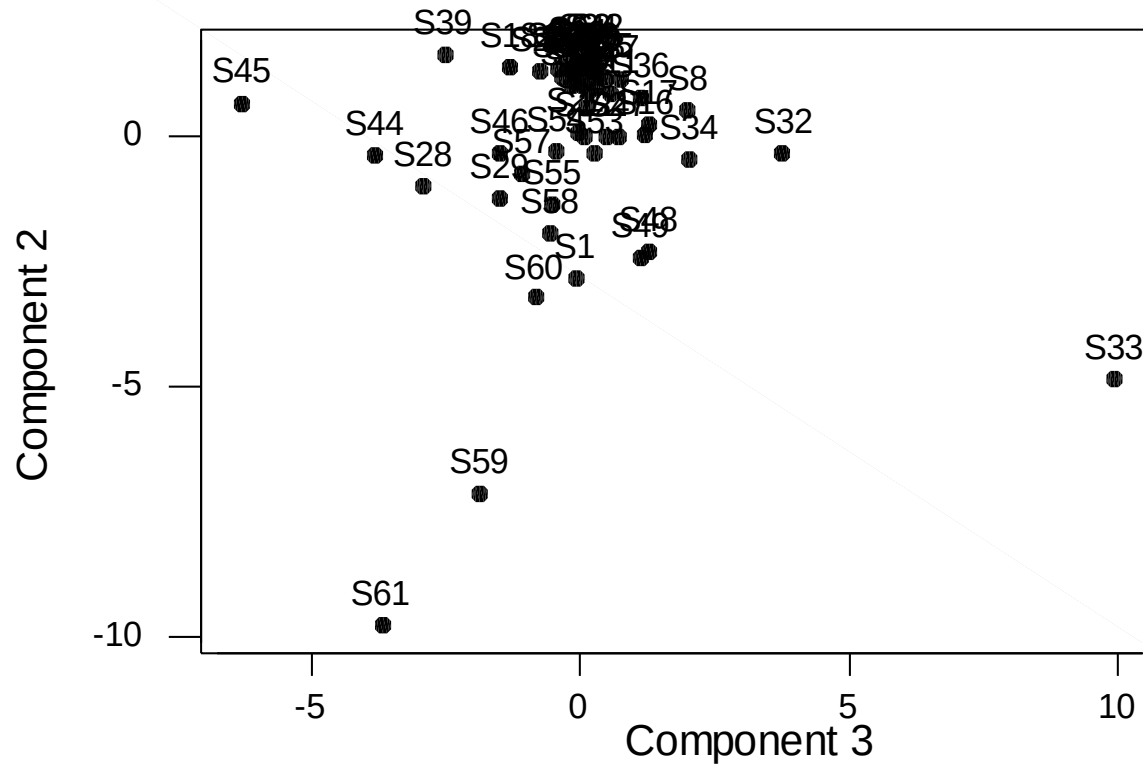
**Cluster Analysis - Specific Litter classification categories
(standardised variables)**



Figure 2a. Principal Component Analysis of Beach Survey Sites (excluding three UK outliers) using Specific Litter Item Classification. Principal Components 1 and 2 (standardised data). Key: T/R= Turkish/Roadside survey; IBC= Inner Bristol Channel; Ri= River source litter; Sh= Shipping source.

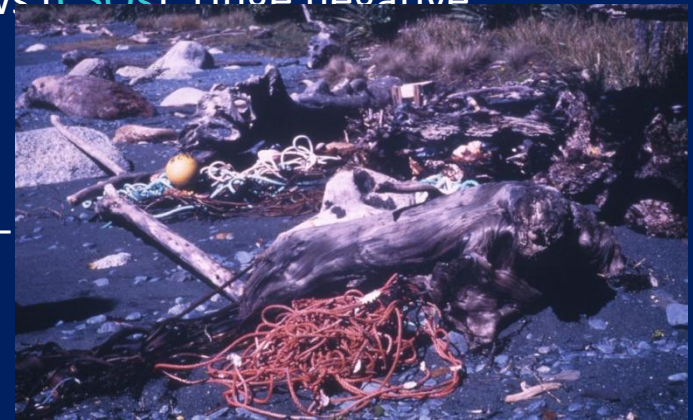


Principal Component Analysis (2&3 standardised data), of UK (excluding three UK outliers) and Turkish litter Items using Specific Litter Item Classification. Malta, Spain, Tunisia and USA beaches added.



