Marine Conservation Society

FACTSHEETS

MARINE POLLUTION

FACTSHEET

CONCERN THAT THE INPUT OF TOXIC CHEMICALS, SEWAGE, OIL, DREDGE SPOILS, RADIOACTIVE WASTE, AGRICULTURAL WASTE AND DOMESTIC REFUSE TO OUR SEAS HAS CAUSED GREAT AND POSSIBLY IRREVERSIBLE DAMAGE TO THE MARINE ENVIRONMENT, IS WIDESPREAD. POLLUTION OF THE SEA AFFECTS US ALL, AND WE SHOULD ALL TAKE AN ACTIVE ROLE TO PREVENT FURTHER DAMAGE.

MARINE POLLUTION

MARINE CONSERVATION SOCIETY

FACTSHEET

SOURCES AND TYPES OF POLLUTION

Sources and types of pollution that we still appear to accept, include:

Sewage pollution.

● **Over 300 million gallons of sewage are discharged into Britain's coastal waters every day .**

● **88% of Britain's large coastal discharges (serving more than 10000 people) receive no treatment or are just screened. Western Germany and Denmark have NO untreated discharges at all.**

The discharge of raw sewage via pipes to beaches and inshore waters is still widespread in the United Kingdom. These discharges contain human excreta, domestic cleaning products, industrial effluents disposed of via the sewers, and oil and run-off from road systems (that can be surprisingly toxic). There may also be a selection of plastic and metal objects, such as carrier bags, ring-pulls and sanitary material. The health risk to bathers has been shown by government funded research at Moreton and Ramsgate beaches in 1990. This is of particular concern since the beach at Moreton passed the mandatory standards set down under the EC Bathing Waters Directive on water quality. For this reason, the **Marine Conservation Society** believes that beaches should be achieving compliance with at least the guideline standards of the Directive, which are 20 times stricter, before bathing or water contact activities can be recommended.

Nutrient pollution.

● **100,000km² of the Baltic Sea sea bed now suffers from an almost permanent deficiency of O_2 . The North Sea could suffer a similar fate.**

● **"Eutrophication effects are seen in some coastal regions of the Southern Bight, the German Bight, the Kattegat, the Eastern Skagerrak, some areas of the French Channel coast, and two small UK estuaries" Quality Status Report 1994.**

Nutrients, especially nitrogen and phosphorous, are the elements essential for the growth of plankton. **Eutrophication** is the "fertiliser" effect of nutrients and much of the seas are naturally eutrophic. However, large quantities of nitrates and phosphates derived from human sewage, farm slurry, silage effluent, excess artificial fertiliser use, bad land management and industrial pollution can cause severe damage to marine ecosystems by upsetting the natural nutrient balance. When excess nutrients are present a **hypertrophic** environment is created.

Algal blooms have been linked to the increasing levels of nutrients in coastal waters. Blooms of phytoplankton (plant plankton), naturally occur seasonally, but problems arise when there is an explosive growth of algae. A combination of environmental factors appears to lead to the formation of dense algal concentrations; heavy land run-off in spring, followed by calm conditions with high temperatures and increased sunlight, produce a layered water column. The surface layer is nutrient rich and warm, providing ideal conditions for the growth of algae.

In UK waters one species, **Phaeocystis**, has been particularly successful. When a Phaeocystis bloom dies a characteristic foam may be whipped up by waves and the dirty, brown scum that eventually washes up on the shore is often mistaken for sewage.

Studies have shown a distinct shift in the species balance of benthic (bottom dwelling) populations due to the introduction of excess nutrients. Opportunistic species tend to flourish at the expense of longer-lived species. Large marine plants are out-competed by benthic algae. When the bloom dies and rots it consumes large quantities of oxygen, on which all other marine life depends. When it falls to the sea bed the bottom layers of the sea become **anoxic** (no oxygen), killing vulnerable creatures such as brittle stars, Norway lobster and many species of fish.

The colour of algal blooms varies depending on the species involved; many discolourations due to algae in the sea are red, hence the term "red tides" Some species within algal

blooms can produce toxins which can be dangerous to human health. If shellfish that have concentrated the toxins produced by the blooms are eaten by humans, two severe illnesses, **Paralytic and Diarrhoetic Shellfish Poisoning (PSP & DSP)** may develop. In 1990, the shellfisheries of the UK from the Humber to Montrose were shut due to the dangers of red tide toxins. Red tides can also be harmful to fish, causing fish mortality on a massive scale.

Hypertrophication has been an important issue discussed at the North Sea Ministerial meetings, and some areas of the North Sea appear to have been affected. In the Skagerrak/ Kattegat region there has been an iincrease in reports of unusual algal blooms but more information is required.

Radioactive pollution.

● **Caesium 137 can be traced in water currents from the Sellafield nuclear reprocessing plant through the Irish Sea, around the north of Scotland and into the North Sea.**

● **Porphyra, an edible seaweed found near Sellafield, accumulates Caesium 137 to 10x the normal concentrations found in seaweed, and Ruthenium 106 to 1500x normal levels.**

The extent of radioactive pollution is increasingly alarming in the post-Chernobyl world. Nuclear power stations and reprocessing plants are the principal sources of discharge to the coastal waters around the U.K. Low level radioactive water is produced from the cooling system, fuel storage ponds and the reprocessing process itself. Radioactive wastes are of concern because they emit potentially harmful radiation. The Irish Sea is the most radioactive sea in the world, primarily due to the discharges, both consented and accidental, from the reprocessing complex at Sellafield (formerly Windscale) The contaminated sediments and sands of the Cumbrian coastline are of particular concern to ecologists and medical professionals alike. The long term effects of low level exposure to radiation are unknown.

These are not the only sources of radioactivity in the oceans. There is a great deal of concern focussing on the number of abandoned reactors on the sea bed from military vessels and waste already dumped in deep sea areas is also a long term threat to the health of the seas.

Oil pollution and the offshore oil industry.

● **The Braer oil spill was one of the largest in history, with 84,000 tonnes of crude oil spilling into the sea on the coast of Shetland in January 1993. Fortunately, the local ecosystem appears to have been saved from the ecological disaster forecasted as ferocious storms dispersed the bulk of the oil. Long term effects on the benthic ecosystem where much of the oil was deposited may take longer to become evident.**

● **The Exxon Valdez oil tanker spilled 35,000 tonnes of crude oil into Prince William Sound, Alaska in March 1989. The clean-up operation, particularly the steam cleaning of beaches, did more harm than good, sterilising sandy and rocky shores. The Exxon company is potentially liable for over 15 billion US dollars in damages to Alaskan fishermen, landowners and Native Americans.**

● **Major accidents at sea account for only 5% of the total amount of oil entering the marine environment each year.**

The pollution of the seas by oil frequently reaches the newspapers and TV after major tanker accidents or acts of war. The direct toxic effects of oil are a result of complex aromatic chemicals in the oil, and the physical clogging effects of the heavier fractions. The oceans of the world are littered with tar balls. The clean-up operations described as successful can never be so. Emulsification of oil spills is rapid and makes effective clean up impossible. However, it is the constant small spills, deliberate flushing of tanks at sea, seepage from marine oil rigs and refineries and inputs from land that make up the bulk of oil pollution. In fact only 3% of oil pollution comes from major shipping accidents. Given how catastrophic these accidents appear, it is clear just how serious the other sources can be to marine life. Offshore oil rigs also are a major pollution source. The benthic communities around theses rigs are severely damaged and depleted, primarily by the toxic effects of oil seepage from the wells, but also by the gross enrichment of the sea bed by the less toxic components. Severe changes in species composition occur on the seabed up to several kilometres around some rigs.

Toxic and industrial pollution.

● **Drums containing 5.8 tonnes of Lindane, a highly toxic pesticide, are still on the seabed of the English Channel after being washed overboard during a storm from the MV Parintis in March 1989.**

● **In 1990, grey seals in the Irish sea were found to have 430 µg/g of mercury in their livers. This is a higher concentration than in the original mercury bearing ore. It would be economically viable to mine the seals for the mercury in their livers!**

● **Cod and whiting in Liverpool Bay have over 5mg/kg of PCBs in their livers.**

Estuaries and coastal areas have traditionally been selected by industry to site polluting processes. The toxic cocktails produced by these industries are often insufficiently monitored. Little may be known about the ecological effects of these chemicals, both acute and chronic. There are many examples of bioaccumulation of pollutants that have caused damage to marine life far away from the point of discharge; the most infamous case being that of severe mercury poisoning of shellfish and people in Minimata Bay, Japan. Many of the Beluga whales in the Arctic are classified as 'toxic waste' due to the extremely high levels of PCBs that they have accumulated.

The Marine Conservation Society shall attempt to monitor the success of the National Rivers Authority and Her Majesty's Inspectorate of Pollution in their combined role to implement Integrated Pollution Control for England and Wales.

Other toxic pollution of our sea comes from the deliberate use of certain chemicals in the marine environment. Since 1987 the use of the antifouling agent TBT has been banned on vessels of under 25m length. However, illegal use still occurs. Larger vessels, such as military vessesl and merchant ships may still use TBT, legally. The effects are known and have been shown to be devastating to populations of dogwhelks and also to the economic status of oyster farmers. The Marine Conservation Society is running a survey to assess the continuing impact of TBT on dogwhelks around the coastline of Britain as part of the Oceanwatch project for schools.

Dichlorvos, an organophosphate pesticide used in intensive salmon farms to control epidemics of sea lice on the fish, has been shown to be highly toxic to marine life, especially invertebrates. The history of dichlorvos use is one of belated regulatory action, inadequate ecotoxicological analysis before use was allowed, and unnecessary secrecy in the gathering of this data and the search for an alternative. Dichlorvos is being used in greater than ever amounts. The lice are now showing resistance which means higher doses and more frequent treatment are required. Suggested alternatives have, it appears, as many associated problems. It is time to assess the fishfarming industry and why it has been developed to be so dependent on chemical inputs.

Plastic rubbish and waste.

● **An estimated 6.5 million tonnes of plastic is deliberately discharged from ships each year. This figure does not include the amount of plastic "lost overboard."**

● **Plastic pellets, 3-4mm in size are found throughout the oceans. Seabirds often mistake them for fish eggs and may consume fatal quantities. The pellets are also accumulating in the food chain (like certain pesticides) and have been found in carnivorous skuas.**

Although dumping of garbage at sea is now illegal under international law (the Marpol Convention, Annex V), the dumping continues. The amount of plastic washed up on our beaches testifies to that each year. The effects of plastic on marine life can be devastating. Seabirds , fish and sea mammals easily get entangled in something as apparently innocuous as a plastic 4-pack ring and die. The Marine Conservation Society gets many reports each year about the effects. Harrowing photographic evidence exists of turtles that have attempted to swallow plastic bags, mistaking them for jellyfish; seals effectively muzzled by plastic rings that have starved to death, and birds that have become entangled in discarded fishing nets and drowned.

Dredging and disposal of waste sediment.

● **In 1987, 38 million tonnes of dredged waste sediment was dumped at 60 different sites around the UK.**

Dredging of estuaries not only destroys the benthic communities of estuarine and coastal sediments, but the resulting waste sediment is often dumped out at sea, carpeting the benthic communities and in some cases releasing toxic pollutants that have built up over the years in the sediment. Research has shown dredge spoil often to be anoxic and containing high concentrations of cadmium, mercury, chromium, copper, lead,nickel and zinc. Dredge spoil from the Manchester Ship Canal contains mercury at 20.7 ppm and lead at 5080 ppm. The loss of estuarine benthic populations can have severe knock-on effects for migratory bird feeding grounds, local shellfish production and fish breeding grounds. Furthermore, the pollution caused by spoil is persistent.

MARINE CONSERVATION SOCIETY POLICY

The Marine Conservation Society works to protect the marine environment from pollution. Through education, expert lobbying of business and government, and encouraging public participation in our work, the Society promotes five basic "Conservation Principles:"

1. SUSTAINABILITY.

The use of the marine environment should not detract from the range of potential uses of the seas by future generations, nor should any use be allowed to cause environmental degradation or harm to the ecological processes of the seas.

2.THE PRECAUTIONARY PRINCIPLE.

Potentially harmful activities should not be allowed on the basis of inadequate proof of damage. A precautionary approach should always be adopted prior to a causal link being made between activity and damage.

3. CLEAN PRODUCTION.

Manufacturing processes should be designed to prevent or minimise waste production and hence reduce the risk to the marine environment. "Closed-cycle" production should be encouraged.

4. FREEDOM OF INFORMATION .

A presumption in favour of public access to all environmental information is required in order to let the public (consumers), clearly see what damaging practices are being carried out in their name. The Society supports a legal basis for freedom of information in the UK.

5 . I N D I V I D U A L E N V I R O N M E N T A L RESPONSIBILITY

Only by making individuals aware of the environment, its splendour and fragility, can we expect to ensure its adequate protection. By educating and informing, the Society hopes to instil in everyone a sense of their own environmental responsibilities.

The Marine Conservation Society believes that the widespread acceptance and application of these principles to the pollution problems described above will lead to the removal of risk to the seas, and adequate protection of this magnificent heritage.

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LITTER IS A GROWING PROBLEM IN THE OCEANS AND ON SEASHORES AROUND THE WORLD. NOT ONLY IS IT UNSIGHTLY AND OFTEN LONG-LASTING, BUT LITTER, ESPECIALLY PLASTIC LITTER, ON BEACHES AND AT SEA, CAN BE A HAZARD TO PEOPLE AND WILDLIFE

PLASTIC-WASTE POLLUTION

Marine debris is the collective term for any man-made object present in the marine environment. There are many different types of litter that, through accident or purpose, enter our seas and are deposited on our beaches. Litter is thrown overboard from boats, discharged form sewage outfalls, carried down rivers, dumped by fly-tipping and left behind by holiday-makers. The majority of the litter seen at sea or on beaches is made of plastic.

The types of plastic product that are found at sea range from raw plastic pellets (about the size of wheat grains, from which larger items are manufactured), to plastic bags and sheeting, cotton bud sticks, mono-filament fishing nets and multi-pack drink-can "yokes".

Once used and thrown away, these plastics persist for many years in the environment, posing a threat to wildlife and resulting in the accumulation of plastic debris in the seas and on beaches.

THE PROPERTIES OF PLASTIC

The essential characteristics that have led to the extensive use of plastic in the packaging, consumer and fishing industries are also those that make them the most pervasive, persistent and hazardous of debris types in the marine environment.

Plastics are extremely durable, lightweight, cheap and versatile, resulting in the replacement of many traditional materials such as metal, glass and wood.

The versatility of plastic products has created a world-wide demand in excess of 100 million tonnes per annum, of which an estimated 10% may be discarded at sea.

Degradation of plastics in sea water is slower than in outdoor air exposure and items may take several decades to break down. Even when plastics break down into smaller pieces they still pose a threat to wildlife.

Plastics are made up of long chains of hydrocarbons, which are so tightly bound that micro-organisms with the ability to break down paper and other types of refuse cannot penetrate them.

Due to their lightweight nature, many items of plastic debris will float on the surface of the sea, or within the water column, where they can harm wildlife, foul fishing gear and cause a hazard to small craft. Floating debris can also be carried substantial distances by wind and currents, resulting in the deposition of items from many different countries on beaches.

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Plastics are the most common man-made item sighted at sea and many surveys such as the MCS's *Beachwatch* survey have found that plastics constitute over half of debris found on beaches in the UK and many other countries around the world.

THE DANGERS OF USING PLASTIC

Plastic items at sea and on beaches pose a threat to both man and wildlife. In the case of marine debris that price is paid by wildlife, while man also must pay a price in terms of polluted beaches, lost revenue and risks to health and property.

IMPACTS ON WILDLIFE

There are two main dangers to wildlife from plastics at sea. Animals may become entangled in discarded or lost nets, strapping bands, six-pack can holders and ropes which can cause flesh wounds, strangulation and drowning. Marine animals also mistake plastic items for food, which if ingested can cause starvation and poisoning.

- It is estimated that over one million birds and 100,000 marine mammals and sea turtles die every year from entanglement in, or ingestion of, plastics.

- Of the 115 species of marine mammal, 47 are known to become entangled in and/or ingest marine debris.

Entanglement

At least 135 species of marine vertebrate and eight invertebrate species have been reported entangled in marine debris including whales, dolphins, seals, turtles, seabirds and fish. Fishing nets, fishing line, plastic strapping and can carriers are the most common cause of entanglement, reducing movement and potentially resulting in serious injury and death by starvation, drowning or suffocation.

