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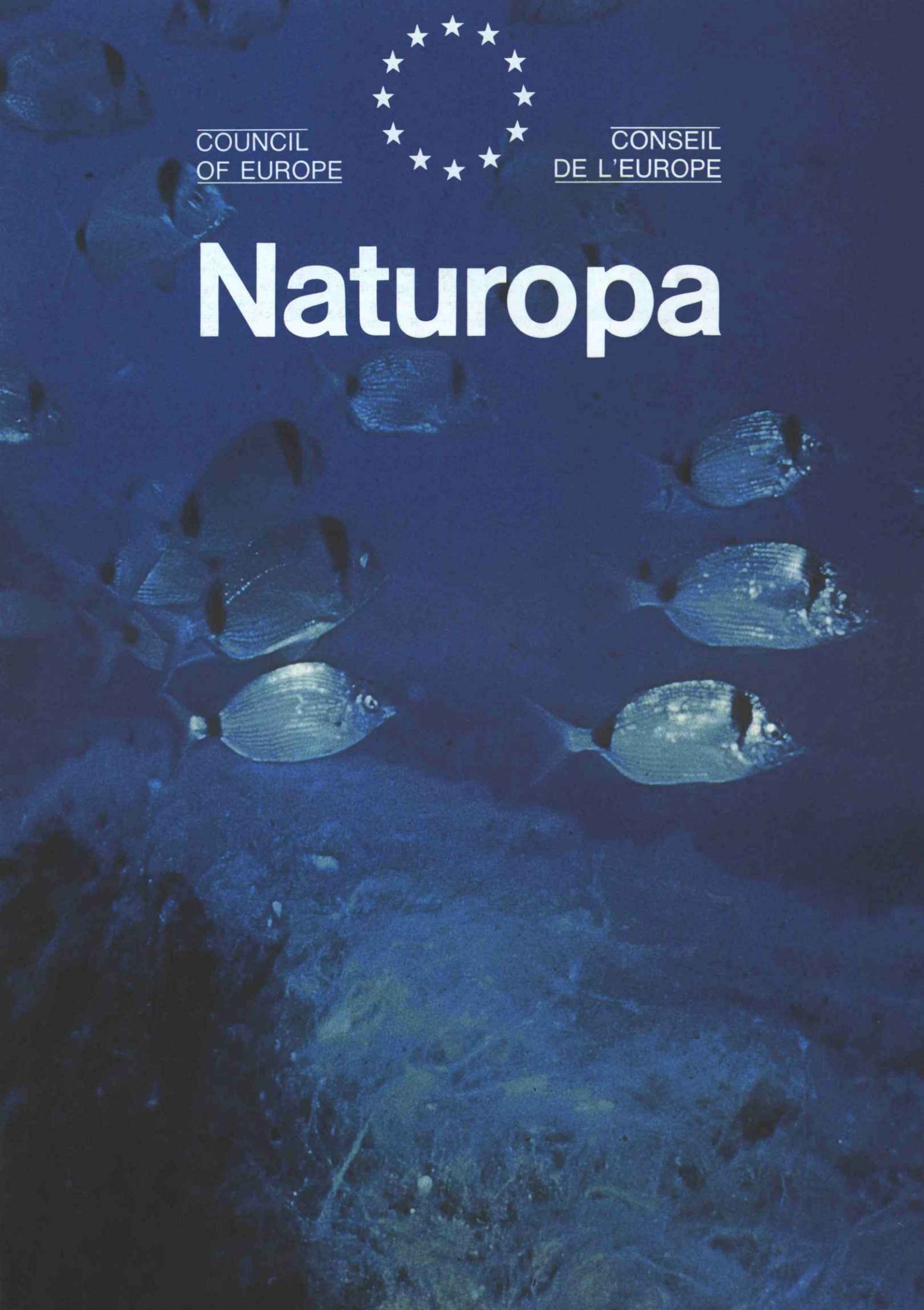

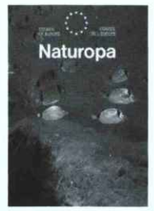

Naturopa

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THE SEAS MUST LIVE

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Oceans, bays, shorelines and lagoons — in all their endless varieties, the seas are fascinating, always reminiscent of eternity. Whether streaked with parallel lines of foam by sudden squalls, glassy calm under a rising moon or clawing at shorelines under hurricane winds, these great masses of water cover with their salty embrace a large part of our planet. Guided by the winds, the streams and the stars, they are in constant movement. Hiding beneath their surfaces of unending colours, moods and smells, there is great life.