WHAT WE KNOW

- With the exception of a few organisations - National Aquatic Litter Group (NALG), MCS, KIMO, Ocean Conservancy, there appears to be **little co-ordination** of effort to tackle marine litter.
- **Legislation** alone appears to be **ineffective** in reducing marine litter.
- Despite a lack of research into the subject, there is much evidence that the **economic impact** of marine litter to the UK is **significant**.
- Large volumes of litter can accumulate in shoreline and seabed sinks and It is estimated that **80% of marine litter originates from land based sources**.
- A significant amount of the **litter items** on our shores are **small** (less than 30cm).
- **50 - 90%** of beach litter comprises **plastics**, which persists in the sea for a long time.
- **Much SRD** still originates from combined sewer overflows (**CSOs**) **Huge negative** impact on public perception of water quality & fitness for bathing and other uses.
- Litter has led to many **volunteer-based survey** and clean-effective means of gathering data.



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

WHAT WE DO NOT KNOW/HAVE

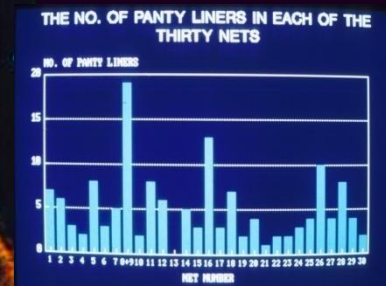
How marine litter affects populations or indeed whole **ecosystems**.

Assessing the **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, since there is no monitoring system to measure any effects of the legislation.