- Studies show that approximately 30,000 northern fur seals die annually due to entanglement, primarily in net fragments.

- Plastics are also used as nesting material. Over 90% of the 30,000 gannet nests on Grassholm Island now contain plastic. This indicates the extent of plastic pollution in surrounding waters as gannets collect almost all of their nest material at sea. Young gannets' feet can often become entangled, resulting in serious injuries.

Ingestion

Whole plastic bags and gallon drums have been mistakenly identified as food and eaten by some mammal, turtle and shark species. These items may physically block the intestinal tract, causing starvation and internal injuries. Chemicals contained in the plastics can also be directly toxic to animals causing tissue damage.

Of particular threat to the largest number of animals are the ever increasing quantities of plastic pieces and plastic pellets in the sea. Seabirds often confuse small pellets with fish eggs and plankton, or ingest plastics with other food and may even feed these to their chicks.

At least 160 marine vertebrate species and two invertebrate species have been reported to ingest marine debris and 88 of the world's 280 species of seabird are known to eat plastic accidentally. Relative to entanglement, much larger proportions of populations ingest marine debris - approaching 100% in certain species of seabird. Plastic debris can gradually accumulate in the guts of some animals. Some species may be able to regurgitate or excrete debris, but plastics do not appear to pass through the intestines of sea birds as there is a marked absence of debris from droppings.

EFFECT ON ECOSYSTEMS

Little is known about the distribution, abundance or impacts of debris on the sea floor, but smothering of benthic and beach faunas affects natural systems at the species and possibly ecosystem level.

Sheets of plastic on the sea floor can prevent oxygen reaching benthic organisms. Abrasion of debris against hard substratum may also cause damage.

Floating items of debris in midwater may provide shelter and food for small fish and migrating animals, as well as a method of transport for colonising new areas. However, this can affect whole ecosystems of some Oceanic islands, if the debris carries species which are alien to the islands and which may have a detrimental effect on native species.

IMPACTS ON MAN - COMMUNITIES, HEALTH AND ECONOMICS

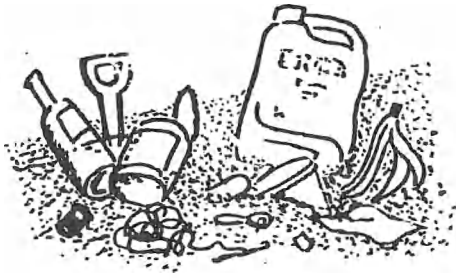
A coastal community that depends on tourism can suffer substantial economic loss if washed-up plastic and sewage related debris destroys the appeal of its beaches or rocky shores. Broken glass and discarded medical equipment may cause injury to beach visitors. Repeated beach clean-up efforts can help reduce the amount of debris on the shore, but these efforts are expensive and time-consuming in themselves.

Commercial fishing interests can be affected when fisheries resources are depleted by lost or abandoned nets and traps that continue to capture target and non-target species - 'ghost fishing'. This also reduces reproductive potential, as immature fish that have not yet produced offspring are removed from the population. Even when the lost nets sink from the weight of their 'catch', the persistent nature of plastic means they can continue to damage the seabed and affect commercially important shellfish species for many years.

Marine debris may also result in lost revenue for fisheries, due to the time and effort involved in sorting debris from the catch, while larger items may actually tear the fishing gear. In some areas, the density of debris in trawls is so great that local fishing grounds have been closed. Also, the presence of certain types of debris, such as glass, in a trawl can result in the entire catch having to be discarded.

WHAT MORE CAN BE DONE?

The Marine Conservation Society believes that all dumping of plastics at sea should be stopped on an international basis and continues to campaign for reduced litter at sea with projects such as the annual *Beachwatch* beach clean and litter survey and the *Adopt-a-Beach* scheme. Based on information gathered since 1993, on the amounts, types and sources of litter on beaches, MCS has gathered the information required to target specific pollutants and polluters and urge action to be taken to reduce litter at source.



THE MARINE CONSERVATION SOCIETY'S KEY RECOMMENDATIONS TO REDUCE LITTER

- Compliance with MARPOL for the provision of adequate, easy-to-use waste reception facilities at all ports and harbours must be achieved rapidly, with consultation of port authorities, port users and waste management services.
- Inadequacies in port reception facilities must be reported and action taken to ensure improvements are made as quickly as possible.
- Results of surveys on the quantities of ship-generated waste must be used to develop ship waste management plans and enforce compliance with legislation.
- Minimum penalties for illegal dumping must be adequate to discourage polluters.
- Education of all user groups must continue through Government agencies and associations representing the various user groups.
- All countries that have not yet signed up to MARPOL must be encouraged to do so.
- Adequate facilities and services for the public to dispose of their rubbish must be provided.
- Local authorities should incorporate beaches in local waste management plans.
- Local authorities should expand beach-cleaning operations and encourage voluntary local initiatives such as the Marine Conservation Society's *Adopt-A-Beach* scheme.
- Water authorities should improve the combined sewer overflow system.
- Government should encourage the expansion of national plastics recycling schemes.
- Government should enforce anti-littering laws to deter fly-tipping and littering by the public.
- Government and industry must implement plans to minimise packaging waste.
- Educational resources on the sources and effects of marine debris and ways of reducing the problem should be incorporated into school curricula and training programmes for ships' crews.

WHAT YOU CAN DO TO STOP THE POLLUTION OF THE SEAS FROM PLASTIC WASTE

Reduce
Reduce the amount of plastic that you use. Use fabric shopping bags instead of plastic carriers. Avoid buying pre-packed goods or those that have an unnecessary amount of packaging.

Re-use
Re-use plastic containers wherever possible.

Recycle
Recycle plastic bottles if facilities are available, if not, contact your local authority and urge them to expand recycling facilities.

Make It Safe
Cut any plastic rings or strapping bands before disposal.

'Bag It and Bin It'
Please don't flush plastic sanitary items and cotton buds down the toilet. Contact the *Bag It and Bin It* campaign for leaflets and stickers (see Further Addresses).

Follow the Seashore Code
Do not leave or bury any litter on beaches or allow litter to get into rivers.

Over the side is *OVER*
Never throw any waste overboard. Find out what litter reception facilities are available at local ports and marinas. Contact the Marine Safety Agency for posters and leaflets against illegal disposal at sea (see Further Addresses).

JOIN US IN THE FIGHT TO CLEAN UP THE MARINE ENVIRONMENT

Join MCS's *BEACHWATCH* and *ADOPT-A-BEACH* campaigns to clear beaches of litter and gather important information on marine debris.

BEACHWATCH

Take part in the national annual beach litter survey and clean-up every September.

ADOPT-A-BEACH

Adopt your local beach and monitor it regularly for marine litter. A full Adopt-A-Beach pack is available from the Marine Conservation Society (£2.00) with details on how to campaign for local improvements.

Write to the Society for membership details **TODAY**:

Marine Conservation Society
9 Gloucester Road
Ross-on-Wye, Herefordshire HR9 5BU
Tel 01989 566017 Fax 01989 567815

Further information is provided in the annual Beachwatch report (£5 incl. postage) available from the Marine Conservation Society.

Further Addresses:

Marine Safety Agency
Spring Place, 105 Commercial Road
Southampton SO15 1EG
Tel. 01703 329100 Fax 01703 329204

Bag It & Bin It
Leedex, 52 Broadwick Street
London W1V 1FF
Tel. 0171 734 9681Fax 0171 734 4913

KEY POLLUTERS AND LEGISLATION

Shipping and Boating

Boat users have traditionally dumped their rubbish into the sea as a matter of course. Oceans were seen as vast domains in which garbage became invisible because it either decayed or sank. Today, however, the situation is very different, as a result of the increased use of non-biodegradeable products such as plastics. Plastics are now used in the majority of fishing gear and make up a large percentage of ships' operational and galley wastes.

A survey in the 1980's suggested that the world's fleet of vessels (excluding commercial fishing vessels) dump at least 4.8 million metal, 450,000 plastic and 300,000 glass containers into the sea every day.

International and national legislation is in place to prevent pollution by ships and other ocean-going vessels, but has proven difficult to police and enforce.

International Convention for the Prevention of Pollution from Ships 1973 (MARPOL 73/78)

The International Convention for the Prevention of Pollution from Ships 1973, was laid down as international law by the International Maritime Organisation (IMO) and modified by the Protocol of 1978, generally known as MARPOL 73/78. MARPOL 73/78 has five annexes covering different types of pollution as follows:

Annex I	Annex II	Annex III	Annex IV	Annex V
OIL	NOXIOUS LIQUIDS	HARMFUL SUBSTANCES	SEWAGE	RUBBISH

Annex V sets minimum specific distances from land inside which certain garbage, e.g. glass, food, and metals can be disposed. The disposal of all plastics is prohibited throughout the world's oceans by any member country. The UK ratified Annex V in December 1988. In 1996, 81 states in total had ratified Annex V.

Merchant Shipping Regulations 1988

It is up to national governments to implement MARPOL through their own legislation. The UK's interpretation of MARPOL Annex V is via The Merchant Shipping (Prevention of Pollution by Garbage) Regulations 1988.

These regulations apply to all ships including small craft and yachts, fishing vessels, passenger ferries, cargo ferries, offshore platforms and Royal Fleet Auxiliaries. However, the Royal Navy is not yet obliged to comply. The regulations prohibit the disposal of plastics anywhere in UK territorial waters and prohibit the disposal of other types of pollutant within specific distances from nearest land.

Inside Special Areas, the North Sea and English Channel:

No dumping of *any waste* within 12 nautical miles of land. Outside 12 nautical miles, it is illegal to dispose of any waste other than food wastes.

Outside Special Areas:

Within 3 nautical miles of any land : No plastic or oily waste, or rubbish of any kind may be disposed of at sea.

Between 3 to 12 nautical miles of any land: No plastic or oily waste, or rubbish unless ground to less than 25 mm.

From 12 to 25 nautical miles of land: No plastic and no oily wastes

Beyond 25 nautical miles: No plastics except lining and packaging materials that float, no oily wastes.

The maximum fine for illegal disposal is £250,000. The main difficulty with enforcement, and hence prosecution, is acceptability of evidence; photographs or video footage of illegal disposal are rarely available and yet, at present, are the best way of securing a conviction.

The Merchant Shipping (Reception Facilities for Garbage) Regulations 1988 require all ports and terminals in the UK to provide adequate reception facilities for waste, including dry waste, sewage and oil. Any harbour authority or terminal operator which fails to comply can be fined up to £2,000 under the Merchant Shipping Notice (No. M. 1389). The UK ratified Annex IV of MARPOL in 1995, which will require port authorities to provide facilities or services for sewage disposal, once implemented.

Land-based Sources

Land-based sources of debris are not easily traced. Besides the sewage system, rubbish may be carried out to sea or onto our shores from inland sources via drains, rivers, and storm-water systems. Coastal sources include recreational beach users, fly tipping, local businesses and unprotected waste disposal sites.

Recreational beach users are responsible for a proportion of beach litter (18% of litter surveyed in Beachwatch '95). Local authorities are responsible for providing bins on amenity beaches, but it is the responsibility of the individual to ensure that they use these facilities.

Environmental Protection Act (1990)

Under section 87 of the Environmental Protection Act (EPA), 1990, it is an offence to drop litter in any public place, including beaches. The EPA also places duties on, and gives powers to, the local authority to keep amenity beaches clear of litter according to the Code of Practice issued by the Department of Environment. This requires that the beach must be regularly cleaned between May and September.

BALLOON RELEASES

- ENVIRONMENTAL CONCERNS

MARINE CONSERVATION SOCIETY

SEAS FIT FOR LIFE

THE IMPRESSIVE VISUAL IMPACT OF THOUSANDS OF BALLOONS BEING RELEASED INTO THE SKY MAY LAST A FEW MINUTES, BUT THE IMPACT ON WILDLIFE AND THE ENVIRONMENT MAY LAST MANY MONTHS WITH POTENTIALLY HARMFUL CONSEQUENCES

Many people are unaware that balloon releases can result in littering and harm to wildlife. Once balloons are out of sight, they don't disappear - what goes up must come down! An estimated 90-95% of released balloons rise to an altitude of 5 miles where the temperature and pressure is such that they burst into small fragments. The remaining 5-10% that do not reach a high enough altitude may remain inflated and can float many miles before descending back to the land or the sea semi-inflated.

The largest ever balloon release was 1.4 million balloons, 10% of which - 140,000 - may have returned to the land and sea where they could have been mistaken for prey and eaten by animals.

Releasing balloons at large promotional and corporate events is not something that can be done without thinking about the consequences. Mass releases are potent symbols of our wasteful and "throw away" society, whilst smaller releases and balloon races can result in a high percentage of balloons littering the land and sea.

Problems caused by balloon releases

Once balloons are released, they can become a serious form of marine pollution. A long list of marine creatures - dolphins, whales, turtles, fish, and seabirds - have been reported with balloons in their stomachs. It is believed that they mistake balloons and other buoyant plastics for their natural prey e.g. jellyfish and squid, and eat them.

The following species, all of which occur in the North East Atlantic waters off the UK, have been reported with latex balloons in their digestive systems:

Common Dolphin
Risso's Dolphin
Loggerhead Turtle
Leatherback Turtle
Blue Shark
Northern Fulmar

It is very difficult to prove that ingestion of a balloon has been the direct cause of death of a beached animal. However, the fact that balloons have been identified in the stomachs of these animals indicates that the balloons are not rapidly broken down by an animal's digestive system and/or that death occurred shortly after ingestion of the balloon.

Illustration by Claire Fletcher

Whilst most balloons used in balloon releases are made of biodegradable latex, some are made of mylar foil which persists much longer in the marine environment. An infant sperm whale met its death in New Jersey in 1985 as a result of ingestion of an inflated mylar balloon which had lodged in it's intestines. Consequently, the whale died of starvation.

A study on balloon persistence in the environment indicated that latex balloons degrade "faster than an oak leaf" and this is often used in defence of mass balloon releases. However, an oak leaf in a cold water environment may take six months to break down and during this time the balloons can be carried hundreds of miles by sea breezes and ingested by marine life.

Attachments such as ribbons and string tied to balloons are a particular problem, as they can lead to entanglement. A Code of Practice for mass balloon releases has been issued and states that ribbons must never be used, which will reduce the incidence of entanglement.

All seven species of marine turtle are near extinction and many turtles of two species in particular, the Loggerhead and Leatherback turtle, have been found with balloons in their guts, probably having mistaken them for jellyfish, their preferred prey.

A study to test whether turtles can digest latex balloons was carried out using pieces of balloon. These balloon pieces took up to four months to pass through the intestinal tract, often being passed in a mass.

This study has been used by organisers of balloon releases as proof that balloons have no detrimental effect on turtles, but no test was carried out to study the effect of ingesting whole balloons which are more likely to be mistaken for food and ingested.

Semi-inflated balloons can block the pyloric valve between the stomach and intestines so that food cannot pass through, causing slow, painful starvation.

Mass balloon releases are not the only problem. Small-scale releases and balloon races may have a disproportionate effect on the environment because:

- the balloons may not be adequately inflated;
- strings or ribbons are often attached which can lead to the entanglement of animals; and
- race tags intentionally weigh balloons down further increasing the potential for balloons to land in the countryside or at sea.

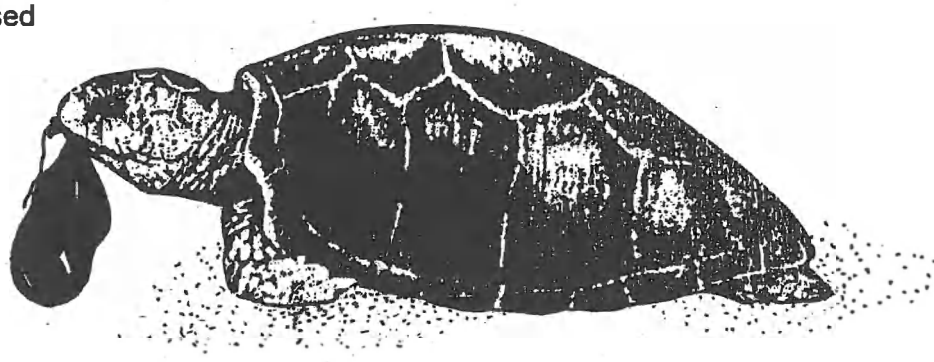
The problems caused by mass balloon releases were first highlighted at a conference in Canada in 1989 on plastic and other debris found at sea. Balloons had been found accumulating on islands off the east coast of Canada; some were still partially inflated and their country of origin was traced to the USA.