Afraid that he might fall off, man sailed the seas and discovered his world. Now that even the last white spots on our continents have become known, we are prying beneath the surfaces ever deeper at ever greater speeds hiding military hardware or using ingenious instruments.

As with all our other resources, in our material optimism which is no longer in relation to the management of natural resources, we have long believed that the seas would for ever yield fish, shells, skins and meat. The last few years, however, electrified to consciousness by a rapid series of disasters, we have had to acknowledge that we have been wrong.

The picture of a dying seabird covered in oil, blinded, its insides burning away but still standing, waiting for its life to ebb away, has become a tragic symbol of what we have done to this part of our environment. We are sinking dangerous wastes down on to the ocean floor, depleting the fish populations and using our rivers to transport the wastes of cities, factories and arable lands to the seas. The oceans and the seas are becoming dangerously ill and naturalists and biologists are warning that we are facing dead wastes no longer capable of providing us with what we need: food and energy.

There are no final scientific data on the influence of the seas on the climate. There are also no final arguments that whales are on the brink of extinction and that one of the symbols of simple food, the herring, is following in the wake of the salmon. But we are being warned that the seas must live so that life can continue.

This special issue of the Council of Europe's nature conservation magazine, *Naturopa*, is our contribution to the world-wide effort of the International Union for the Conservation of Nature and Natural Resources and the World Wildlife Fund to save the oceans and marine life. The Council of Europe's Parliamentary Assembly has also responded to this particular environmental problem and last October held a colloquy in Malta. Its results too will help to lay the basis for understanding and thus the necessary action to ensure the survival of marine life.

H.H.H.

Editorial

(Photo Jan van de Kam)

I am pleased as the Minister responsible for fisheries in Ireland to have this opportunity of drawing attention to the pressing need which exists for immediate and effective measures for the conservation of fish stocks in our seas and in particular in the North East Atlantic, the sea area with which I am most concerned.

Until comparatively recently, indiscriminate fishing has taken place, particularly on the high seas where there was no effective international regime to control and monitor the effects on stocks. With the development of larger and more efficient fishing vessels and of increasingly sophisticated fishing gear, pressure on fish stocks grew to the point where these stocks became seriously depleted. Fishery scientists have been aware of the dangers but because of the lack of an internationally accepted conservation organisation little was done to alleviate the problem.

More recently the North East Atlantic Fisheries Commission (NEAFC) was established in an effort to achieve a management regime for the rational exploitation of fishery resources in the Atlantic. A vast amount of scientific data on fishery resources was available to the Commission and several praiseworthy restrictions such as minimum sizes for mesh of nets and for fish landed were introduced. These particular measures were basic to fishery conservation as they permitted fish to spawn and reproduce. However, because of the fact that some species were not subjected to control, the enforcement of size restrictions became extremely difficult, particularly in mixed fisheries. In recent years, quotas based on a Total Allowable Catch determined on scientific evidence for stocks in various fisheries became a popular conservation measure. In theory quotas are a reliable conservation measure but in practice this has not been found to be the case, mainly because of the difficulty of controlling and monitoring catches. The present state of the herring stocks in areas such as the North Sea and the Celtic Sea south-east of Ireland is a classical example of the consequences of failure to take effective conservation measures in good time. Stocks of herring in these areas have become so run down that the only possible way of preventing their complete destruction is by closing temporarily the fisheries concerned, a course of action which, in fact, has already been adopted within the EEC. This of course is a very drastic solution because of the short term effect on the livelihood of fishermen, fish-processing workers and other interests, but, in the long-term interests of all, the future well-being of the fisheries must be ensured.

One effect of the failure to reach international agreement on effective conservation measures has been the decision of many countries to declare 200-mile exclusive fishery limits. Coastal state control over the fishing grounds cannot but improve fishery management as a whole in these areas.

As I mentioned earlier great emphasis has been put on quotas in recent years as a conservation measure. Quotas undoubtedly have a role to play but on their own are a completely inadequate tool in fishery management. To be effective, quotas must be linked to fishing effort and must be properly monitored and controlled.

Despite the drastic decline which has taken place in the stocks of most of the popular varieties of fish, one need not be pessimistic about the future of the European fishing industries. If the nettle of conservation is now grasped firmly, fish stocks can be not only maintained but also increased substantially. Unpopular measures may at times have to be taken but this cannot be helped.

It is very noticeable and encouraging in all maritime countries that there is now a growing awareness of the need for fishery conservation and for rational exploitation of fish stocks. We can only hope that this awareness will lead to adequate action by the responsible authorities.

While current international emphasis is on the conservation by management of the world's fisheries it is important to remember in support that the marine environment must be protected from further pollution and existing sources of pollution ameliorated.