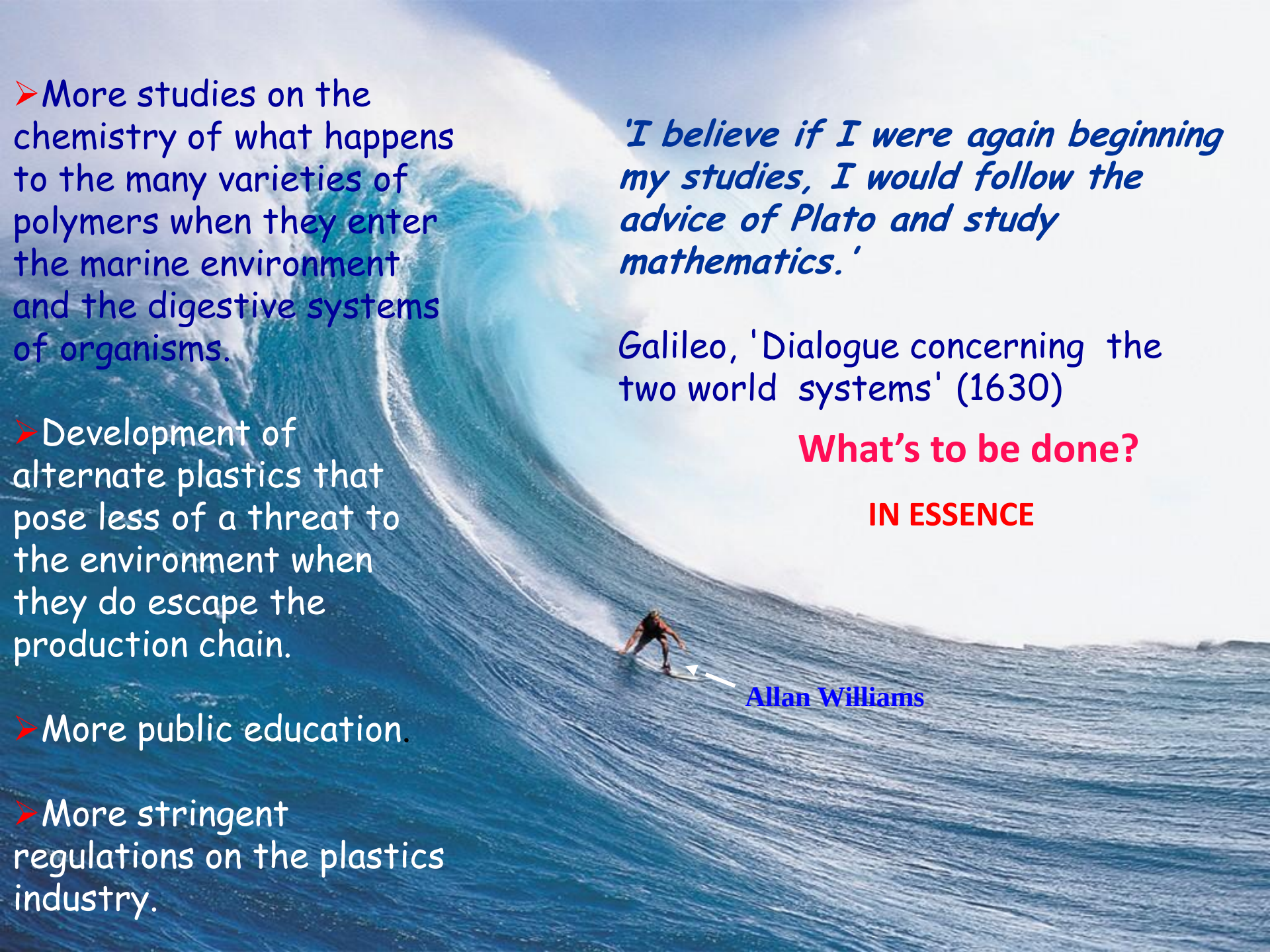


Recommendations for Further Action

This requires action on a number of fronts and in particular calls for **co-ordination of existing activities** in order to enhance their effectiveness. It can be done e.g. drink driving campaigns changed people's behaviour

- What **co-ordinating mechanisms** are needed to fulfill the aim of reducing litter input and impact, e.g., expand public/private partnership to monitor /reduce debris; community efforts, appoint a Lead Agency & '**General**'.
- The promotion of **communication & education** to stimulate a more pro-active approach to litter prevention and minimization through collaboration between various stakeholders, e.g. reduce, reuse, recycle.
- **Research** into the **economic and ecological** impacts of marine litter and the effectiveness of current measures for its control; new technology risk assessment tools e.g. ERA, and contingency valuation techniques - wtp.,





➤ More studies on the chemistry of what happens to the many varieties of polymers when they enter the marine environment and the digestive systems of organisms.

➤ Development of alternate plastics that pose less of a threat to the environment when they do escape the production chain.

➤ More public education.

➤ More stringent regulations on the plastics industry.

'I believe if I were again beginning my studies, I would follow the advice of Plato and study mathematics.'

Galileo, 'Dialogue concerning the two world systems' (1630)

What's to be done?