Balloon releases immediately began to be cancelled in response to these findings, even the Canadian government decided to cancel the release of tens of thousands of balloons in Ottawa to mark Canada Day. This wave of anti-balloon sentiment has continued to spread across the whole of North America and many states in the US have now abandoned balloon releases.

Balloon Releases in the UK

It is the concern of the Marine Conservation Society that this message has not reached events organisers in the UK. The Marine Conservation Society / Reader's Digest annual *Beachwatch* beach-clean and survey of coastal litter records hundreds of balloons in the UK, at an average rate of over 3 balloons recorded per km of coast surveyed. In the 1997 *Beachwatch* survey, 538 balloons were found on 169km of coast.

Since 1990 however, it has become questionable whether balloon releases are still within the law. Under the Environmental Protection Act 1990, it is an offence to drop "or otherwise deposit" litter in a public place. During the debate on the Act, balloon releases and their potential for littering were discussed, but unfortunately, such events are not specifically noted in the EPA as being illegal.



The Marine Conservation Society, the Royal Society for the Prevention of Cruelty to Animals, the Tidy Britain Group and the National Farmers Union share the view that balloon releases should not occur in the UK given the evidence for the harm that they cause to wildlife and the aesthetic damage to the environment.

We recognise that balloon releases are often associated with charitable events and fund raising and are being considered for millennium celebrations. Whilst not wishing to prevent such events nor spoil peoples' fun, **we are calling on all organisations to support a voluntary ban on balloon releases and to celebrate or commemorate events in more animal- and environment-friendly ways.** It would be unfortunate if money were to be raised for one good cause only to find it is responsible for the blight of another.

What you can do:

◆ Inform the Marine Conservation Society of any planned balloon releases so that we may contact the event organiser to explain the potential consequences, of which they are often unaware, and persuade them to reconsider.

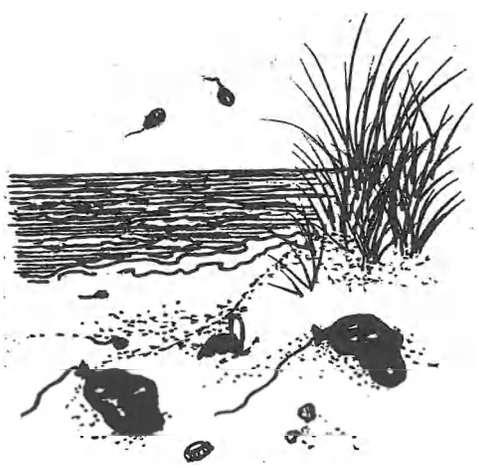
◆ Consider the alternatives to a balloon release. Why not use the same balloons intended for release to build one or more balloon statues - sell balloon numbers and choose the winning ticket lottery style?

◆ If, despite our recommendations, the event organisers decide to proceed with a balloon release, we urge them to use latex balloons rather than mylar or foil balloons and that they follow the Code of Practice issued by the National Association of Balloon Artists and Suppliers (NABAS) Tel. 01989 567678

◆ Commit your organisation or company to signing the Voluntary Ban on Balloon Releases, by completing the pledge form overleaf.

◆ If you find a balloon on the beach with a company name, send it back to the company with a copy of this factsheet urging them to think twice next time. libraries will often provide you with business and corporate headquarters' addresses.

◆ Take part in *Beachwatch*, an annual beach-clean and coastal litter survey event sponsored by Reader's Digest and organised by the MCS, or join the *Adopt-A-Beach* scheme and monitor your local beach for litter such as balloons and other debris harmful to wildlife. These surveys provide us with vital data to monitor the state of Britain's beaches, and make a case for government action to clean up our oceans. Send an SAE to MCS for details.



Join Us Today

The Marine Conservation Society is the leading UK charity dedicated solely to protecting the marine environment, for wildlife and for future generations. We rely on funding from members to continue our vital work in preventing the pollution of our seas and beaches and protecting habitats and species. Please support our work by sending a donation, or becoming a member.

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Registered Charity 1004005

Further Reading

Annual Beachwatch Report. A comprehensive report on the issue of marine and coastal litter in the UK. The report covers the results of the most recent annual MCS Beachwatch survey and covers the impacts on wildlife and people, legislation and recommendations for action to reduce marine litter. £5.75 (incl. postage) from MCS.

A Study of the Effect of Balloon Releases on the Environment. 1989. By D K Burchette. Available from the National Association of Balloon Artists and Suppliers (NABAS), Katepwa House, Ashfield Park Avenue, Ross-On-Wye, HR9 5AX.

MARINE CONSERVATION SOCIETY

VOLUNTARY BAN ON BALLOON RELEASES

I, the undersigned, on behalf of _____:

☐ Support the national voluntary ban on mass balloon releases for the millennium.

☐ Will raise awareness of members within the organisation of the environmental impact of released balloons.

☐ Will encourage members to focus fund-raising events on activities that do not harm the natural environment.

☐ Will incorporate a policy opposed to mass balloon releases within company/environment policy.

Signed.....

Date.....

Print Name.....

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POLLUTION FACTSHEET

SEWAGE POLLUTION

POLLUTION OF THE SEAS IN THE UK FROM HUMAN SEWAGE CONTINUES TO DAMAGE HUMAN HEALTH, MARINE ENVIRONMENT, SHELLFISHERIES AND LOCAL ECONOMIES. DISCHARGES OF INADEQUATELY TREATED SEWAGE ARE BOTH UNACCEPTABLE AND UNNECESSARY.

MARINE CONSERVATION SOCIETY

SEAS FIT FOR LIFE

Introduction

Sewage is produced in huge quantities - approximately 26 billion litres a day - and is defined as waste matter from domestic residences and industrial processes that is carried away in sewers and drains. Sewage contains chemicals and grey water from industrial processes, grey water from domestic sinks, baths and washing machines and anything else that has been washed down drains, or flushed down the toilet.

Untreated, or raw sewage contains faecal matter, and associated bacteria, fats, chemicals and nutrients such as nitrogen and phosphate. In low concentrations, faecal material from domestic and wild animals as well as humans, has little effect on the marine environment and the nutrient and particulate elements may actually be of benefit to the ecosystem. When large quantities of untreated sewage is discharged into rivers and coastal waters it causes pollution and poses a health risk to bathers.

Sewage pollution is caused when high concentrations of industrial and domestic waste enter the marine environment. The bacteria, solids and nutrients in these discharges can destroy the natural balance of aquatic ecosystems by removing oxygen from the water and introducing non-degradable waste, high levels of nutrients, chemicals and pathogenic (disease causing) organisms.

How does sewage enter the marine environment?

Sewage enters water courses and eventually the sea either by a continuous outfall, an intermittent discharge, a diffuse source such as land runoff, or from ships and recreational boats. The majority of human sewage pollution in the UK enters the marine environment from continuous outfalls.

Sewage inputs from combined sewer overflows, ships and recreational boats have never been quantified and are likely to be considerably less than from continuous sewage discharges. A consent, or permission to discharge certain quantities of sewage is requested by individual water companies and granted by the Environment Agency (EA) in England and Wales and Scottish Environment Protection Agency (SEPA) in Scotland. These consents are designed to protect the waters into which the sewage is discharged. However, some discharges regularly breach their consents and many do not have numerical consents, meaning there is no limit on the amount of effluent allowed to be discharged. The relevant authority (EA or SEPA) has a duty to carry out routine monitoring of all discharges. **However in England and Wales 45%, and only 10% in Scotland, of continuous coastal and estuarine discharges were monitored for compliance with discharge consents, and intermittent discharges are never monitored.**

Impacts of Sewage Pollution

The extent of sewage pollution depends on several factors. Untreated sewage can cause the death of fish and other aquatic life, contaminate shellfish, destroy the appeal of beaches with sewage related debris and create a potential source of disease. Untreated sewage contains bacteria and viruses as well as bathroom waste such as condoms and sanitary products. A 1995 opinion poll showed that public concern about sewage on beaches was rated the fourth most important issue of all concerns for the environment.

Ecological Damage

Sewage is primarily organic in nature and therefore subject to bacterial decay. As a result of this bacterial activity, the oxygen concentration in the water is reduced and sewage is said to have a high Biological Oxygen Demand (BOD). This can starve aquatic life of the oxygen they need and also leads to the breakdown of proteins and other nitrogenous compounds. This further results in the release of hydrogen sulphide and ammonia, which are potentially toxic to fish in low concentrations.

Solids suspended in sewage may also blanket river and sea beds preventing respiration of the benthic flora and fauna.

'Sensitive' waters which are vulnerable to eutrophication (excessive growth of algae and nutrient inputs) can be designated

under the EC Urban Waste Water Treatment Directive. Discharges affecting these areas are required to be treated to tertiary level including nitrate stripping. **However no marine waters have as yet been identified.**

The dumping of sewage sludge at sea has historically been another cause of ecological damage. Dependent on the hydrography, sludge can smother the benthos, increase biomass, decrease species biodiversity and increase heavy metal concentrations. Following amendments to the EC Urban Waste Water Directive this practice has been prohibited since 1998, but ecological damage may continue at historic dump sites.

Health Risks

The sea naturally contains many micro-organisms, some of which are pathogenic in certain circumstances. Bathers are at an increased risk of contracting illnesses, due to the presence of untreated sewage in seawater. In particular, gastro-intestinal disorders are linked to sewage pollution, with viruses implicated as the cause.

The discharge of sewage near waters used for bathing, diving, sailing, surfing and other water sports constitutes a well documented health risk. This is because raw or partially treated sewage contains bacteria, viruses and other pathogens which are hazardous to human health. Coliform bacteria occur naturally in the environment and are excreted by wild and domestic animals as well as humans. Faecal streptococci bacteria on the other hand are almost always associated with human sewage and their presence in a sample is believed to be a better indicator of sewage contamination than coliforms.

A report by the World Health Organisation (WHO) published in 1999 identified a good causal relationship between gastro-intestinal symptoms in bathers and water quality as measured by faecal streptococci or enterococci. However, little evidence was foundlinking other complaints such as ear and eye infections, respiratory illnesses and more serious diseases such as hepatitis and typhoid. However, there have been individual cases where more serious illnesses such as temporary paralysis, muscle dysfunction, Hepatitis A have been linked with sewage polluted water.

There is also evidence that bacteria and viruses can be transferred from the sea to the air and subsequently, with onshore winds, to the land. Bacteria and viruses in surface waters may be concentrated into bubbles through an 'aerosol effect'. There is a general consensus amongst researchers that the spread of disease and infection by pathogen laden microdroplets in marine aerosols derived from bubble bursting has been proven. However, no epidemiological studies have been completed in this area and there is need for further research.

Shellfisheries

A major health risk from sewage discharges is through the ingestion of contaminated seafood. Shellfish thrive in areas of high organic matter, such as sewage inputs, pathogens accumulate on their gills and are transferred to the consumer. The 156 Shellfish waters in the UK are protected under the Shellfish Waters Directive. Shellfish beds are monitored for 9 parameters, including faecal coliforms in shellfish flesh. Results in 1999 showed a **deterioration** in shellfish beds conflicting with the imrpovements recorded in bathing water quality.

Amenity Loss

Debris such as sanitary towels, condoms and cotton bud sticks, associated with sewage probably has the highest monetary cost assoicated with its presence on our beaches, due to loss of tourism and blockage removal. In *Beachwatch 2000*, the Marine Conservation Society's national beach litter survey, sewage related debris (SRD)constituted 6.5% of the total litter collected. Many people are becoming aware of the risks associated with SRD and may avoid beaches and recreational waters where SRD is a recurring problem. A coastal community that depends on tourism can suffer substantial economic loss if washed-up SRD destroys the appeal of local beaches.

Sewage Pollution in the UK

A network of 320,000 kilometres of sewers service households and businesses throughout the UK, from which approximately 182 million litres of raw sewage is discharged daily. **Twenty one percent of the population's sewage does not receive adequate (secondary) treatment while a mere 18% receives tertiary treatment.**

Responsibility for the Sewage System

The sewer system is the responsibility in England and Wales of the 10 regional water companies under regulation on a national level from the DETR, MAFF, the Welsh Office, the Department of Health, EA, and the Office of Water Services (Ofwat). In Scotland, N. Ireland, Isle of Man and Channel Islands sewage disposal is the responsibility of the state owned water companies and associated regulators. The cost of sewage treatment and disposal is paid for through water rates. The level of this is set by the water price regulator (Ofwat) every five years through a process called the 'Periodic Price Review'. This includes the level of investment that the water companies have to make.

The outcome of the 2000-2005 Periodic Price Review set in motion an £8.5 billion investment programme for environmental improvements which included more stringent requirements for the level of treatment to be achieved by 2005.

In Scotland the Scottish Executive will set the framework for investment in the sewage infrastructure for the four year period 2002 to 2006 in a Water Quality and Standards paper sometime in 2001.

Sewage Treatment

Sewage pollution can be reduced and avoided by the application of various levels of treatment to remove solids, bacteria, viruses and nutrients. These treatments aim to produce a final effluent which is clean enough to acheive certain water quality standards set by the EC Bathing Water Directive and EC Urban Waste Water Directive. There are four possible stages in sewage treatment.

Preliminary Treatment

The settlement of sewage to separate the suspended solids involves two preliminary stages - grit removal and screening. This aims to remove the larger solid debris which is disposed of as landfill. 11% of the UK's sewage is treated to this level. Many smaller items such as cotton bud sticks are not screened out and are discharged in large numbers, littering river banks and beaches.

Primary Treatment

This is a settlement process which removes suspended solids. Effective sedimentation removes 50 - 70% of the suspended impurities but only 20 - 30% of the biological oxygen demand (BOD) from the sewage. The discharged effluent will still contain high levels of bacteria and viruses. 13% of the UK's sewage is treated to this level.

Secondary Treatment

Secondary treatment is a biological purification stage in which settled sewage from primary sedimentation is digested by micro-organisms. These processes are effective at reducing BOD, ammonia and suspended solids and can (dependent on the efficiency) remove up to 99% of indicatorbacteria and 90% of indicator enteroviruses. The Government announced in September 1998 that secondary treatment will be the minimum requirement for all significant coastal discharges in England and Wales. In the UK over half the population is served by secondary treatment.

Tertiary Treatment

Tertiary treatment is any additional treatment process designed to achieve higher standards of water quality. This may be either an "active" or a "passive" system. Active sytems include - sand filters, micro filters, ultra-violet or pebblebeds. Passive systems include reed beds, grass plots or lagoons. Disinfection systems, either ultra-violet or micro filtration can both remove remaining viruses and up to 99.9% of faecal bacteria. Other tertiary treatments concentrate on nitrogen and phosphorous removal, called nutrient stripping. 21% of the UK is served by tertiary treatment.

Ultra-Violet (UV)

UV light systems appear at present to pose no threat to the marine environment, since this treatment is non-additive (i.e does not involve the use of chemicals). The use of such systems is increasing in popularity among a number of organisations within the water industry, including Welsh Water, Yorkshire Water, Wessex Water, South West Water and Jersey's water authority. Most water authorities have a number of tertiary treament schemes included within the current improvement programme.

Physical

Europe's first ultra-filtration membrane technology plant was opened in April 1998 by Wessex Water. Like UV, this treatment is non-additive and removes the majority of harmful pathogens.

Chemical

This is an additional disinfection treatment that can be applied to both secondary and primary treated sewage. The chemicals used may include sodium hypochlorite, peracetic acid or ozone. None of these have been adequately tested to ensure their safety with regard to marine life and human health when used in the disinfection of sewage.

Intermittent Discharges (CSOs)

There are around 25,000 intermittent discharges around the UK, of which about one third are believed to be "unsatisfactory" i.e. they pollute the receiving waters. Combined sewage overflows (CSO's) and storm drains contribute considerable intermittent amounts of sewage, especially after heavy and prolonged rainfall. This is due to insufficient capacity of holding tanks and low capacity treatment works. CSOs can make a significant contribution to failures of bathing waters to meet microbiological standards.

