North Sea Strategies

P. H. A. HOOGWEG, K. J. WULFFRAAT and B. G. M. VAN DE WETERING
Ministry of Transport and Public Works, Tidal Waters Division, P.O. Box 20907, 2500 EX The Hague, The Netherlands

The North Sea environment has to be protected. It is widely recognised that functions and uses of the North Sea system should be balanced. The North Sea has the most intensive traffic of any sea in the world. Every year fishermen land three thousands million kilograms of fish, a quarter of the total North Sea fish stock. On the Dutch coasts we may find the most valuable wetlands in the world. On the other hand, the North Sea is an enormous garbage bin. Thousands of tonnes of heavy metals and chlorinated compounds are emptied into it every year. It is obvious, the North Sea has an environmental problem. The only way out is via "Sustainable Development", which garantees sustainable uses as well.

Not so long ago, ships steaming out of Rotterdam harbour at the start of their voyage to the Dutch East Indies or the New World were escorted by schools of porpoises and had dolphins sporting in their wake. These days you won't see a single dolphin or porpoise off Rotterdam, however hard you look. A retired captain asked how many there used to be, answered with the wisdom of an Eastern sage: "Well, these days you don't count the seagulls in the crow's nest either, do you?"! Except for a few strays, sea mammals like the porpoise and the dolphin have vanished from Dutch coastal waters. Very occasionally, one is washed up on the beach. Dead.

The North Sea offers a thousand uses to the people living nearby. Fishing, nature reserves, shipping, raw materials and recreation. We even can dump a certain amount of waste in it. If mankind is to greedy to harvest, these uses come into conflict with nature. It seems that this is the nub of the problem of the North Sea. Because of overfishing, overlaoding with waste and too much recreation and shipping the North Sea is no longer able to accommodate a fully-fledged, sustainable ecosystem. Animals at the top of the food chain, such as dolphins, sharks and certain fish-eating birds, have disappeared from the coastal waters. To solve the North Sea problem, we have to base our future policy on Sustainable Development.

Drop in the ocean

The shallow North Sea is wedged in by the coasts of the United Kingdom, Norway, Sweden, Denmark, West Germany, the Netherlands and Belgium. The North Sea has an area of about 575 000 square kilometres. It contains roughly 55.000 cubic metres of salt water: that's less than one hundredth of a per cent of all the salt water on the planet. You could say it's just a drop in the ocean. About 200 million people live in this heavily industrialized area and they are second only to the North Americans in their use of natural resources and consumer goods.

The water in the North Sea is not stationary. Everyone knows about the waves, high and low tides. But there are larger-scale movements of water too. Tidal currents, the earth's rotation and the predominant wind direction largely determine the flow of water in the southern part of the North Sea. The resulting average flow is anticlockwise and follows the deepest parts of the North Sea. Ocean water that enters the North Sea between the Shetlands and Scotland flows southwards along the British coast, crosses the central North Sea and then, together with water from the English Channel, flows along the coast of Europe, through the Norwegian Basin and towards the North Pole.

Environmental chemists believe that the rising levels of PCBs, heavy metals, nutrients and pesticides are at the root of the North Sea-problem. Polluted rivers flow into the North Sea, thereby sealing its fate. Water of river Tyne, United Kingdom, can be found in the German Bight; five to ten per cent of the seawater north of the Wadden Islands is Rhine water and the Danes experience most problems from polluted Elbe water. You can see why from the flow of the Tyne-, Elbe- and Rhine water through the North Sea (fig.1).