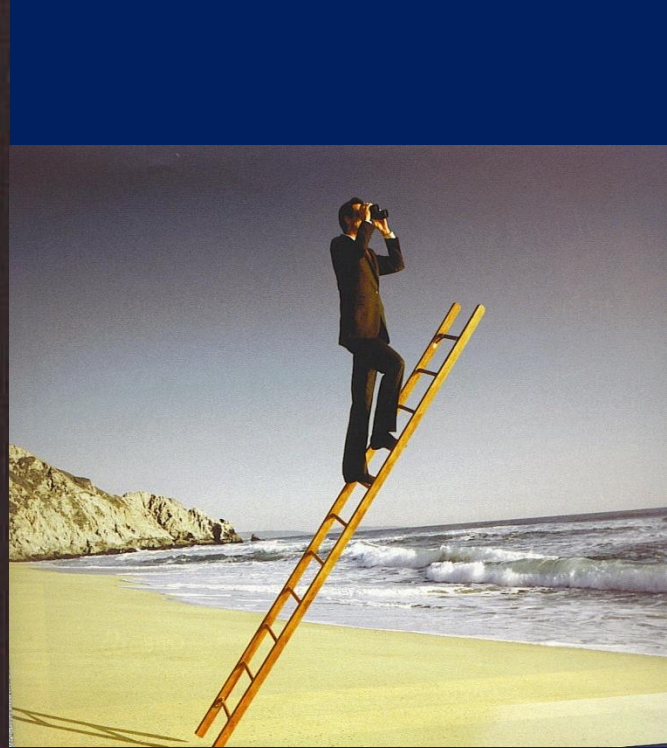
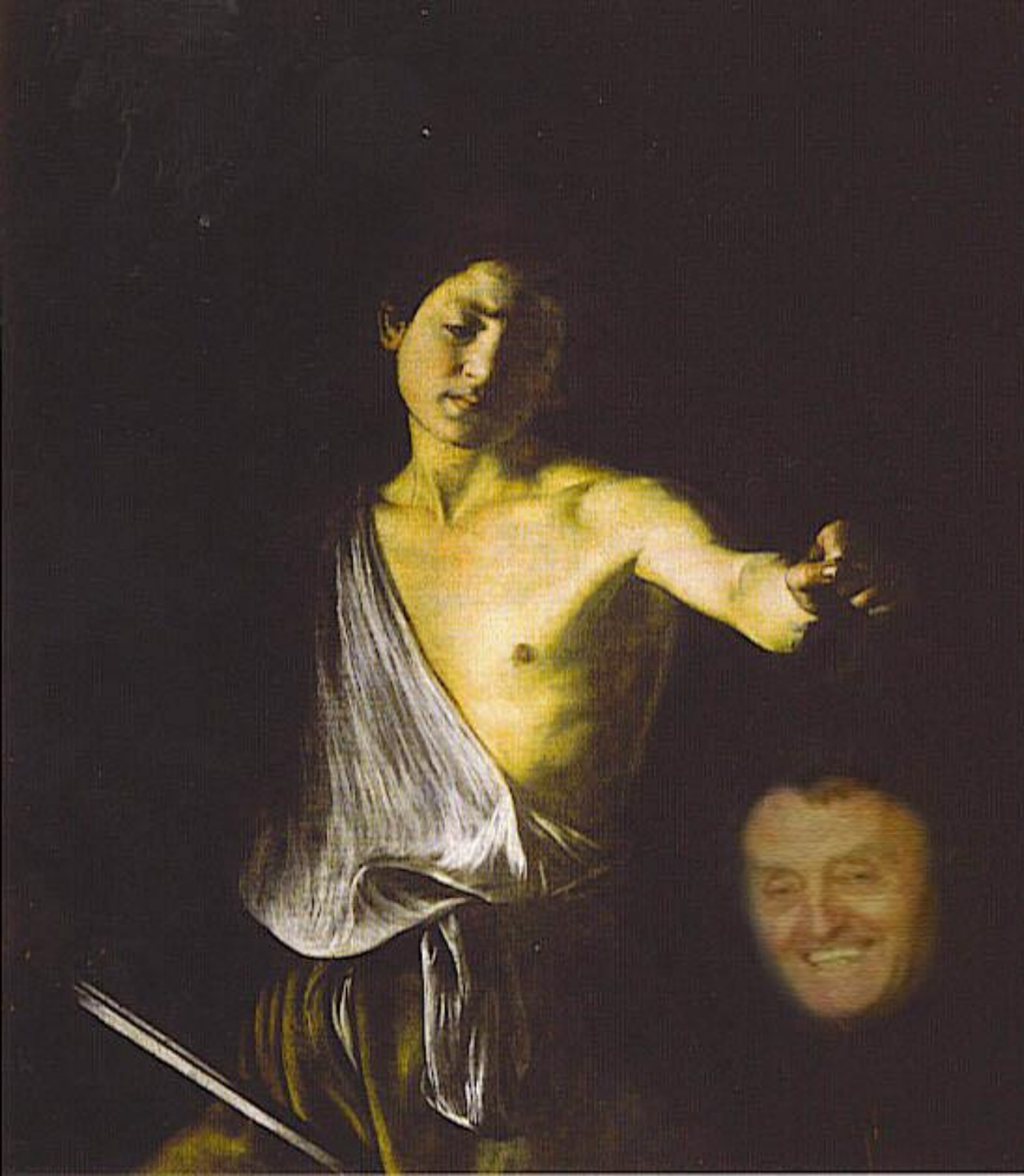
IN ESSENCE