There are two types - storm water overflows which take only storm water and combined sewer overflows (CSOs). CSOs are generally short pipes which discharge directly into rivers, estuaries and the sea. CSOs on average discharge around 10 times a year and are legally allowed to discharge 3 times per bathing season (May - Spetember), outside of this there are no set discharge rates. With climate change and increased storminess the frequency of CSO discharges will increase. CSOs should be designed to only discharge in a one in 20 year storm event. All effluent needs to be screened and stored in tanks for treatment to the necessary level, prior to discharge.

The Government has acknowledged the problems CSOs cause and announced an ambitious improvement plan in September 1998. This involves improvements to around 4000 unsatisfactory CSO's between 2000-2005 by the water companies, which works out at 2 CSO upgrades every day!

Sewage Disposal and Uses

The treatment of sewage produces large quantities of sludge. Sludge comprises deposited material generated in primary, secondary and tertiary processes. Sewage sludge is an exploitable resource and should be recycled for beneficial use whenever possible, subject to the appropriate safeguards.

For many years, sludge has been and continues to be disposed of to farm land, landfill or incinerated. The disposal of sludge at sea ceased at the end of 1998.Sludge can be used to provide heat and energy from the methane produced through aerobic

digestion. The most popular method of recycling sludge is as a soil conditioner on farm land and it is also being used to culture rag worms. Dried sludge can be utilised in many other ways as a fertiliser, fossil fuel, in brick manufacture, oil production and gasification to produce fuel gas.

Diffuse Pollution

Sewage pollution from outfalls has been the major source of bacterial pollution in coastal waters for the past century, this has masked other sources of bacteria. As point source discharges have been cleaned up with investment in sewage treatment other sources are becoming more dominant, especially during wet weather. Bacterial pollution can also come from diffuse sources such as agricultural and urban runoff, storm waters, private discharges and in more localised areas septic tank leaks, dog and human faeces on the beach.

Sewage Legislation

There are around 12 legislative instruments affecting sewage policy, the main improvement drivers being the Urban Waste Water Treatment Directive, the Shellfish Waters and Bathing Water Directive. The latter of which is currently undergoing a revision (see EC Bathing Water Directive Factsheet).

Further Information

House of Commons Environment, Transport and Regional Affairs Committee (1998). Sewage Treatment and Disposal. The Stationary Office.

DETR, Raising the Quality - Guidance to Ofwat on the Environmental and Quality Objectives to be achievedby the Water Industry in England and Wales 2000-2005 (1998).The Stationary Office.

Kay et al. (1994). Predicting the likehood of gastroenteritis from sea bathing. Lancet Vol 344 1/10/94.

WRc (1994), Health Effects of Sea Bathing (WM 9021) - Phase III, Final report to DoE.

World Health Organisation. Guidelines for Safe Recreational-water Environments: Coastal and Fresh-waters Draft (1998). WHO.

MCS Good Beach Guide 2001 - **www.goodbeachguide.co.uk**

MCS EC Bathing Water Directive or Nutrients Factsheet 50p+SAE from MCS.

Marine Conservation Society Recommendations

Secondary treatment of sewage as a minimum for all coastal discharges.

Improvements to all unsatisfactory combined and storm overflows and strict all year controls on discharges with punitive fines for breach of consent with better monitoring.

A review of the policy of discharge consents for intermittent discharges

Year round treatment of sewage, no consent should be given to turn off treatments outside the bathing season.

Idenification and treatment of all private outfalls.

All consented discharges should be routinely monitored by the relevant authority.

Nitrate and phosphate stripping and BOD removal for all discharges affecting rivers, estuaries and sensitive marine areas.

Immediate revision of the EC Bathing Water Directive to include-

- Designation of all recreationally used coastal areas.
- Higher bathing water quality standards.
- Warnings in areas used for recreational purposes of any discharges / overflows polluting the water.
- Consideration of sewage discharges in vicinity of bathing waters

All beach awards to be based on Guideline standards as the minimum criteria for bathing water quality.

Urgent improvements to quality of waters affecting shellfish beds.

Nitrate and Phosphate stripping and bioloigcal oxygen demand removal for all discharges affecting rivers, esturaies and senistive marine areas.

Research into diffuse sources of bacterial and nutrient pollution. Development of a nationwide strategy to control non-point

For further information contact:

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In 1990, this culminated in a case being brought against the UK in the European Court, where the UK was judged to have failed the European law. In mitigation, numerous promises were made by the UK to ensure full compliance with the Directive by the bathing season of 1995. However, **in 1999, the UK had still not achieved full compliance - 8.5% of UK bathing waters failed the minimum Mandatory Standard.** This is disgraceful considering the UK has had 22 years in which to comply and beaches that fail these minimum standards pose a significant health risk to bathers.

Table 1 shows 1999 European bathing water results in order of compliance with the Mandatory Standard. UK has the highest failure rate and second lowest Guideline compliance rate.

Table 1

	No. Bathing Waters	% achieved Guideline	% achieved Mandatory	% failed Mandatory
Belgium	39	12.8	100	0
Greece	1816	95.8	98.8	1
Holland	78	93.6	98.7	1.3
Ireland	121	89.3	98.4	1.6
Spain	1624	87.8	97.8	2.1
Italy	4811	92.4	96.1	3.5
Portugal	342	83.3	93.8	6.2
Germany	414	82.6	93.5	6.3
Denmark	1177	80.9	92.8	5.9
UK*	**541**	**50.5**	**91.5**	**8.5**
Finland	93	60.2	91.4	3.2
Sweden	379	73.4	84.5	5.5
France	-	-	-	-

*Includes 6 beaches in Gibraltar

Due to lack of compliance the Commission decided in July 2000 to take the UK to the Court of Justice, however this has come too late - as action is finally being taken to clean up our bathing beaches. The Government has stressed the need to work towards compliance with the Guideline Standards. **In 2000, 44% of UK bathing waters met the Guideline Standard compared to 40% in 2000 and this is set to rise with a target of 60% by 2005.**

Inadequacies of the EC Bathing Water Directive

The EC Bathing Water Directive is widely considered to be outdated and inadequate and MCS has pressed for the following failings to be addressed:

* *Inadequate microbiological standards*

The bacteriological standards set by the Directive to comply with the basic Mandatory Standard were based on research conducted in the seventies. There is now an increasing amount of scientific evidence which shows that these standards are not stringent enough to safeguard the health of bathers. Indeed, studies funded by the UK Department of the Environment revealed an appreciable risk of contracting an illness from recreation in waters passing the minimum EU Mandatory Standard (Kay etal. 1994).

This study identified **adverse health effects from bathing in waters when faecal streptococci concentrations exceeded 32/ 100ml**.

There are currently no Mandatory Standards in the UK for faecal streptococci or viruses - indicators which give the best prediction of illness. There is much evidence to suggest that it is disease-causing agents such as viruses which constitute the greatest threat to public health, as they cause illness in very low concentrations and they are some of the most persistent organisms in the marine environment. The current practice is to sample for viruses 'when a need is shown to exist'.

* *Nearby sewage discharges*

The current Directive does not consider the effect of inadequately treated sewage discharged in the vicinity of the bathing beach. Scientific studies have shown that sewage derived pathogens can travel an outfall. Compliance Directive is based pu water quality at a spec usually where most peop However, MCS has found th beaches which achieve Gui Standards have raw, screene primary treated sewage discharg into the immediately adjacen waters. Under some tidal states and weather conditions such discharges are likely to pose a serious health threat and in the MCS *Good Beach Guide*, only beaches which achieve the Guideline Standards and are not affected by raw, screened or primary treated sewage are recommended as safe for bathing. MCS believes that beaches should not be given awards for water quality if they are affected by raw, screened or primary treated sewage.

* *Unsatisfactory Combined Sewer Overflows (CSOs)*

High rainfall can result in stormwater and sewage waste being diverted from sewage treatment works and discharged, untreated, directly into coastal waters via combined sewer overflows (CSOs). **There are 25,000 intermittent discharges in the UK, each used ten times a year on average. The regulators (EA and SEPA) have deemed over 8,000 of these to be "unsatisfactory"**, so it is not surprising that some areas of the UK coastline continue to have unacceptably poor water quality, despite investment in sewage treatment. It is clear that the CSO system must be upgraded and monitored by both the water companies and the relevant agency, to ensure that water quality standards are met.

* *Monitoring of recreational waters*

The UK's definition of a 'bathing water' is very narrow, covering just one group of sea users: bathers. This does not include the many other watersports enthusiasts such as divers, surfers and sailors. MCS, together with other groups in the UK and Europe, have been campaigning

EC BATHING WATER DIRECTIVE

MARINE CONSERVATION SOCIETY
SEAS FIT FOR LIFE

Sewage Contaminated Bathing Waters

The discharge of untreated sewage near waters used for bathing, diving, sailing, surfing and other water sports constitutes a well documented health risk. This is because raw, or partially treated sewage contains bacteria, viruses and other pathogens which are hazardous to human health. Numerous studies have indicated that the greater the sewage contamination of bathing waters and the greater the exposure of people to the contaminated water, the higher the incidence of contracting ear, nose and throat infections,or stomach upsets involving, vomiting and diarrhoea. More serious illnesses such as temporary paralysis, muscle dysfunction and Hepatitis A have been associated with sewage polluted bathing waters although the scientific evidence for these associations is less robust.

The EC Bathing Water Directive

The existing EC Bathing Water Directive (76/160/EEC) came into force in 1976. Its primary aim is to protect the public from the health risks associated with bathing in sewage contaminated waters. It lays down minimum water quality standards relating to sewage pollution for designated bathing waters across the European Union. There are two standards; the minimum Mandatory Standard and the optimum Guideline Standard.

UK Bathing Waters

Under the Directive, EU Member States are obliged to designate 'bathing waters' - where bathing is explicitly authorised, or where bathing is not prohibited and practised by a large number of bathers. **In 2000, there were 545 designated bathing waters in the UK, plus a further 261 beaches which, although not designated, were monitored under the terms of the Directive.** The remaining beaches - over half the UK total - are not monitored, so pollution levels are unknown and potentially present a risk to the public.

Bathing waters are monitored for 19 different parameters approximately every fortnight throughout the bathing season, which runs from May to September. Water quality monitoring is carried out by the Environment Agency (EA), the Scottish Environmental Protection Agency (SEPA), the Department of the Environment - Northern Ireland and the relevant authorities in the Isle of Man and the Channel Islands.

The Mandatory and Guideline Standards

The Mandatory Standard (also known as the Imperative Standard) represents the legal minimum that must be achieved by EU Member States. In the UK, this is based on indicator bacteria levels, specifically total coliforms and faecal coliforms.

For a bathing water to comply with the minimum requirements of the Directive, at least 95% of the water samples taken during the bathing season must meet the Mandatory Standard, i.e., bacterial counts not exceeding 10,000/100ml for total coliforms and 2,000/100ml for faecal coliforms.

Microbiological Standards of the EC Bathing Water Directive (units per 100ml) (required compliance rates in brackets).

	Mandatory	Guideline
Total Coliforms	10,000 (95%)	500 (80%)
Faecal Coliforms	2,000 (95%)	100 (80%)
Faecal Streptococci	None	100 (90%)

The Guideline Standard requires only voluntary compliance by EU Member States. Under the Guideline Standard, the levels of coliform bacteria must be twenty times lower than the levels permitted under the Mandatory Standard. There is also a standard for faecal streptococci, a specific indicator of human sewage contamination. At least 80% of the water samples taken throughout the bathing season must meet the strict coliform standards and 90% must meet the faecal streptococci standard to achieve the Guideline Standard.

The UK Track Record

The UK has a dismal track record in complying with the EC Bathing Water Directive. Compliance should have been achieved by 1985, but the UK comprehensively failed to do so.

for the interpretation of a 'bathing water' to be widened to include all waters that are used regularly for recreational purposes. The official definition of a bathing water in the Directive should therefore be amended to 'bathing or recreational waters'.

✗ *Year-round monitoring*

As a consequence of the UK's restricted interpretation of the term 'bathing', the 'bathing season' is deemed to be from May to September when the water is relatively warm. Water quality standards therefore only have to be maintained during this limited period. Throughout the rest of the year, coastal waters may be adversely affected by sewage pollution and consequently pose a risk to all those who use the sea year-round. Some water companies have admitted to switching off UV disinfection treatment of coastal discharges outside the bathing season.

✗ *Wet Weather Waiver exemptions*

Wet weather can result in inadequately treated sewage entering the marine environment via combined sewer overflows. This leads to increased levels of bacteria and viruses in coastal waters, which may then be present in water samples. Under the terms of the Directive, a 'wet weather waiver' may be granted to annul these adverse effects from the data set. In the UK, wet weather waivers are permitted following a one in five year storm event. This waiver masks the true levels of bacteria and viruses in bathing water at certain times of the year and may give the public a false sense of security.

✗ *Public notice of failed waters*

The public are not currently notified if waters fail the Mandatory Standard or if sewage treatment systems are inoperative, e.g. following heavy rainfall. They can not therefore make an informed choice as to whether it is safe to bathe. MCS believes that the public should be informed when the risk of sewage contamination is increased, but does not consider the closure of beaches as a necessity.

European Commission Review of the Directive

The microbiological standards in the EC Bathing Water Directive have been under review by the European Commission since 1994. But successive EC presidencies have failed to proceed with the proposals due to scientific, technical and political reasons.

The 1994 proposed revision of the Directive included a number of changes, one was a new Mandatory standard for faecal streptococci of 400/100ml. This was a matter of much debate, the water industry proposed a much weaker standard and the Government's public health experts argued that this bacteriological level was too stringent.

In 1997, the European Parliament made the following recommendations in relation to the European Commission's proposed revision of the Directive, which went even further:

- A new Mandatory standard for faecal streptococci of 100/100ml
- A revised Guideline standard for faecal streptococci of 50/100ml
- The definition of a bathing water should include those waters used for watersports
- The Directive should formally recognise that water quality is crucial for the protection of public health
- If a bathing water fails the Mandatory Standard, bathing should be prohibited and the public should be informed via warnings in the local media.

In 1999, the World Health Organisation (WHO), published stringent new guidelines for the microbiological quality of bathing waters following a five year review. The report found good evidence for a causal relationship between gastro-intestinal symptoms in bathers and water quality as measured by faecal indicator bacteria. The report concluded that the strongest predictors of the risk of contracting gastroenteritis are measures of faecal streptococci and a derivative, intestinal enterococci. The recommendations provide guidelines on the number of faecal streptococci per 100ml which correspond to different levels of health protection:

The highest of the standards - 95% of samples with fewer than 10 faecal streptococci/100ml - is extremely demanding and would protect 399 out of 400 bathers from illness. The second highest standard - 95% of samples with fewer than 50 faecal streptococci/100ml - corresponds with a single excess incidence of illness in 80 exposures. The third highest 200 faecal streptococci/ 100ml - is the lowest observed adverse effect level for all adverse health outcomes, MCS believes that this standard would reduce the risk of illness to an acceptable level.

The 1994 proposals was formally repealed in December 2000 when the Commission released new proposals to revise the Directive. The main elements include -

- A greater emphasis on provision of better information to the public
- A shift from bathing water monitoring to management, establishing a beach profile considering all potential pollution and contamination sources
- Tightening of the water quality standards to just one for coastal waters based on the WHO recommendations
- Better defintion of 'bathing' to 'any direct body contact with water, involving submersion and/or risk of ingestion of water' which includes many watersports enthusiasts.

The new propsal is scheduled for adoption by the EC at the end of June 2001.The proposal will then be passed to the European Parliament for political discussion.

UK Government Action to Raise Standards

House of Commons Select Committee

In 1997, the Marine Conservation Society gave evidence to the UK House of Commons Environment, Transport and Regional Affairs

Committee on Sewage Treatment and Disposal. The report published in February 1998 fully supported the European proposals for a revised EC Bathing Water Directive and included far reaching recommendations which, if implemented, would lead to significant improvements in the quality of UK coastal waters. These included:

- Tertiary treatment for all sewage discharges by 2002
- High Natural Dispersion Areas opt-out under the Urban Waste Water Directive to be scrapped
- Long-term investment to be required of the water companies
- Prior warning for bathers about polluted beaches and bathing waters
- Combined sewer overflows to operate only once in twenty years

2000-2005 Periodic Price Review

In 1998, the Government took on several of these recommendations during the Periodic Price Review for 2000-2005. This is a process which determines the improvement plans to be carried out by the water and sewerage industry and the related water bills. The 'Final Price Determinations' issued by the Office of Water Services (OFWAT), in November 1999, set in motion a £8.5 billion investment programme for environmental improvements to be complete by 2005.
Included in the plan are targets to:

- Achieve at least 97% compliance with the Mandatory Standards by 2005
- Achieve 60% compliance with the Guideline Standards by 2005
- Apply secondary treatment to all sewage discharges serving populations over 2,000 people
- Improve 4675 combined sewer overflows - approximately 18 every week.