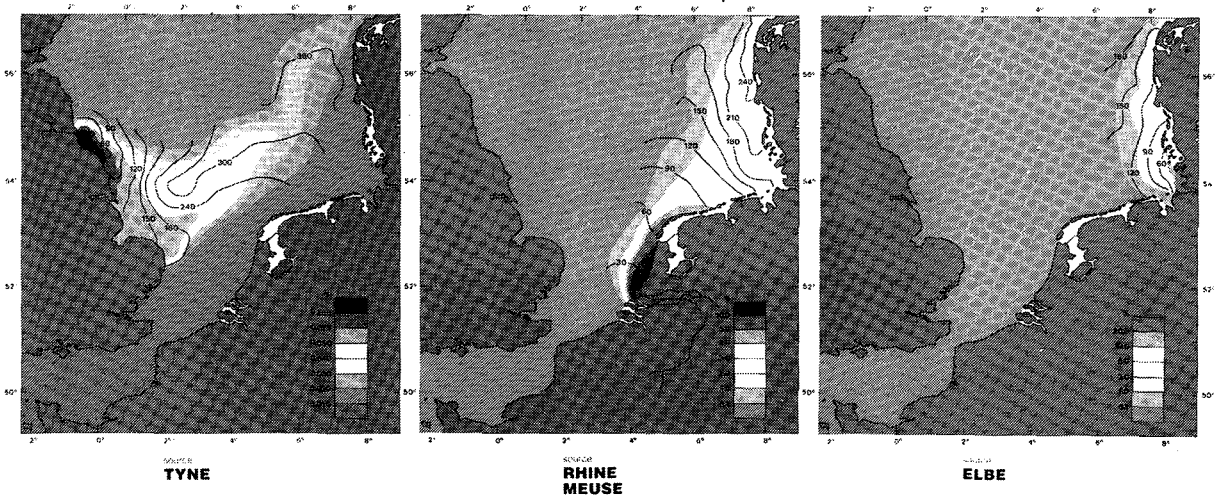

Figure 1: Outflow of river Tyne, Rhine and Elbe in the North Sea

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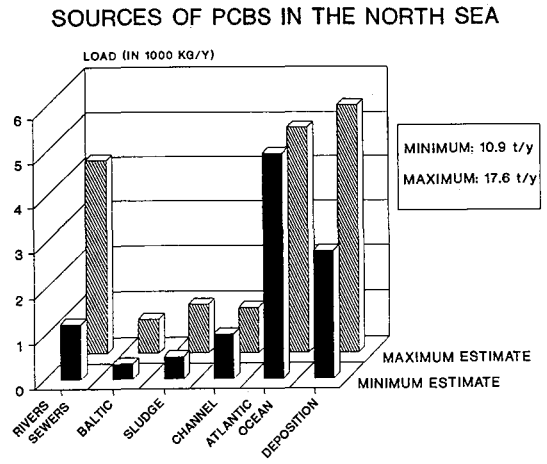

Figure 2: Sources of PCB-pollution

Given the pattern of flow in the North Sea it's not surprising that the highest levels of PCBs are found in the German Bight and Wadden Sea. But what does this mean for the animals living there? The PCBs ingested by sea mammals with their food are not excreted from the body but accumulate in fatty tissue. Therefore PCB levels far exceeding the limits for chemical waste are found in the fat of seals and dolphins from the Wadden Sea and Baltic, in fish-eating birds, and even their eggs. Research has shown that these compounds reduce the fertility of many animal species. This can result in a species dying out.
Problems of PCBs in the environment were first reported in the early sixties. Since then the Dutch seal only survived because of immigration of seals from Denmark and Western Germany and rehabilitation in special seal sanctuaries. Of course scientists wanted to find out where the PCBs come from. It appeared that atmospheric deposition and Atlantic currents together are responsible for 60 to 70 per cent of the total input. Deposition and sea currents combine a large input with an extremely low concentration. In contrast, the Western European rivers and the dumping of dredged materials from harbours impose a severe burden on a small area. Therefore they are the cause of the serious environmental problem of PCBs in our coastal waters. However it remains necesarry to tackle atmosferic PCB emissions in order to phase out atmosferic and Atlantic inputs.

Turbidity
Chemical pollution is not the only reason for the sorry state of the sea. Scientists believe that enhanced turbidity of the water, resulting from the vast amounts of suspended matter, obstructs a sustainable development of the North Sea ecosystem as well. Research has shown that eversince the sixties the turbidity has increased and the zone affected by turbidity has grown because of dumping of harbour sludge and algal blooms.

Suspended matter occurs naturally in the coastal waters. Rivers transport vast amounts of eroded material from the land to the sea. This is subsequently deposited along the coast. The high concentrations of suspended matter do have ecological significance: primary production by algae - the total amount of organic matter they synthesize - is limited in the turbid waters of the coastal zone. Further offshore is a zone with less suspended matter but with enhanced levels of nutrients. Here, algae grow excessively, and are so numerous that they reduce the transparency of the seawater. Bad news for animals like the dolphin, which hunt their prey by sight. Further out to sea nutrients are in shorter supply. Algal growth is therefore limited and the sea water rapidly becomes more transparent.