➤  Allan Williams

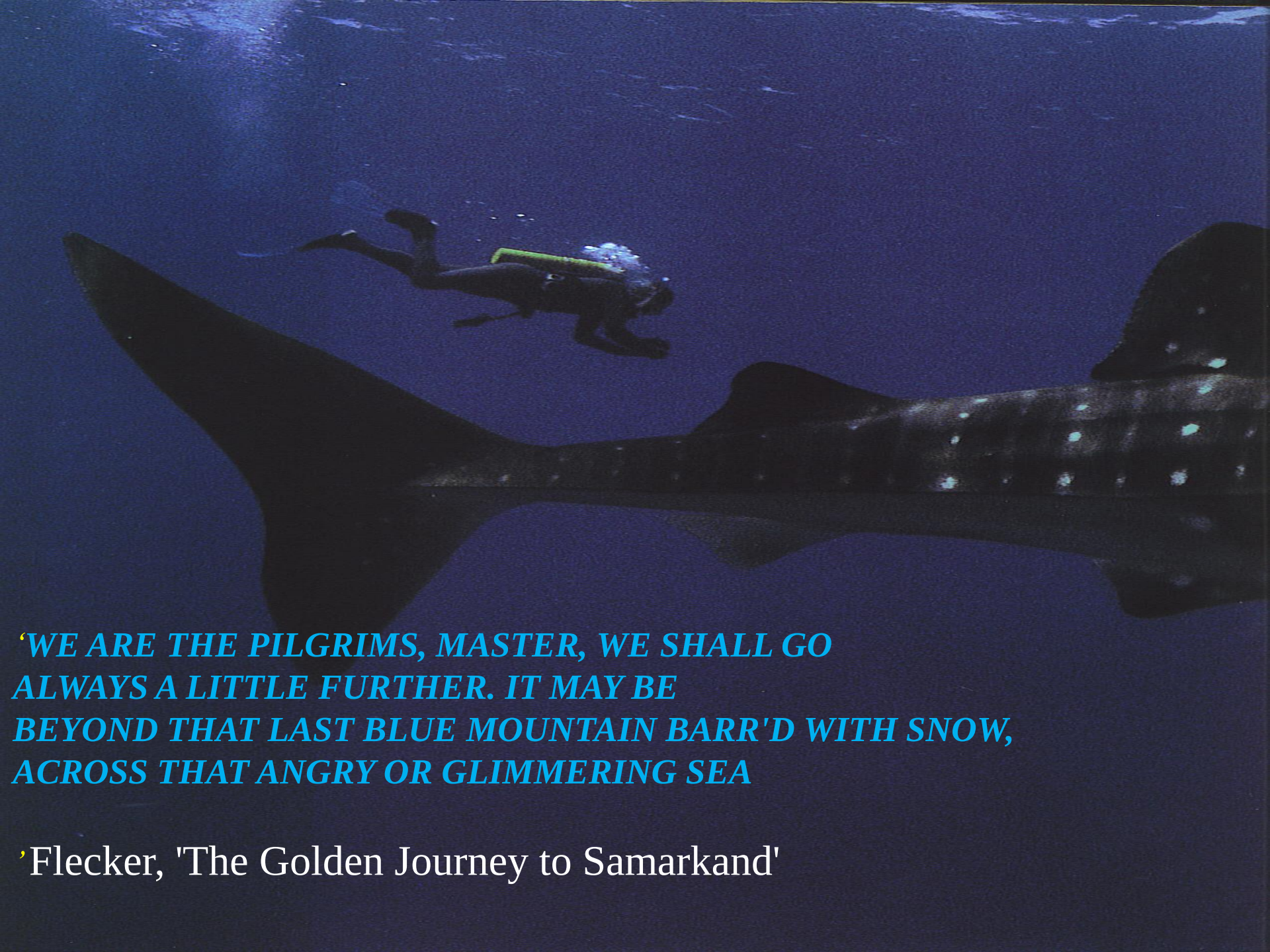
Should we do this?

Take this
{ for dropping litter }





**ANY
QUESTIONS?**

A diver in a black wetsuit and yellow oxygen tank swims horizontally in the upper left quadrant of the frame. Below the diver, a large, dark shark with white spots on its side swims horizontally across the middle of the frame. The background is a deep, dark blue water with some light reflecting off the surface at the top.

*'WE ARE THE PILGRIMS, MASTER, WE SHALL GO
ALWAYS A LITTLE FURTHER. IT MAY BE
BEYOND THAT LAST BLUE MOUNTAIN BARR'D WITH SNOW,
ACROSS THAT ANGRY OR GLIMMERING SEA*

'Flecker, 'The Golden Journey to Samarkand'



LET'S HAVE A COFFEE BREAK...

SMOKING IS PROHIBITED!!!

Beach Factor Priorities, 2008, Wales (n=818))

1. Scenery

Vehicles on beach

2. Safety

Beach material

3. Water quality

Floaters

4. Sewage debris

Rainfall

5. Litter

Temperature

Odours

Water Clarity

6. Oil

Sand colour

Toilet cleanliness

Pests

Noise

Dogs

Dangerous cliffs

Car park location

Traffic fumes

Lifeguards