MCS welcomed the plan as a vindication of a 12 year campaign to improve the quality of UK bathing waters. The five year plan will go a long way to addressing the UK's reputation as the Dirty Man of Europe. The improvements will also pave the way to compliance with any stricter standards set under a revised EC Bathing Water Directive.

Further Action Needed

However, although the five year improvement plan and a revised Directive will ensure better protection of human health at bathing beaches, further action is needed to protect those that use our coastal waters for recreational activities other than bathing and to address non-point sources of sewage pollution, such as agricultural run-off and the remaining unsatisfactory combined sewer overflows.

As part of the ongoing campaign to address the problems of sewage pollution, MCS recommends the following actions:

Immediate revision of the Directive to include:

Replacement of current Mandatory and Guideline standard with one Mandatory set at an achieveable and appropriate level to protect human health such as:-
Intestinal Enterococci standard of 200 IE/100ml
No total or faecal coliform monitoring
95% compliance for all Mandatory bacterial standards

Consideration of inadequate sewage discharges in the vicinity of bathing beaches. Failure of beaches affected by raw, screened or primary treated sewage discharges.

Designation of all waters commonly used for recreational purposes (sailing, diving, surfing etc.)

No exemptions for wet weather waivers unless a public notice was issued during the time that the sewage treatment system was inoperative or the beach was likely to be affected by pollutedstorm discharges to the sea or adjacent rivers

Adequate public notification of beaches failing the Mandatory Standard

Tertiary treatment of coastal sewage discharges affecting bathing waters

Year-round monitoring of all recreational and bathing waters

Improvement of all Combined Sewer Overflows and strict controls on discharges

The MCS campaign for clean seas will continue to call for improvements to sewage treatment and controls on discharges as well as pressing for higher water quality standards to protect human health and local economies. As part of the campaign MCS compiles the annual Good Beach Guide, which provides information on the water quality at over 1,000 UK beaches and only recommends those that are considered to be free from sewage contamination.

For further information contact:
Kate Hutchinson, MCS Coastal Pollution Officer
kate@mcsuk.org
www.mcsuk.org
www.goodbeachguide.co.uk

SEWAGE POLLUTION IS STILL A MAJOR PROBLEM AROUND THE COAST OF THE UK - ONE OF ITS MOST VISIBLE AND UNPLEASANT ASPECTS IS SEWAGE-RELATED DEBRIS...

SEWAGE RELATED DEBRIS

MARINE CONSERVATION SOCIETY

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Many of the beaches of the UK are covered in sewage related debris (eg condoms, plastic backing strips from panty liners or nappies, bottle tops, strips of plastic used to seal loo cleaner bottles before opening, tooth-paste tube tops, etc).
The problem is both an aesthetic and ecological problem.

1. Swimming around in such matter can be foul. It may also present a health risk to bathers and those on the beach. And how do you tell your five year old what it is that he or she has found and explain rationally why he or she should let go of it at once ? It is simply unbelievable to many people that they have to endure this sort of pollution. It may be even more unbelievable to many that they are indirectly responsible for it.

2. Marine life can also be affected by plastic and other litter in several ways.

Entanglement in larger items can cause sea birds to drown - many diving birds are found each year. Crustaceans, fish and other life can become entangled - because plastic is designed to be durable and strong, the body surface of these animals may be broken by the constant pressure of the plastic. The mass of photographic evidence gathered each year by experts is sickening.

However, when plastic is mistaken for food by marine animals, there are potentially very serious problems. The oesophagus of marine mammals or seabirds can be blocked, stopping further feeding and leading to starvation. The stomach may fill with undigested plastic items and the animal may feel satiated without gaining any nutritional value at all and hence may starve while apparently food supply is plentiful. Certain plastics are not totally chemically stable, containing plasticisers that may be directly toxic.

IT SHOULD BE ILLEGAL !

Under the Environmental Protection Act 1990, it is illegal to drop litter in a public place (it has been illegal under local by-laws in many parts of the country for a long time). This is simply common sense to even the most unconcerned person.

Under Annex V of the MARPOL Convention (international law) it is illegal to dump any plastic items over the side of ships. The Department of Transport publicised this legal restriction very successfully with the slogan "Over the side is over", but the lack of effective policing means that the littering goes on (eg a Soviet coffee jar, ships detergent bottles and seemingly endless mineral water bottles were found in a brief visit in June 1991 to Beachy Head, East Sussex, which is one of the UK's Voluntary Marine Protected Areas). That it is illegal to dump plastics over the side at sea is also, one would think, just common sense.

However, it does not appear to be illegal for the 10 private water companies to pump plastic from land (where it is illegal to drop plastic) to sea (where it is also illegal to dump plastic) down the many outfall pipes that carry raw sewage around our coast. A staggering 88% of the UK's largest (i.e serving more than 10,000 people) coastal sewage outfalls carry effluent that is still either raw sewage or sewage that is very coarsely screened - certainly not fine enough to remove condoms and panty-liners. There

are many hundreds of smaller outfalls that do exactly the same.

But maybe it is the public to blame - there would be no problem if the public did not flush anything they want round the U-bend. It is perhaps time that the public realised that all those "personal" items that are flushed around the U-bend may end up disgusting people on the beach, floating past someone's head in the water or worse still choking a sea bird or causing a marine mammal to starve to death.

What can you do to stop the problem ?

1. Join the Marine Conservation Society - the more members we have the more we can do to stop the abuse of the seas. Write to us today for details !

2. Take part in an organised beach clean-up. But be careful what you pick up - use rubber gloves (or a special litter-picking tool if you have access to one).

Send us any slides or photos you take showing the state of the beaches and what you collect.

3. Don't flush anything round the U-bend that could just as easily be put in the dustbin. If at all feasible, see if you cannot find alternative disposable products that do not contain long-lasting and durable plastics. Write to the manufacturers to ask them if they make such a product.

4. Make sure your council environmental health department keeps your beach clean - they may be legally bound by the Environmental Protection Act 1990 to do as you ask and clear up the litter (even if it has washed ashore from ships or outfall pipes).

For further information, contact :

Marine Conservation Society,
9 Gloucester Road,
Ross-on-Wye, Herefordshire
HR9 5BU.
Phone 0989-66017.

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FACTSHEET

WE HAVE ALL SEEN THE AFTERMATH OF LARGE OIL SPILLS VIVIDLY PORTRAYED ON THE TELEVISION AND IN NEWSPAPERS. HOWEVER, THE CONSEQUENCES ARE OFTEN NOT AS SHORT TERM AS THE MEDIA COVERAGE. RECENT EVIDENCE SUGGESTS THAT ROUTINE DISCHARGES OF OIL ARE ALSO ON THE INCREASE AND ARE A MAJOR SOURCE OF OIL ENTERING THE MARINE ENVIRONMENT.

MARINE CONSERVATION SOCIETY

FACTSHEET

OIL POLLUTION

Anyone could be forgiven for believing that tanker accidents, such as the Braer (1993), Exxon Valdez (1989), Amoco Cadiz (1978), Kowloon Bridge (1986) or Torrey Canyon (1967) disasters, or deliberate actions such as occurred during the Gulf War (1991), are the only causes of oil pollution at sea.

The truth of the matter is, that accidents contribute only about 10% of the total input of oil to the seas. The vast bulk of oil entering the seas does so through routine operations and leakages at oil installations, tanker terminals, coastal refineries and the tankers at sea. Considerable amounts of oil also enter the oceans from oil changes in garages that are then dumped down drains.

Routine oil discharges

A record number of oil pollution incidents were reported in 1990. Of the 791 affecting the UK coastline, 345 were a result of offshore oil spills, releasing 899 tonnes of oil into British waters. Since 1990 the number of oil pollution incidents has dropped, with 183 reported oil spills in 1993. Routine oil discharges have also declined from 12,310 tonnes in 1990 to 3,938 tonnes in 1993. Offshore installations such as those that dot the northern North Sea have a profound effect on marine life. In the immediate vicinity of the rigs, for a radius around each rig of up to 2 km, the benthic (bottom-dwelling) communities are severely damaged by oil seepage from the well head. The toxic effect of the oil kills all life immediately around the well head. There is then an area of organic enrichment, due to the less toxic components of the oil. These rigs are a continuous source of pollution of wider marine ecosystems.

Half the world's extracted crude oil is carried at sea by tanker. The escape of oil to sea during shipping occurs from routine tank cleaning at sea, however carefully the cleaning is carried out. Oily ballast waters are also a source of oil discharge despite the fact that discharge is illegal under **MARPOL Annex I** which is fully ratified. Oil slop is also deliberately discharged on the way to dry dock when tanker repair is required.

Even at terminals there can be significant spillage of oil. Here spillage is a direct result of human error and bad practice. Often, economic considerations outweigh ecological safety considerations in the minds of the operators, and short cuts are taken resulting in oil pollution from the terminals.

Clean up methods

In many cases, the media report that a clean-up has been "successful". This is never the case. The "success" referred to simply means that any slick has broken up. The oil emulsifies and sinks to the seabed where it smothers benthic communities, forms tar balls that can be found throughout the world's oceans, or is washed up on coastlines.

Mechanical Booms are used to contain oil slicks and prevent the oil from reaching the coast, so that detergents or skimmers can be used on a restricted area. However, wave motion can easily render booms useless and in the conditions in which most oil spills occur (the Braer ran aground in Force 9 gales), booms are of no use at all. Booms are expensive and inefficient, recovering a maximum of 10 % of the spilt oil.

Skimming equipment (used to suck up the oil and pump it into containers) can only operate before the oil and sea water mix to form an emulsion. In most cases the skimming equipment is not available quickly enough and again they can only be effective in calm conditions.

Dispersants and detergents act by reducing the surface tension that makes the oil and water immiscible, so that the oil breaks down into droplets which are dispersed down into the water column. Detergents do not reduce the ecological damage that oil causes, and have often been found to be more toxic to marine life than the oil itself. They simply shift the damage away from the media, making it less visible and hence less shocking.

Bioremediation techniques are based upon the use of **micro-organisms** to naturally break down the oil. By adding nitrate and phosphate fertilisers and tested strains of microbes to the oil, the microorganisms proliferate and metabolise the carbon constituents of the oil. In Alaska, experimental plots of the shore affected by the Exxon spill were seeded with fertilisers, and within a couple of weeks the breakdown of oil by resident microbes had speeded up. This technique has yet to be used on a major spill and oil.

Gelling agents are a new weapon in the armoury of techniques to fight oil spills. A mixture that can turn oil, petrol and most solvents into a rubbery gel is being tested in Australia. It is claimed that the chemical concoction can convert 30 times its own volume of organic liquid into a rigid gel, but this has yet to be tested on an oil spill at sea.

A survey revealed that a total of 155 clean-up operations were completed around the UK in 1992 at a cost of £127,000. But only 6% of this sum was recovered from the polluters. Amendments were made to the Merchant Shipping (Salvage and Pollution) Bill in 1994 to impose liablility (on shipowners) for the damage caused by oil pollution.

Long-term ecological damage

When tanker accidents do occur the impact is very obvious. The impact of an oil spill on the marine environment depends on the importance of the area as a breeding and/or feeding ground and on the season and oceanographic conditions. An ecological disaster appears to have been avoided following the Braer spill in Shetland due to strong storms which dispersed the oil down into the water column and away from the rocky shoreline. Although many seabirds and marine mammals were saved from the direct effects of the oil, the long term effects on the benthic and pelagic communities and hence, up through the food chain may not become evident for some time.

The lighter fractions of the oil evaporate at the water surface, while heavier fractions sink and form tar balls which (if not ingested) eventually degrade with the help of bacteria in the water column or in the sediments.

Sea birds are the most immediate victims of an oil spill. They become smothered in oil, unable to fly, and in a desperate attempt to clean themselves, ingest oil and are poisoned. Some species are attracted to the shiny surface of a slick and have been known to dive into it. Sea bird populations around the UK may be suffering a gradual decline in numbers due to the effects of oiling from frequent, smaller spills that do not attract media attention. It is difficult to assess the impact, but a good indication of the problem is given by the condition of sea birds washed up on the coasts of the North S and English Channel. About 60% of sea birds found washed up on beaches are oiled. Along the Channel coast this figure can be as high as 75 %.

Marine mammals such as whales, dolphins and seals may be able to avoid oil slicks but risk starvation because the food chain will be endangered to an extent. Seals may also be affected by the toxicity of oil if it is ingested.

Otters are the most vulnerable mammal species as they rely on their fur for insulation rather than a layer of blubber. If an otter swims into an oil slick, its fur rapidly loses its insulative properties as the fur becomes clogged. Otters that died in the aftermath of the Exxon Valdez oil spill suffered hypothermia, emphysema (from breathing in toxic fumes) and poisoning after ingestion of the oil.

Marine plant life can be smothered by heavier oil fractions that sink to the sea bed. Many benthic organisms such as adult mussels and barnacles, feed by sifting food particles out of the water through delicate filtering apparatus. Oil can coat both their feeding apparatus and gills. Populations may be wiped out and replaced in the short term by opportunistic species tolerant to oil, such as *Capitella Capitata*, a polychaete worm that is well-known as an indicator of organic enrichment. Some benthic populations smothered by oil may be devoid of life altogether.

Commercially harvested fish and shellfish that are contaminated with oil may have a tainted flavour. Also, they may contain toxic compounds such as benzo-a-pyrene, a potent carcinogen. Shellfish populations may not recover from the impact of oil pollution for many years. Commercial fisheries contaminated by oil show increased incidence of fin rot and other fish skin lesions. Reproduction of flatfish was severely reduced by the Amoco Cadiz spillage in 1978.

A number of major accidents have highlighted the effects of oil spills on wildlife:

*** The 200,000 tonnes of crude oil that escaped from the wrecked tanker Amoco Cadiz in 1978 killed at least 30,000 seabirds as well as 230,000 tonnes of fish and shellfish along the coast of Brittany.**

*** ...s of oil escaped into ...m Sound, Alaska when ...xxon Valdez ran aground in March 1989. By September of that year 36,000 seabirds, 1,000 sea otters and 147 bald eagles had fallen victim to the oil spill. This is only a fraction of the estimated 400,000 seabirds and 4,000 sea otters that died but were not found.**

The solutions

It is impossible to stop oil pollution altogether so long as there is a global oil industry. However, there are preventative measures that can be taken to minimise the impacts:

*** In 1993 the UK implemented regulations under the MARPOL Convention concerning oil tanker safety, that must be phased in by July 1996. The law requires that all new oil tankers over 5,000 tonnes have double hulls. Double bottoms are required for tankers in the 600 - 5,000 tonnes range. In addition, oil tankers reaching 25 years of age will have to have protective double bottoms or wing tanks to continue in operation. All ships other than oil tankers of more than 400 tonnes will be obliged to carry on board an oil pollution emergency plan, setting out procedures for reporting spills and actions to be taken in the event of an emergency.**

*** Offshore oil installations should be more closely monitored for oil seepage and the disposal of oil-contaminated drilling muds.**

*** All engines should be properly maintained to minimise oil leakages.**

*** Terminal operators should be subject to tighter safety regulations and better codes of practice to reduce spillage by human error or from damaged and old pipes.**

The emphasis must be on prevention of oil pollution. It is a myth to believe that clean-up is ever successful. Nevertheless, the oil industry should be made to pay for pollution it causes, as an incentive to reduce the chance of spills in the future. Any fines imposed must reflect both the severity of a pollution incident and the impact that the fine will have on the company involved.

What *you* can do to help:

If you see oil slicks off the coast, or oil on the beach, tell the Marine Conservation Society's Pollution Officer about it. Also alert the Coastguard, Local Authority or The Marine Pollution Control Unit (MPCU):

Marine Pollution Control Unit,
HM Coastguard
Spring Place
105 Commercial Road
Southampton
Hampshire
SO1 5 1EG
Tel: 01703 329102
Fax: 01703 329105

(1) Write to the local authority to ask them to clear up the oil found on beaches. Also ask them if they have up-to-date contingency plans ready in the event of an oil spill.