Vast amounts of material dredged from harbours are dumped near the shore and have caused the turbidity of seawater to increase dramatically. As a result, the zone in which algal growth is light-limited has widened appreciably. The nutrient loads brought to the North Sea by the rivers have increased manyfold in the last thirty years. Coastal zones became seriously eutrophied. The zone of algal bloom and turbidity has clearly become much broader. In autumn bio-degradation of this enormous algea biomassa may lead to oxygen shortage.

Fishing
Chemical contamination and turbidity only partly explain why the North Sea ecosystem is unable to hold its own. There is another important factor. According to biologists; fishing and the disturbance it causes. Every year mankind catches a 25% of the total fish stock in the North Sea. Since some species are almost exterminated and fishermen are shifting to other, more abundant species, it is obvious that this isn't a sustainable fishery. Fishermen are harvesting too much from North Sea ecosystem.
Last year the Department of Public Works, the Institute for Fisheries Research and the Netherlands Institute for Sea Research studied the effects of beam trawling. This typically Dutch form of fishing has major repercussions on the ecosystem. The nets penetrate the sea bed to a depth of at least 6 centimetres. After an area has been trawled this way three times only half the numbers of sea urchins, starfish and tubeworms remain. Less than 10 per cent of the captured animals survive. During the research that meant that for every kilogram of fish for consumption brought on board, 2 to 4 kilograms of dead sea life were thrown back overboard.
Every year, every square metre of sea floor off the Dutch coast is subjected to several such trawls. This intensive harvesting inevitably leads to changes in the population. In biological terms: short-lived organisms such as worms or herrings that reproduce rapidly and in large numbers are favoured. Long-living predators from near the top of the food chain - such as rays, sharks and porpoises - disappear. Moreover every year some 3000 seals and dolphins drown in the nets of fishing vessels. The AMOEBA-approach presents a clear view on this ecological information (see references, Water in the Netherlands, a time for action).

Overfishing caused serious trouble. The European Community proposed a policy of assign quotas. These annual quotas are landed in a few months. As fishermen changed their interest to other, more abundant species, we have to fear for those species as well. During the third North Sea Ministers Conference therefore, politicians agreed in more research to the ecological consequences of fishing.

A policy in future might be to create natural reserves at sea where fishing is not allowed. On the short term we have

to give up extra income from the fishing trade, but on the long term natural reserves provides us with young fish stocks.

Uses

When all is said and done, one is forced to draw one conclusion: 'we expect too much of the North Sea'. In future it will be unevitable to harmonise the uses and the needs. This brings us to the question how to realise such a Sustainable Development? First of all you need more information about the uses.