(2) If you find dead marine life that has been oiled, tell us about it. If you find sea birds that are oiled, but still alive, phone the RSPCA on 01403 - 64181. They can best advise on where to take the birds for cleaning and have produced a leaflet on how to clean oiled birds

(3) Take part in **BEACHWATCH**, an annual beachcleaning event, organised by the Marine Conservation Society, or join **ADOPT A BEACH** and monitor your local beach on a quarterly basis. These surveys provide data to help protect the coastline for the future.

(4) Never dispose of oil or oil-based substances down the drain. Take them to your local oil collection point - your local council will advise you of its location. Much of this oil can be cleaned and recycled.

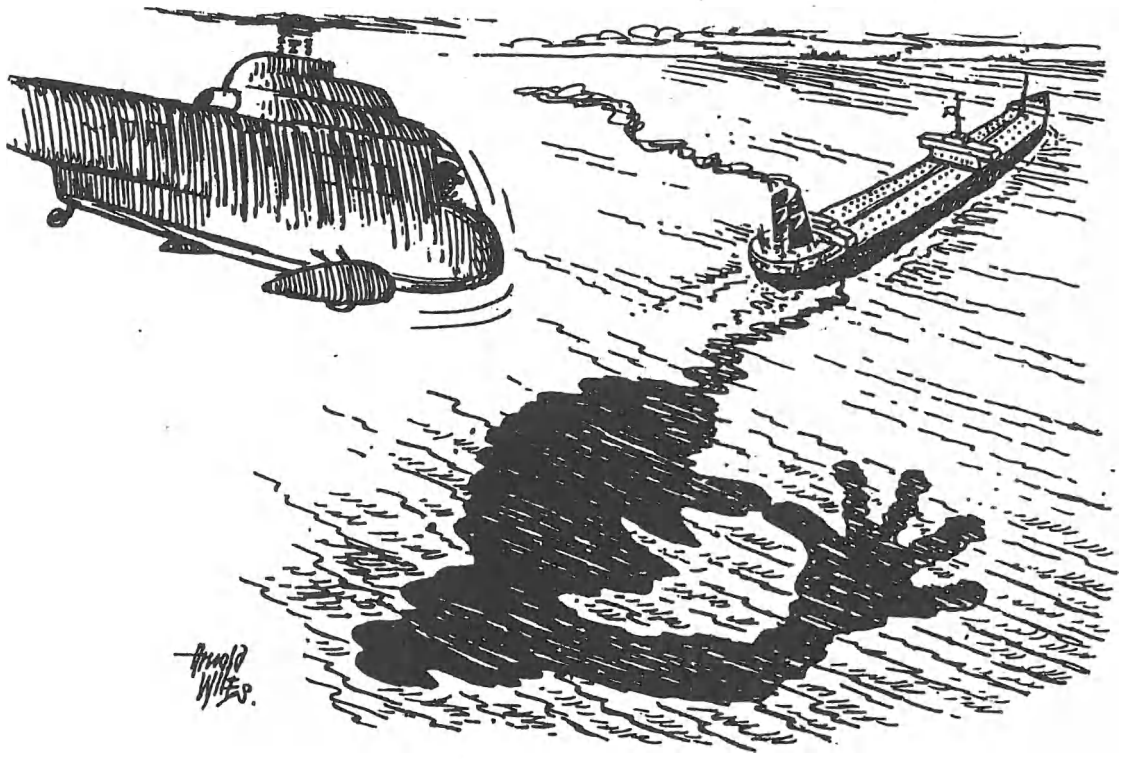
(5) Write to the International Tanker Owners Federation to ask what tanker owners are doing to prevent routine oil spills:

The International Tanker Owners Federation Ltd.,
Staple Hall,
Stonehouse Court
87-90 Houndsditch,
London EC3A 7AX

(6) Help the Marine Conservation Society to pressure for change in the oil industry by joining us today. Write to the address below for details or call us on 01989 566017.

MARINE CONSERVATION SOCIETY,
9 GLOUCESTER ROAD,
ROSS-ON-WYE,
HEREFORDSHIRE,
HR9 5BU

TEL: 01989 566017
FAX: 01989 567815



"That's what really hurts! The blatant 'couldn't care less' attitude of some of the polluters."

DMN/05/
2000

Tributyltin and Antifoulant Paints

TBT OR NOT TBT?

TBT is a toxic chemical that has been used in anti-foulant paints for many years, having serious adverse effects on a wide range of marine life. Fortunately, after many years of campaigning, there is light at the end of the tunnel in the form of a global ban on TBT by 2008.

MARINE CONSERVATION SOCIETY
SEAS FIT FOR LIFE
Reg Charity No 1004005

Introduction

Antifouling paints are used to coat the bottom of ships to prevent marine organisms such as molluscs and algae attaching themselves to the hull - thereby slowing down the ship and increasing fuel consumption. In the early days of sailing ships, lime, and later arsenic, was used to coat ships' hulls, until modern industry developed effective chemical antifouling paints using metallic compounds such as copper. In the 1960's the most effective antifouling compound to date was developed - the organotin tributyltin, or TBT.

TBT based paints became very popular as they proved to be more effective at killing marine organisms on structures than any previous antifoulant paint. However, it was subsequently discovered that TBT and other organotins are highly persistent in the marine environment, killing non-target organisms, and contaminating a wide range of marine species.

The trouble with TBT

Problems with TBT were first noticed in the 1970's in France, where high TBT levels caused high mortality of commercially harvested oyster larvae, and also deformities such as shell thickening in the adult shells. Another species of mollusc, the dogwhelk (*Nucella lapillus*) is also highly sensitive to TBT exposure. Even low TBT levels cause female dogwhelks to exhibit a condition known as imposex (female masculinisation). Severe cases result in the female dogwhelk being effectively rendered infertile. Eggs are still produced internally, but cannot be laid due to the egg duct being blocked. This has had severe impacts on UK populations of dogwhelks, which became dominated by males, older adults and effectively infertile females and so very few, if any egg capsules were laid.

Due to concerns about the occurrence of imposex in dogwhelk populations, the Marine Conservation Society, with the voluntary help of its members, carried out surveys of dogwhelk populations and the effects that TBT was having upon them. Dogwhelks spend all their lives on the same stretch of shore which makes them very suitable as pollution indicators. The surveys were carried out at marine inlets and marinas over an 8 year period from 1986 to 1994, with between 50 and 100 sites being surveyed per year.

The surveys highlighted areas around the UK that were adversely affected by TBT. Some sites that seemed suitable habitats for dogwhelks were found to have none at all, e.g. the 1991 survey found no dogwhelks at Salcombe, West Kirby and Reculver. These are all areas where there had been considerable boating activity. In some areas adults were present but with few, if any juveniles, e.g. Maer Rocks and Miellette Bay, sites which were also close to sources of TBT pollution.

Shell of the dogwhelk *Nucella lapillus*. Dogwhelks were one of the first of many organisms known to be affected by TBT

POLLUTION FACTSHEET

Results from the 1993 dogwhelk survey indicated that the effect of TBT contamination could still be seen at sites around the UK where imposex levels had previously been found to be high and the population skewed towards adults. However, the effects were shown to be very localised and the overall picture was one of recovery, with juvenile dogwhelks and egg capsules being found at many sites, including those directly adjacent to boating activity. The effects of TBT are not confined to molluscs, however.

At very low concentrations, TBT has been shown to affect a wide range of fundamental biological processes such as reproduction, development, decreased immune response and neurotoxicity. TBT's androgenic (masculine characteristic) effect appears not to be restricted to invertebrates, but may include hormonal disturbance in other animals including humans. TBT and its metabolites, monobutyltin (MBT) and dibutyltin (DBT) have been found in a range of vertebrates including birds, marine mammals such as whales, dolphins and sea otters, and fish worldwide.

Less is known about the effects of organotins on these animals, but studies carried out so far indicate several deleterious effects:

- **Embryotoxicity in seabirds**. Studies indicate reduced fertility and lower hatching success. Seabirds may be less susceptible to high levels of organotins because of their ability to moult and specialised metabolic processes. However, high levels of organotins have been found in marine birds in coastal locations.
- **Bioaccumulation in marine mammals**. Whales, dolphins, porpoises, otters and seals have been reported to accumulate organotins in their blubber, liver, kidney and muscle, leading to possible damage to reproductive and nervous systems.
- **Synergistic action with other pollutants**. During the late 1980's and in the 1990's mass mortalities of marine mammals occurred worldwide, including seals in Lake Baikal, striped dolphins in the Mediterranean and bottlenose dolphins off the coast of Florida. These deaths have been attributed to the morbillivirus, but it is thought that a combined number of pollutants, including TBT, may have acted to suppress the immune system of these marine mammals (immunosuppression).
- **Hormone disruption.** TBT is an endocrine disrupting chemical (EDC) with evidence of its effects occurring in fish species in addition to the well known case of imposex in dogwhelks.

Human populations that consume large quantities of contaminated fish or marine mammals will also be at risk. Experiments using TBT on human placental and brain tissue have shown that hormone disruption can occur in exactly the same way as it does with molluscs. The levels of TBT used in these tests at which disrupted hormonal function was observed, has raised concerns about the risks to heavy consumers of fish. This is of particular concern in Poland, where the Tolerable Daily Intake (TDI) levels for TBT of 15 ug TBT per 60kg person are being exceeded due to consumption of highly contaminated fish from the Baltic Sea.

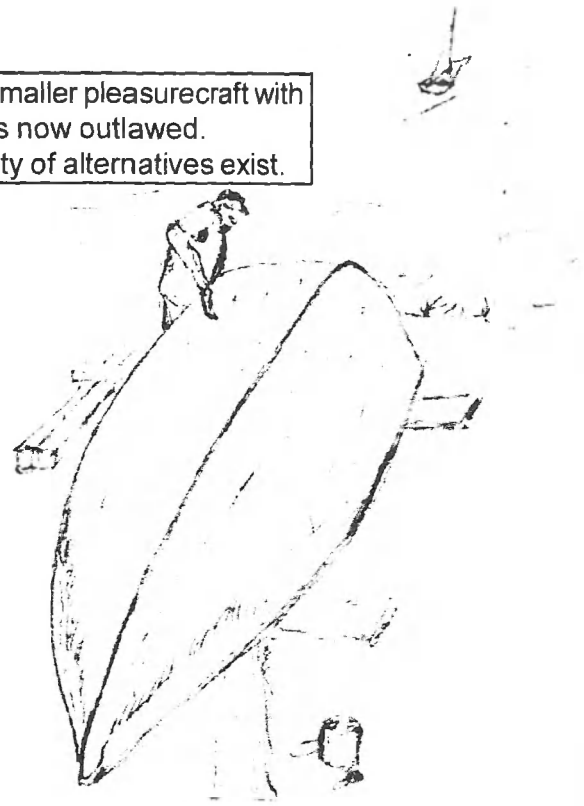
What's being done?

Due to research and pressure on governments by the Marine Conservation Society and other organisations in the early 1980's, countries began to ban TBT on vessels below 25 metres in length. France imposed regulations in 1982, the UK followed in 1987, with other industrialised countries, USA and New Zealand in 1988, Australia and Norway in 1989 and Hong Kong in 1992, following suit. A covenant was signed in the Netherlands in December 1999 by the government and fishing industry, to immediately ban the use of TBT on fishing vessels (TBT on pleasure craft had already been banned), with agreement by Dutch shipyards not to use them and paint manufacturers not to deliver them. However, some TBT-based paints may find their way onto the black market, and are probably still being used by boat owners who obtain them from the commercial sector.

The application of organotin-based paints on marine and freshwater structures in the UK, e.g. on aquaculture cages, fishing nets, jetties, etc. was also banned in 1987. Larger vessels were exempt from the ban, since it was thought that they were not a major contributor to TBT pollution in coastal waters.

There is little regulation of TBT in developing countries, and flag of convenience shipping, which forms a large part of the total global shipping tonnage. There is also considerable localised input to the marine environment from hull cleaning operations in dry docks and slipways where the stripping of old TBT painted hulls takes place.

In 1999, the International Maritime Organisation (IMO) confirmed that there is to be a global prohibition on the use of organotin-based antifouling paints on all ships, with prohibition target dates of 1st January 2003 for application and 1st January 2008 for presence on the hull. The IMO is currently drafting a new international treaty to this effect which is expected to be adopted by the IMO at a diplomatic conference in 2001. That said, the treaty will only enter into force when a sufficient number of states have ratified it and this may take several years, with ships continuing to use hazardous organotin-based antifouling paints in the interim.



Treating the hull of smaller pleasurecraft with TBT-based paints is now outlawed. Fortunately, a variety of alternatives exist.

The Marine Conservation Society welcomes this news, but would like to see more countries introducing bans in advance of the IMO treaty. Japan was the first country in 1990, to completely prohibit the use of TBT as an antifouling agent on non-aluminium vessels.

TBT alternatives

There are various less harmful, even benign substitutes to TBT based paints which can be effectively applied to marine vessels and structures. These include:

- **TBT-free antifoulant paints**. These include copper-based and other 'less toxic' anti-foulant chemicals. Future problems may develop, however, as a herbicide needs to be used in conjunction with copper which may have adverse effects on the marine environment.
- **Physical cleaning**. Removal of organisms on the hull using rotating brushes or high pressure hoses.
- **Electricity**. Creation of a different electrical charge between the hull and the seawater unleashing a chemical process which prevents fouling. Disadvantages: expensive, easily damaged and increases energy consumption.
- **Prickly coatings**. Coating with microscopic prickles. Shown to prevent build up of algae and barnacles with no environmental harm, but may increase drag on a vessel.
- **Natural biocides**. Research is ongoing into natural compounds that prevent or hinder fouling - e.g. sponges and corals produce 'natural antifoulants'.
- **Non-stick coatings**. Prevent fouling by creating an extremely slick surface. Light fouling does occur but is easily removed with high-pressure hoses in annual dry-dock visits.
- **Use of alternative boat storage facilities**. For example, in America dry-sailing is popular. Boats are stored in large hangars. Fork lift trucks are then used to put the boats in the water prior to use. As a consequence boat maintenance costs are substantially reduced and antifouling paint is not used. This would not be practical for larger ships, however.

Proponents of TBT argue that these alternatives are not as effective as TBT, and thus will cost shipping companies millions of pounds per year through increased fuel consumption (due to increased drag on the ships' hulls generated by more fouling organisms).

While the availability of alternatives has been in dispute for some years, there is now little argument against change. Paint companies are making much of their TBT-free products, and tests are showing performance equivalent to the old TBT formulations. The only dissenting voices are now those of the TBT manufacturers and a few large flag states.

MARINE CONSERVATION SOCIETY, 9 GLOUCESTER ROAD, ROSS-ON-WYE, HEREFORDSHIRE HR9 5BU TEL. 01989 566017

Another argument against banning TBT is that there would be an increase in alien species being transported around the globe. The transportation of alien species occurs largely through the exchange of ballast water and not on ships hulls (see our 'Alien Species' factsheet).

It has also been suggested that a total ban is unnecessary since coastal areas have recorded declines in TBT levels leading to the recovery of mollusc populations. This is true in some areas, for example at Bembridge and Tusker Rocks where there has been an increase in juveniles and egg numbers in surveys conducted in 1989 and 1993 respectively. However, TBT is not just a coastal problem, it bioaccumulates and has been recorded in marine animals globally including the blubber and liver of sperm whales who live, feed and breed in the deepest seas. Sediments heavily contaminated with TBT (and other chemicals) still occur in the vicinity of ship yards and marinas world-wide where the stripping of hulls coated with TBT takes place; it is thought that these areas are a significant source of TBT in the marine environment.

The Marine Conservation Society has called for the standard monitoring of sediments dredged from ports and harbours for TBT, to ensure that sediments contaminated with TBT are not dumped at sea.

MARINE CONSERVATION SOCIETY RECOMMENDATIONS:

- A more proactive approach from government and industry to implement a ban on the use of TBT in advance of 2008;
- Research and monitoring of the hazardous alternatives to TBT to assess their effects on the marine environment and regulate their use if found to be damaging to marine life;
- Increased efforts to improve the range and effectiveness of non-toxic antifouling technologies;
- The incorporation of the ISO 14001 environmental management award scheme or similar 'green' schemes by companies that are active in the marine environment;
- More research into the effects of how endocrine disrupting chemicals (EDC's) such as TBT act synergistically with other chemicals in the marine environment.
- Improvement of the operation and regulation of dry-dock and wash-down facilities to prevent further TBT contamination from large vessels.
- Monitoring of dredged sediments in ports and harbours for TBT and treatment to remove TBT prior to disposal at sea.

WHAT YOU CAN DO TO HELP:

Join the Marine Conservation Society today to help us continue our campaign for the prevention of pollution from TBT and other toxic chemicals. The Marine Conservation Society is the UK's leading charity dedicated to the protection of the marine environment and its wildlife, and relies on funding from members to continue its work.

Boat owners - please avoid the use of TBT/ organotin paints and use non toxic alternatives when possible to help protect the marine environment. For more information see the 'Safe waters - Using antifouling paints safely' leaflet published by the Health & Safety Executive (HSE) and the Environment Agency. Phone HSE on: 01787 881165 for a copy.

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www.adoptabeach.org.uk

THE MARINE CONSERVATION SOCIETY (MCS) IS THE NATIONAL UK CHARITY DEDICATED TO PROTECTING THE MARINE ENVIRONMENT & ITS WILDLIFE

SINCE THE MID 1970'S INCREASING ATTENTION HAS BEEN PAID TO MARINE EUTROPHICATION AND ALGAL BLOOMS OF VARIOUS TYPES. THIS IS A SERIOUS PROBLEM WHICH IS LIKELY TO RECEIVE SIGNIFICANT ATTENTION FROM ALL NORTH SEA STATES, ESPECIALLY AT THE NORTH SEA CONFERENCE IN 1993. WHILE MANY BLOOMS ARE A NATURAL, EVEN ESSENTIAL PART OF THE MARINE ECOSYSTEM, THE INCREASE IN NUMBER AND SCALE OF BLOOMS, FUELLED BY EXCESSIVE NUTRIENT ENRICHMENT HAS AROUSED CONCERN AMONGST THE PUBLIC, WATERSPORTS ENTHUSIASTS, ENVIRONMENTALISTS AND THE SCIENTIFIC COMMUNITY.

NUTRIENTS, ALGAL BLOOMS AND PLANKTON

MARINE CONSERVATION SOCIETY

FACTSHEET

Introduction.

High inputs of nitrogen (N) and phosphorus (P) to the sea from land based activity cause a substantial increase in the ambient concentrations of available N and P. The inputs are from three main sources | :-

- sewage,
- agricultural run-off
- industrial discharges.

There may also be a large input in the form of airborne particulates, such as windblown topsoil.

In the Baltic Sea, winter concentrations of nitrogen have increased threefold over the last twenty years. In the Kattegat, a doubling has occurred in this time period.

There are many problems due to unchecked nutrient input:-

Eutrophication and Hypertrophication:

Some seas are are naturally eutrophic environments, meaning that they contain sufficient levels of nutrients to sustain growth. However, the introduction of excessive levels of nutrients creates a hypertrophic environment which effectively "overloads" the ecosystem putting it under stress. This can have serious consequences, in particular, massive algal blooms can occur. Algal blooms are a proliferation of phytoplankton (plant plankton) due to the "fertiliser effect" of the added nutrient input. The blooms consist of a variety of phytoplankton species and associated zooplankton (animal plankton). An excessive growth of some species leads to additional problems. For example, certain **dinoflagellates** (single-celled organisms that have plant and animal characteristics and form part of the plankton), in the form of **"Red Tides"**, can cause **Paralytic Shellfish Poisoning** (PSP) and **Diarrhoetic Shellfish Poisoning** (DSP) in humans who consume contaminated shellfish. The toxins are concentrated by shellfish, such as marine mussels to levels that can cause severe illness in humans. Fears over the finding of PSP toxins off Britain in 1990 caused the official closure of shellfisheries on the east coast of Britain as far north as Montrose. In 1991, the stretch of coastline between Newcastle upon Tyne and Berwick has had a similar restriction imposed. It must be pointed out that while red tides are nothing new, they do appear to be getting more severe - although this may be a function of the newly-found concern of MAFF / SOAFD. Red tides may also be fatal to many forms of marine life, causing mass mortality amongst fish.

In May 1991, other blooms (NOT "Red Tides") were reported off the Welsh and Angelsey coasts. The Welsh coastline is subject to **Phaeocystis** blooms. Many other areas, such as Liverpool Bay appear to be experiencing blooms more frequently.

The clouding of the waters by all live blooms can have severe disruptive effects for the ecological balance of an area. The light that is essential for higher aquatic plants to survive is shaded out by the algae. Some may die out in these areas. Some macroalgal species will change their physical distribution in response to the reduced light, and hence will appear in shallower waters, in turn out-competing other seaweeds.

When an algal bloom begins to die off, it sinks to the sea bed, where rapid bacterial decomposition of this dead organic matter leads to the deoxygenation of the lower layers of the sea. The effect of this is to kill off benthic (bottom-dwelling) communities. The initial stages of deoxygenation can be observed in such species as brittle stars, causing them to "stand on tip - toe," and Norway lobster that emerge from burrows in an attempt to reach oxygenated layers of water.

In 1981, numerous flatfish were found dead in the eastern North Sea and German Bight following a large planktonic bloom which led to an 80% decrease in oxygen saturation in bottom waters. The picture was repeated in 1983 and 1986. It is widely believed that bloom frequency and intensity are both increasing, with damaging effect, although this is difficult to prove conclusively due to poor historical records. There is, however, evidence to support both sides of this argument.

In some cases the decaying algal blooms appear washed up on beaches as a brown, foul smelling slime. In recent years the occurrence of slime 'slicks' has ruined the tourist trade on the Adriatic coast of Italy, because beaches and the waters edge were covered with decaying algal masses. Concerns about the human health implications of these masses, and the survival of human sewage-borne disease organisms in the slime, forced many holidaymakers elsewhere. Local fishermen suffered hardship as a result of the blooms' negative effect on fish stocks and the subsequent vastly reduced market for their produce. Decaying blooms are not confined to Adriatic beaches and appear also appear on many UK beaches each year, especially on the north Wales coast / Liverpool Bay.

It has been proposed that long term nutrient enrichment of coastal waters may shift the species balance of planktonic communities in favour of dinoflagellates. The food web would then be disrupted, with plankton-feeders being unable to find sufficient biomass of their particular food species. Allowing this to happen is clearly something to which all "conservationists" should be opposed.

Significantly, decomposing blooms on beaches are often mistaken for sewage scum, or when seen at sea, they are mistaken for sewage slicks . Information and education is therefore of paramount importance.

What is the solution to eutrophication ?

The solution to eutrophication has to encompass many different practices. The nutrient input does not come from one simple point source:-
There are hundreds of outfall pipes carrying sewage from the British coast into the seas; there is a continuous steady leaching of phosphates and nitrates from agricultural land to rivers and seas; there are more severe inputs resulting from slurry or silage effluent escapes on farms; there may be considerable wind-blow from agricultural land to sea. The sodium tripolyphosphate (STPP) input from detergents has also been targeted, particularly by Ecover, as a contributory factor. Finally, there are nitrogen and phosphorus wastes directly discharged to sea by industry.

Despite the large scale of the problem and the apparent complexity of the solution, there are measures that can be taken to reduce the inputs of nutrients to the seas and reduce the frequency and severity of eutrophication:

1. Sewage.

The effective treatment of sewage is essential as it is not only from a human health standpoint that sewage discharge to the seas has been shown to be a danger. The EC Municipal Waste Water Directive (MWWD), which has recently been adopted by member states will demand the use of secondary treatment for most large outfalls. Only in cases where the member state can show the receiving water body to be "less sensitive" will a lower standard of treatment be acceptable. In many cases, tertiary treatment will be required. This will involve nutrient stripping of the effluent to remove the bulk of nitrates and phosphates present prior to discharge.

2. Detergents and household cleaners.

Inputs of phosphate to sewage from detergents and household cleaners are significant. Sodium Tripolyphosphate (STPP) is used in many conventional washing powders because it acts as a 'softener' to hard water, enabling the surfactants (which perform the cleaning) to get to work. In some powders phophates represent about 30% by weight of the contents (up to 40% in dishwasher powders). The phosphate loading of sewage that results is probably a significant contributory factor to the eutrophication problems of fresh and sea waters. It may be that a big reduction in the use of STPP, while not being a solution in itself, would reduce the severity of hypertrophication. Although some sewage discharges may be phosphate stripped in future, a vast number of smaller discharges will not. Tertiary treatment of this kind is also an expensive "end - of - pipe" solution to a more fundamental problem.

3. Industrial pollution.

Through an effective industrial pollution regulation system, the input of N and P from estuarine and coastal industry can be reduced. Industrial effluents that contain N and P should be subject to nutrient stripping prior to discharge. A more fundamental solution would be the introduction of "clean technology" that minimises any waste stream. This is a less daunting task than that of controlling agricultural inputs.

4. Agricultural inputs.

Agricultural inputs of nutrients to freshwater and hence estuarine and coastal waters can be controlled by a variety of methods. The prevention of silage effluent entering water courses can be simply achieved by good storage design. Similarly, the discharge of slurry can be avoided by design and good practice. The National Rivers Authority is becoming increasingly active in prosecuting offending farmers, but there are many that escape the net.

There is a debate over the extent to which inputs of artificial and organic fertiliser are responsible for nutrient leaching from agricultural land. It appears that the problems arise from a combination of excessive fertiliser use, poor timing of fertiliser application (when plants are not taking up N and P effectively), and poor land management (such as the ploughing of old grassland in late autumn and winter), resulting in bare, nutrient-rich soils exposed to leaching.

What YOU can do to help:

- ***Join the Marine Conservation Society and support our campaigns.***
- ***Use only phosphate-free detergents such as those produced by ECOVER.***
- ***Write to your water company and ask them to treat all sewage to at least secondary, but preferably, tertiary quality.***
- ***Report any sightings of algal blooms to the MCS.***
- ***Report any suspected pollution incidents from slurry or silage effluent to the local NRA office.***

For membership details contact: MARINE CONSERVATION SOCIETY, 9 GLOUCESTER RD., ROSS ON WYE. HR9 5BU

THE CONTAMINATION OF OUR SEAS WITH RADIOACTIVE WASTES FROM POWER STATIONS, WEAPONS TESTING AND DELIBERATE DUMPING POSES AN EXTREMELY LONG-TERM THREAT TO MARINE ECOSYSTEMS AND ULTIMATELY HUMAN HEALTH. WITHOUT ACTION TO STOP FURTHER CONTAMINATION NOW, WE MAY BE LAYING THE FOUNDATIONS OF A GLOBAL DISASTER FOR FUTURE GENERATIONS.

MARINE CONSERVATION SOCIETY

FACTSHEET

RADIOACTIVE POLLUTION

Introduction

Radioactive pollution is an extremely emotive issue. It is an unseen threat to our health and has traditionally been associated with the military and undue secrecy. Although there is a natural background radiation associated with sea water, largely due to the presence of potassium-40, there are several ways that man has introduced radioactive contamination into the seas. There are three types of radiation produced by different radioactive substances, each posing a slightly different threat, depending on the method of exposure to each.

These are:-
(i) alpha particles
(ii) beta particles
(iii) gamma rays

However, the three types of radiation are generally considered as one type of pollution.

Nuclear weapons testing , nuclear power stations, the reprocessing of nuclear waste and the disposal of nuclear waste all result in emissions of abnormal levels of radiation. Radiation has a variety of ecological effects on marine life.

The ecological and human health effects of radiation

Radioactive substances can bioaccumulate in marine food chains; they are concentrated by those species higher in the food chain to levels way above the external environmental level. Thus marine animals can be exposed to doses way in excess of the level of contamination in the water around them. The actual effects of large doses of radiation or bioaccumulation of radioactive substances include:

- **genetic disturbances**
- **increased egg and larval mortality in marine animals**
- **increased adult mortality in marine animals**

These effects are a direct result of the damage caused to the DNA molecule - the molecule that carries our genes - by radiation. Mutations in the structure of the DNA molecule can be lethal, or may result in deformity or disfunction when the damaged gene is expressed.

Our knowledge of the long-term ecological effects of this exposure is by no means complete. However, we do know that exposure to radiation causes a variety of cancers in man such as childhood leukaemia and lymphomas. We also know that the effects of radiation may not show themselves for some time after exposure.

Where does the contamination come from?

Radiation pollutes our seas and oceans from:

(i) Weapons testing

Since the Second World War, nuclear tests have been carried out above and below ground. The fall-out from tests includes strontium-90, caesium-137 (now found over much of upland Wales after the explosion of the nuclear reactor in the Soviet Union at Chernobyl) and plutonium-239 which has a half life of 24,400 years. Above ground testing is very rare. However, there are fears that certain South Pacific atolls that have been used for underground testing (particularly by the French) may be about to collapse into the sea, hence releasing large amounts of radioactive contmination into the sea. It was while in protest at this testing that the Greenpeace flagship, the "Rainbow Warrior" was sunk and one man killed by the French Secret Service in Auckland Harbour, New Zealand.

(ii) Liquid wastes

Nuclear reactors generate vast volumes of radioactively contaminated cooling waters. Nuclear powered ships, such as the icebreakers that operate in the Arctic circle, staying at sea for many months at a time, and nuclear-powered submarines (not necessarily those designed to carry nuclear weapons) contribute a small amount compared to these coastal nuclear power stations. (However, there are a collection of reactors already on the sea-bed due to accidents resulting in the loss of these submarines.)

In 1987, there were 433 nuclear reactors already in operation or under

construction. The coastline of the UK is dotted with reactors, run by Nuclear Electric, all of which will be discharging contaminated water into our coastal waters until they are finally decommissioned. Decommissioning is an essential part of the correct operation of a nuclear power station, but is expected to be vastly more expensive and technically difficult than was predicted by both the government and the nuclear industry.

(iii) Sellafield (formerly Windscale)

Sellafield is the major source of marine radiation pollution in the UK. Discharges from the Sellafield nuclear installation / reprocessing plant (run by British Nuclear Fuels) have made the Irish Sea one of the most radiaoctive seas in the world. It is estimated that at least 250kg. of plutonium have been discharged into the Irish Sea. It is clear that the precautionary principle was not applied - there is no way of retrieving the plutonium once it has been discharged.

Discharges of Caesium-137 from Sellafield are so extensive that, since Caesium-173 does not occur naturally, it can be used to track ocean currents up the west coast of Scotland and into the North Sea. There has been considerable accumulation of radioactive particles in muds and sediments in estuarine muds and saltmarshes on the Cumbrian and Solway coasts.

The link between leukaemia and nuclear installations is growing stronger. The childhood leukaemia cluster around Sellafield has been linked to the victims' fathers having worked at Sellafield. However, nobody can be sure if, or when, a cluster linked to time spent on the mudflats may appear.

However, there is no doubt that Sellafield's new THORP reprocessing plant looks set to make the UK the nuclear dustbin of the world for years to come, reprocessing and storing waste from the nuclear reactors of Europe. While other countries have an easy route for the disposal of their wastes, the nuclear industries in those countries will continue to expand.

(iv) Solid wastes

Now regulated by the London Dumping Convention (1972), the dumping of solid nuclear waste has been carried out with little regard for the ecology of the oceans. Most dumping occurs into ocean deeps. The items dumped include contaminated piping, concrete, glassware, disposal clothing and spent fuels. The waste is embedded in bitumen or concrete and encased in steel drums. Eventually, the drums will corrode and the contents will leak out. The consequences of leakage were simply ignored by the industry.

The theory behind dumping at great depths is, that there is little or no link in the food web between the flora and fauna of the abyss and commercial pelagic fisheries in shallower waters; contamination of the human food chain is therefore considered unlikely. However, the probability that the abyssal ecosystem becomes heavily contaminated by radioactivity when drums start to corrode is very high. Furthermore, it is known that abyssal currents come to the surface in the Antarctic. The planktonic life in that region is at the base of the krill and pelagic species fisheries. Best estimates calculate that peak human exposure to radioactive contamination from deep ocean dumping via this Antarctic food chain will be in about 200 years, by which time there could be extensive contamination of the abyssal ocean and upwelling currents. By then there will be no way of controlling this source of pollution and clean-up will be impossible.