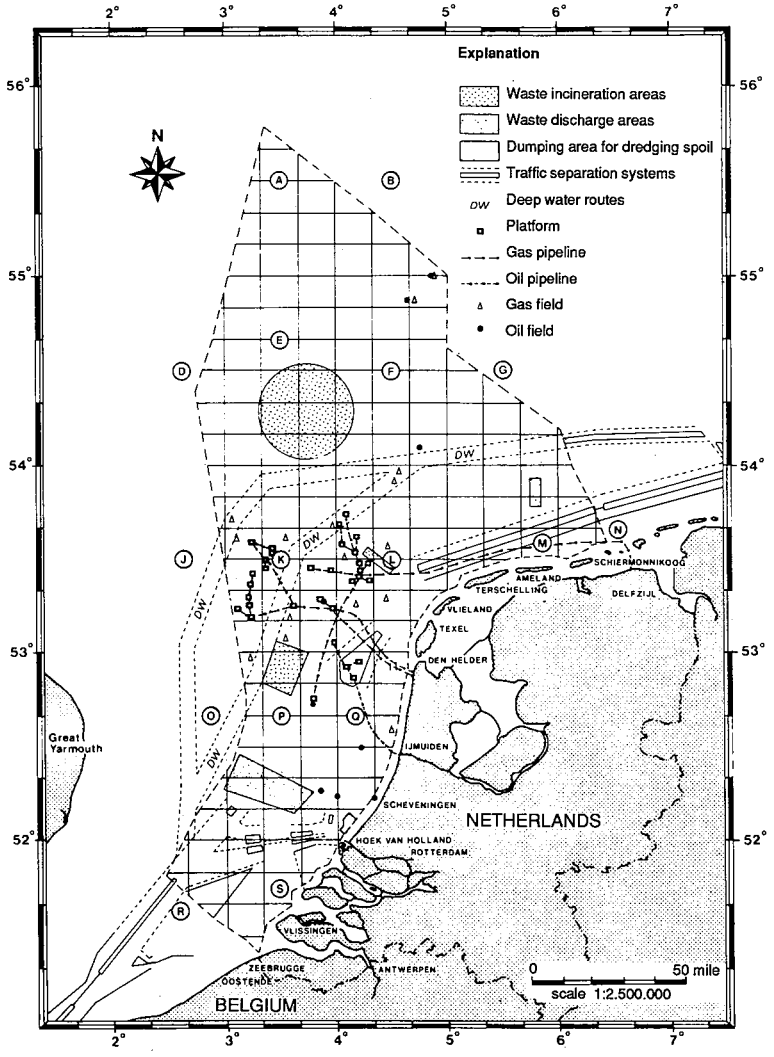

figure 3: Uses of the North Sea

The North Sea is one of the largest offshore oilfields. There are currently 160 oil and gas production and drilling platforms in the North Sea. About 8000 kilometres of oil and gas pipeline lie on the sea floor. The North Sea has the most traffic of any sea in the world; more than 420 000 shipping movements every year. Traffic lanes along the coasts connect major harbour areas. The North Sea is the most productive sea in the world. That makes it one of the most intensively fished seas in the world too. Every year we land 3 thousand million kilograms of fish - a quarter of the total North Sea fish stocks. There are zones for incineration and dumping of chemical waste. Sewage sludge and dredged spoils are also dumped. The North Sea is one of the largest garbage bins in the world. If we add the amount that the rivers bring in, 40 000 tons of metal and many thousands of tons of chlorinated compounds are emptied into it every year. Extraction of sand and gravel is in operation. In all North Sea ripparean states coastal recreation is important. And last but not least, The Wadden and the Oosterschelde nature reserves are among the most valuable wetlands in the world.

All these functions make certain demands of the North Sea. Hence the need for a sensible policy. The North Sea is an international sea. That means that both an international policy and an international approach are needed. Since the late sixties the North Sea states have been discussing which measures they should take to reduce the pollution of the North Sea. The Oslo and Paris conventions were among the results of these discussions.

International policy

The Oslo Convention entered into force in 1974. Initially, the Commission set out to control the dumping of industrial wastes, sewage sludges en dredged materials and the incineration at sea of liquid industrial wastes. A system of national licensing was set up through which each country could report its dumping and incineration operations to the Commission. The Commission publishes statistics on all dumping and incineration operations in annual reports. In 1989, the Oslo Commission has agreed that the disposal at sea of all hazardous industrial waste should cease in the North Sea by the end of that year. In the rest of the Convention water by the end of 1995. Incinaration at sea should come to an end in 1994.

The Paris Convention, which entered into force in 1978, refers to landbased sources of sea water pollution. Rivers, direct discharges - included are discharges from oil producing platforms at sea - and atmosferic deposition. The Paris Commission controls discharges into the sea by agreeing programmes and measures to eliminate, reduce or prevent the input of hazardous materials into rivers and the sea. As a basis the Commission makes a yearly inventory of the input of some heavy metals, PCBs and from time to time nutrients (table 1). The Paris Commission has successfully tackled problems caused by mercury, cadmium and oil from various sources.

1984 was a very important year for the North Sea. In the autumn of 1984 ministers from the countries bordering the North Sea met in Bremen (FRG). During this first North Sea Ministers Conference politicians recognized that the North Sea is worth being protected, and to a greater extent than before. Despite this awereness, the conference did not lead to concrete measures. But there was an agreement to meet again in London.

In London, the second Conference, a political goal was set. All North Sea riparian States should amongst others prepare a national action plan describing the measures to be taken with the aim of achieving a substantial reduction of the order of 50% between 1985 and 1995 in total inputs of substances that are persistant, toxic and liable to bioaccumulate.