WHAT YOU CAN DO TO HELP

1. Write to Nuclear Electric and ask them if they know exactly what the many discharges of radioactive contamination do to marine life both in the short and long term. Ask them to apply the "precautionary principle" to all radioactive waste management.
The address is:
Nuclear Electric
Barnett Way
Barnwood
Gloucestershire
GL4 7RS

2. Write to British Nuclear Fuels Limited and ask them why the Irish Sea is one of the most radioactive seas in the world. Urge them not to make the UK the nuclear dustbin of the world.

The address is:
British Nuclear Fuels PLC
Information Services
Risley
Warrington WA3 6AS

Or write directly to Sellafield:
BNFL Ltd.
Sellafield
Seascale
Cumbria CA20 1BR

3. Put pressure on all levels of government to abandon all plans to build new nuclear power stations. Encourage them to decomission all those already operating.

Write to:
UKAEA
11 ,Charles II St.
London SW1Y 4QP

4. Keep up the pressure for an end to all nuclear weapons testing throughout the world.

5. The UK's aging nuclear submarine fleet are due to be decommissioned soon. Ask the government how they intend to dispose of the used reactors and the contaminated superstructures of these vessels.

4. Join the Marine Conservation Society to join in the fight to protect the marine environment. For membership details write TODAY to:

MARINE CONSERVATION SOCIETY
9 GLOUCESTER ROAD
ROSS ON WYE
HEREFORDSHIRE
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** TELL YOUR FRIENDS TO JOIN MCS TOO !*

FACTSHEET

ON THE EVENING OF 15TH FEBRUARY 1996, THE 'SEA EMPRESS' OIL TANKER RAN AGROUND IN MILFORD HAVEN, CARRYING A FULL LOAD OF CRUDE OIL. A WEEK LATER, OVER 70,000 TONNES OF HER CARGO HAD BEEN LOST INTO SURROUNDING WATERS, AND LOCAL COMMUNITIES AND ENVIRONMENTAL GROUPS WERE IN DESPAIR OVER THE PRICE THAT WILDLIFE AND THE MARINE ENVIRONMENT HAS HAD TO PAY FOR THE POOR MANAGEMENT OF THE INCIDENT.

MARINE CONSERVATION SOCIETY

FACTSHEET

SEA EMPRESS

THE INCIDENT

On the evening of Thursday 15th February 1996, the 147,000 tonne supertanker *Sea Empress*, loaded with light crude oil, ran aground off the Pembrokeshire coast. This was just the beginning of a tale that will go on for many years to come. The accident occurred when the ship attempted to enter Milford Haven Port on its way to the Texaco oil refinery at low tide, but was denied access by the harbour authorities. Only months before, another tanker, the *Borga*, had run aground in the same area. The following diary gives a summary of events.

DIARY OF A DISASTER

Thursday, 15th February 1996

At 8.07 pm, the *Sea Empress* ran aground off St. Anne's Head, outside the mouth of Milford Haven Port. Two hours later she was re-floated after having lost some 6,000 tonnes of light crude oil.

Friday, 16th February

The weather was calm and the vessel was afloat, held by four tugs, with the crew on board. By mid afternoon, the coast guard announced that the salvage operators were planning how to transfer the remaining oil to other vessels.

Saturday, 17th February

The weather was still good, but gales were forecast. The pilots requested that the tanker be towed to deep water where tides would be less strong and pollution risks reduced. This request was refused. The coastguard hoped that pumping-off would commence 'soon' but it was found that the engine room would have to be dried out first because it had flooded. The weather worsened and though the salvage operators turned her bow into the storm, by early evening the tug lines had snapped, the anchor chains had broken and the *Sea Empress* was aground again. In the evening, the bow was flooded to stabilise the vessel at low tide. It was planned to re-float her on the morning tide.

Sunday, 18th February

The storm worsened, the morning re-floating was cancelled, extra tugs were ordered and the vessel had to be evacuated for safety reasons. The Chinese tug *De Yue* from Falmouth secured a line to the *Sea Empress* but, as the weather worsened still further, the salvage operators had to evacuate.

Monday, 19th February
Throughout the night, the vessel continued to spill oil. By midday, the salvage operators stated that they were fixing ground moorings to the seabed and that the preparation for pumping off the oil would take more than two days. In the evening, the tide was too strong for the tug to hold the *Sea Empress* and she drifted across the mouth of the haven, only to be skewered on a pinnacle of rock. By now 12 of the 17 cargo tanks were ruptured, and by 11 pm, the salvage operators evacuated once again as they feared that the tanker would break up.

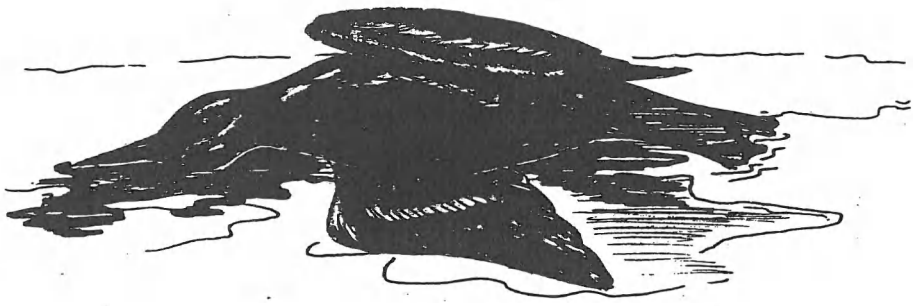
Tuesday, 20th February
Large quantities of oil were lost overnight and a political row began to grow over the handling of the salvage operation. On the evening high tide, air was pumped into the ship to increase buoyancy and try and re-float her, but without success.

Wednesday, 21st February
Lord Goschen, Shipping and Aviation Minister, stated that the planned re-floating in the morning had been cancelled because of a lack of buoyancy, not because of a lack of tug-power. On the evening high tide, the vessel was finally re-floated, using a total of 12 tugs, and taken to a jetty in the haven, still spewing oil. The authorities in charge stated that the removal of the oil should start the next day.

Thursday, 22nd February
The vessel was still leaking. There was no attempt made to transfer the oil.

Friday, 23rd February
Still no pumping to transfer the oil.

Saturday, 24th February
Nine days since the initial incident, over 70,000 tonnes of oil had been lost into the environment and pumping was finally started to remove the oil from the stricken tanker



THE CLEAN-UP

The stormy weather and the high tides were important factors affecting the decisions taken and contributed to the environmental impact of the oil which contaminated intertidal and offshore sediments along 200 km of shoreline.

One of the first actions that should have been taken to try and restrict the spread of oil was the deployment of oil-absorbent booms. This, however, was delayed by rough seas. By the time the booms could be used, the slick had spread so far that there were no booms long enough to be of much help. Chemical dispersants were sprayed from aircraft, causing the slick to break up and spread through the water column, increasing the number of organisms that were to be affected. The effects of these detergents very often last longer than those caused by the oil, especially to the fish eggs and shellfish larvae that are in the plankton.

Groups of volunteers worked alongside council and oil refinery workers in an effort to remove some of the oil from beaches; scraping up residues, mopping up oil with large sheets of absorbent gauze, using generator-powered cleaners to suck up the large concentrations of oil and rescuing oiled seabirds. An estimated 10,000 tonnes of oil were manually removed from Pembrokeshire beaches, but a further 60,000 tonnes remained in the marine environment.

THE ENVIRONMENTAL EFFECTS

The Welsh coast is, biologically, an extremely sensitive area. Of the 140,000 tonnes of light crude oil that the *Sea Empress* was transporting, half was lost into the sea. 100 km of Irish coastline and parts of the north Devon coast were subsequently polluted by tar balls blown across the sea by strong winds shortly after the disaster.

The affected area encompased many Sites of Special Scientific Interest, 5 Specially Protected Areas, 5 Special Areas of Conservation , 2 Marine Nature Reserves (Skomer and Lundy Islands), 1 Marine National Park, a stretch of Heritage Coast, an area of Outstanding Natural Beauty and an Environmentally Sensitive Area.

Fifteen nationally rare benthic species (those that live on the seabed) have been identified along the Pembrokeshire shoreline. These organisms tend to get forgotten, being out of sight most of the time. Just days after the spill, however, large numbers of dead razor shells and sea potatoes were strewn on the beaches for all to see. Filter feeders, such as sea squirts, mussels and barnacles, are especially vulnerable as the oil coats their gills when they draw water into their bodies to extract food. High onshore winds drove the oil inland, affecting intertidal species such as shellfish, crustaceans and sea anemones.

Plant life, such as seagrass and seaweeds are at risk from the smothering and toxic affects of the oil and from the chemical dispersants used on the spill; this in turn affects other organisms that depend upon these for food and shelter.

The most obvious victims of the *Sea Empress* disaster are seabirds, of which an estimated 20,000 died as a direct result. The Pembrokeshire coast and its islands are very important breeding areas for many species. Hundreds of birds were rescued, but of those that were released, very few will survive.

Whilst trying to clean themselves by preening, the birds ingest oil, thereby poisoning themselves. With this, and the loss of waterproofing and insulation, oiled seabirds stand very little chance against the unsympathetic elements. Guillemots, which return annually to Skomer Island in their thousands, have a tendency to dive if danger arises, making them even more likely to become coated. Some species may dive into the polluted water because the oily sheen resembles the flash of fish scales. Other seabird species at risk include Oyster Catchers, Shelducks, Scoters, Razorbills, Shearwaters, Red-throated Divers, Great-crested Grebes, Puffins, Cormorants and Shags.

The Grey Seal population on the South Wales coast breeds between September and December. Fortunately, therefore, pups were not affected by the oil spill. If the breeding season had been later this would have had a devastating affect, as they rely on their fur for insulation (adults have a layer of blubber) and would suffer from hypothermia if their coats became oiled. However, both juvenile and adult seals are vunerable to the dangers of ingestion of toxic components, as well as from blinding.

The area's populations of harbour porpoise and bottle-nose dolphins are yet another entry on the list of marine life that was at risk from the slick and the ingestion of contaminated fish.

The local fish and shellfish populations were tainted by the oil, rendering them unfit to eat and costing the local fishing industry some £7 million in lost revenue. Fish recover within a relatively short time, but oil can persist in shellfish populations as it remains in the sediment for many years, due to low rates of degradation.

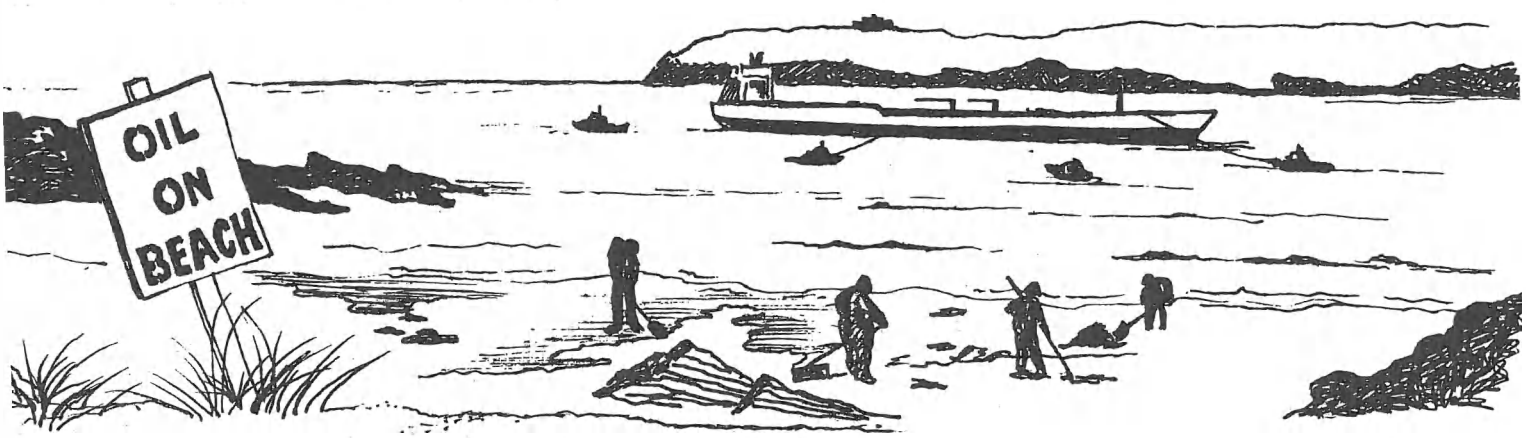
The full consequences of this disaster will not be known for a long time. Surveys are being undertaken to try and estimate both the short and the long term effects. Even a slight change in the foodchain can have escalating results. The benthic communities are likely to suffer badly; local populations may be wiped out by the oil as it disperses through the water column and settles into the seabed. Re-population depends upon the gradual recolonisation from unaffected areas. Oil-tolerant opportunistic species will take their place in the short-term. Seabirds, and other animals that feed on shellfish living in this sediment will be continually ingesting toxic compounds. The persistence of such compounds within body tissues may reduce life-expectancy, the number of young produced in a life-time and, therefore, the future breeding population size. Some species may fail to breed altogether.

The visible signs of the oil on rocky shores will eventually be cleaned by wind, rain and wave action but the residues and their effects will be around for a lot longer.

THE DONALDSON ENQUIRY AND SHIPPING POLICY

The oil spill caused by the *Braer* grounding on the Shetland coast in January 1993 led to an official inquiry headed by Lord Donaldson, a former Master of the Rolls. In May 1994 a report on the inquiry, 'Safer Ships, Cleaner Seas', was presented to the Department of Transport, listing 103 recommendations on how to improve the prevention and control of pollution from merchant shipping; the Government response was published in February 1995.

In the *Sea Empress* incident, there appears to have been conflict between the Environment and Economics - those wishing to do all in their power to protect the marine environment against the Department of Transport, the ship owners and the salvage operators wishing to reduce the monetary costs of such an operation.



THE *BRAER* INQUIRY - RECOMMENDATIONS RELEVANT TO THE *SEA EMPRESS*

❖ The report recommended that five supertugs be stationed around the British coast, ready to provide emergency assistance. 'three key areas' were stressed, these being the English Channel, North-West Scotland and the Western Approaches. The Government only provided two such tugs, leaving the Western Approaches (including the Welsh coast) unprotected. During the *Sea Empress* salvage operation, the salvage operators involved declined the offer of the use of one of these two supertugs, even after it became evident the tugs that were present on site were unable to cope.

❖ The report recommended that escort-tugs should also be introduced to tow tankers to reception facilities, in addition to local pilots going on board. This would prevent mistakes being made similar to those of the *Sea Empress* when she tried to enter Milford Haven when the tide was too low.

❖ One of the recommendations was for the introduction of double-skinned hulls for tankers to reduce the amount of oil lost if an accident should occur (if piercing only the outer skin). The earlier grounded *Borga* had a double-skinned hull, preventing her from leaking oil when she became grounded outside Milford Haven port. At present the International Maritime Organisation has ruled that existing tankers do not have their hulls modified until they have completed 30 years service.

❖ The Donaldson Inquiry recommended that the Government should establish Marine Environmental High Risk Areas through which ships should exercise extra caution. Not enough information is available to a ship's Master to alert him of the sensitivity of the area through which he is passing; one such 'MEHRA' has been proposed off Skomer Island. Unfortunately the Government is stalling on the issue of MEHRAs, determined to wait until an international agreement is reached, even when the Donaldson Inquiry advised that this lengthy delay was not necessary.

WHAT THE FUTURE HOLDS . . .

An official inquiry into the Sea Empress accident and the conduct of the salvage operation was ordered by the Department of Transport's Marine Accident Investigation Branch (MAIB); the report is likely to be published in 1997. An environmental monitoring and assessment programme led by the Countryside Council for Wales has been initiated to study the possible long-term effects on the ecology of the environment caused by the oil and the chemical dispersants used on it. There is continuing pressure, from environmental organisations and the local community in Pembrokeshire, for an independent public inquiry to be held. It is hoped that this time, lessons will be learned and implemented immediately.

The Marine Conservation Society would like to see action taken on the recommendations of the Donaldson Inquiry, by the implementation of changes to shipping policy. This would give the marine environment greater protection from such accidents in the future.

MCS calls for immediate action on the following points:

- **The number of Government-funded emergency tugs should be increased in sensitive areas, especially the Western Approaches.**
- **Access to sensitive areas should be restricted to tankers with double-skinned hulls.**
- **Marine Environmental High Risk Areas should be introduced.**
- **Compulsory escort to reception facilities should be implemented.**

With all the modern day technology at our disposal, we have a duty to improve safeguards to our marine and coastal environment and prevent future disasters.

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