Direct en River inputs (tonnes)	year[1]	N	P	Cd	Hg	Cu	Pb	Zn	Cr	Ni	As	g-HCH	PCBs
Belgium[2 3]	1988	57,400[4]	8,200[4]	4.1	1.8	55	62	495	NI	NI	NI	0.1	0.05
Denmark	1986	24,978	4,195	0.4	0.2	13	4.3	44	NI	NI	NI	NI	NI
Fed. Rep. of Germany[3]	1988	255,700	17,6000	14	16	420	250	3,000	NI	NI	NI	0.7	<0.2
Netherlands[3]	1988	518,510	42,800	26	6.6	680	330	3,900	NI	NI	NI	1.4	0.2
Norway	1988[5]	78,690	4,670	0.2	0.2	95	17.3	337	NI	NI	NI	NI	0.09
Sweden	1988	20,883	429	0.3	0.02	44	9.5	210	NI	NI	NI	NI	<0.01
United Kingdom	1986	210,406	30,425	<28	<7.9	<480	<320	<2,300	NI	NI	NI	<0.4	NI
Total[6]:		1.200,00	108,000	<73	<33	<1,790	<990	<10,290				<2.6	<0.6

NI: No Information
1 Figures for N and P cover 1985
2 Input at border between Belgium and the Netherlands in the river Scheldt
3 Input including load from upstream countries
4 Including channel "Gent-Terneuzen" and Dutch load on Westernscheldt
5 Sum of data on direct inputs 1988 and river input data from QSR 1987 (1984-data)
6 Order of magnitude only (rounded figures)

Table 1: Inputs of some heavy metals, HCB and PCB to the North Sea system.

Measures

Only this year the Third International Conference on the Protection of the North Sea was held. On 7 and 8 march ministers of the governments of Belgium, Denmark, Germany, France, the Netherlands, Norway, Sweden, Switserland, the United Kingdom and the Commisioner of the European Community discussed the targets and the timeframes set at the Second Conference in London. They welcomed observers of the German Democratic Republic and Czechoslovakia, also part of the Northsea Catchment area. It is to be hoped that the changes in Eastern Europa will have a positive effect on the natural environment as well.

In the Hague the ministers announced a comprehensive set. Emissions of hazardous materials will be reduced by 50%. National inventories of the inputs of these hazardous substances resulted in a list of 36 priority substances. Among these substances; heavy metals, pesticides, solvents and basic chemicals. Atmosferic input of 17 of them sould be tackled as well to reach a desired emission reduction. Some substances are extremely dangereous. For dioxines, mercury, cadmium and lead we need a minimum reduction of 70%.
The ministers had special attention for PCBs. It was agreed to phase out and destroy in an environmental safe manner all identifiable PCBs as soon as possible with the aim of a complete destruction by 1995 and at the latest by 1999.

Substantial reductions of nitrogen and phosphorus inputs are to be achieved by those States bordering areas where algea blooms occur. This means a nutrient removal from household waste waters at municipal treatment plants. Authorities aim for nitrogen concentrations in effluents below 10 to 15 millgrams per litre and phosphorus concentrations below 1 to 2 milligram per litre. Of course industrial effluents will be applying the Best Available Technologies by 1995. From the inventories, it can be foreseen that, with the aid of Best available Technology, one will succeed in the emission reduction of phosphorus. For nitrogen, this is not the case. Instead of municipal waste water agriculture is the the most important source of nitrogen in the environment. So, the use of manure and fertilizer in agriculture will have to be evaluated.

During the Third Conference it appeared that almost all North Sea States have stopped the dumping of sewage sludge and industrial waste. Except the United Kingdom. But, the British will phase out dumping of chemical waste in 1993 and the dumping of sewage sludge in 1998.

In The Hague, the ministers also agreed to take action within the International Maritime Organisation to prevent pollution from ships. It is necessary to cut down the discharges of oily wastes and the leftovers of cargo. In this connection shore reception facilities are essential. If not, shipowners are tempted to less decent ways to get rid of their wastes. On the other hand, if shore reception facilities are available, control should be improved. Moreover the collection of evidence against shipowners who are violating the rules must be less difficult as it is nowadays.

Oil pollution by offshore industry is a major North Sea problem. The ministers decided to prohibite the discharge of oil contaminated cuttings as soon as possible. Moreover it is necesarry to develop a control system for the discharges, and use, of chemicals offshore and related measures. The ministers asked the Paris Commission to do so.

Stranded or sunken ships, cargoes lost at sea should be removed if they cause harm to the marine environment. Action will be taken to ensure sufficient salvation capacity on a world wide basis. Compensation for the costs should in principle be obtained from the polluters in question.

	Substance	Water	Air		Substance	Water	Air
1.	Mercury	*	*	19.	Simazine	*	
2.	Cadmium	*	*	20.	Atrazine	*	
3.	Copper	*	*	21.	Tributyltin-compounds	*	
4	Zinc	*	*	22.	Triphenyltin-compounds	*	
5.	Lead	*	*	23.	Azinphos-ethyl	*	
6.	Arsenic	*	*	24.	Azinphos-methyl	*	
7.	Chromium	*	*	25.	Fenitrothion	*	
8.	Nickel	*	*	26.	Fenthion	*	
9.	Drins	*		27.	Malathion	*	
10.	HCH	*	*	28.	Parathion	*	
11.	DDT	*		29.	Parathion	*	
12.	Pentachlorophenol	*	*	30.	Dichlorvos	*	
13.	Hexachlorobenzene	*	*	31.	Trichloroethylene	*	*
14.	Hexachlorobutadiene	*		32.	Tetrachloroethylene	*	*
15.	Carbontetrachloride	*	*	33.	Trichlorobenzene	*	*
16.	Chloroform	*		34.	Dichloroethane 1,2-	*	
17.	Trifluralin	*		35.	Trichloroethane	*	*
18.	Endosulfan	*		36.	Dioxins	*	*

Table 2, List of priority substances

In order to give protection to marine wildlife, the ministers signed a Memorandum of Understanding on Small Cetaceans in the North Sea. Habitat protection might be a useful instrument. It recognised that the fishing effort is in inbalance with the sustainable development of the North Sea ecosystem.

Back to the Netherlands

The Ministerial Declaration of the Third North Sea Conference shows that there is plenty of work to do in the Netherlands. It is evident that the results of the conference will have to be incorporated in the national policy of the riparian states. But, how to phase out PCB? How to cut in halve nitrogen or phosphorus loads?

A special programm has been developed to reduce the input of dangerous substances from the largest river entering the North Sea, the river Rhine. The Rhine Action Programm aimes at a 50% reduction of total discharges by the year 1995. Similar actions are necesarry for other important rivers.

All Dutch industry must use the Best Availably Technology. Therefore Dutch authorities are in discussion with the main dischargers of waste water. Their aim: new permits with new standards. For instance, in 1995 fertilizer industry may only discharge a couple of percents of the amount of cadmium it discharged in 1985.

Communal waste water treatment plants will have to enlarge their activities. Special facilities will remove 75% of the nutrients. This is just to start somewhere. Agriculture is a key point in reducing nutrient loads. Therefore the ministers of agriculture will be invited for a next conference in 1993. That is not the only problem they have to deal with. The use and production of pesticides is another major problem.

Emission regulation only is inadequate. The National Policy Document on Water Management argues that the uses should be tuned in to eachother. This might include zoning of the uses. Fishing and offshore activities shouldn't be allowed throughout the whole sea. This also means conservation. If safety regulations permit we should give the estuaries some extra protection. Moreover it is considered to create wildlife or to reconstruct exterminated ecosystems; for instance the former sea grass fields in the Dutch Wadden.

Conclusions

Mankind must consider the sea as a coherent whole. The approach of Sustainable Development offers both a sustainable ecosystem and sustainable uses. On the long term only this option provides a continuous harvesting and survival of nature. And the porpoise? Maybe the memorandum of understanding on small cetacean is not to late. Habitat protection is necessary. By-catches in fishing industry is a sad detail. Above all the porpoise needs clean water. A call for action.

References

Water in the Netherlands; a time for action. National policy document on water management. Ministry of Transport and Public Works, 1989.

Effects of beamtrawl fishery on the bottom fauna in the North Sea. Netherlands Institute for Sea Research (NIOZ), Netherlands Institute for Fishery Investigations (RIVO) and North Sea Directorate (RWS/DNZ), 1990.

Ministerial Declaration and Memorandum of Understanding on Small Cetaceans. North Sea Conference The Hague. March 7 and 8, 1990.