I am confident however, because of the reform spirit animating the various international conventions (Oslo, Paris, London, etc.), that their collective application will continue to reduce the pollution threats from dumping at sea, inputs from land-based sources and any pollution hazards attaching to offshore exploration for oil and minerals.

In conclusion I would like to congratulate the Council of Europe's Information Centre for Nature Conservation for its initiative in pinpointing the need for fishery conservation and indeed on its efforts to conserve the natural environment as a whole.

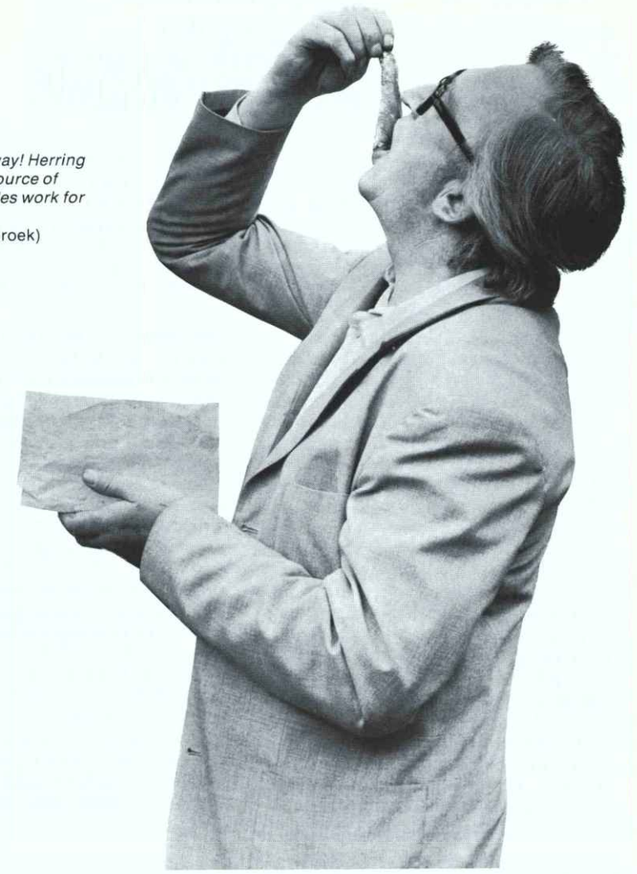
Brian Lenihan

The last herring ?

Management of fish stocks

Alan Preston

That's the Dutch way! Herring still is a plentiful source of protein and provides work for tens of thousands
(Photo C. Mastenbroek)



Introduction

This paper reviews our state of knowledge of the impact of sea pollution on the quality and abundance of fish and shellfish populations in the north-east Atlantic.

It should be made clear at the outset that with the exception of a few well-known dramatic instances of acute pollution we cannot unequivocally attribute any changes in abundance of fish or shellfish stocks to the presence of pollutants in the marine environment. What we can do is detect and quantify pollutant residues of many kinds in both fish and shellfish and in some cases follow their trends in time and space. Nor, with a few exceptions, notably radionuclides and a few metal and pesticide residues, are we able to interpret the effects of the concentrations found on the health of the consumer: certainly not in strictly quantitative terms.

It is extremely difficult to define marine pollution, or to formulate a sensible judgement on the scale of the problems involved. Much of the concern about pollution arises from the ill-considered way in which the marine environment has been used in the past for the receipt of waste materials, rather than from any belief, founded on solid scientific evidence, that serious damage has already been rendered on any significant scale. There are of course real problems, but by and large those of an acute kind are of a local nature such as the mercury poisoning in Minamata, Japan, the typhoid outbreak in Naples and major coastal oil spills.

Several chronic problems are more widespread, as for example the oil contamination of beaches, or the reduction in the breeding performance of some sea birds, brought about by egg-shell thinning following exposure to chlorinated hydrocarbon pesticide residues in the birds' food supply.

There is much talk of global marine pollution problems, but this is true only in the sense that there are many areas throughout the world with common problems, of which sewage pollution is certainly, in world terms, the most general. The effects of such problems do not, however, extend to more than a small proportion of the global marine environment.

Pollution regulation in the north-east Atlantic area

Several regulatory actions are already underway within the north-east Atlantic region and the majority of Western European states are participating in one or more of the Oslo,[1] London,[2] Helsinki,[3] or Paris Conventions,[4] whilst EEC[5,6] members are further concerting their regulatory activity within the Community framework. It should be recognised that most of these regulatory actions stemmed from the concern that low levels of contamination of particularly toxic materials which cause no obvious effect may, if they persist, in the long run be leading to subtle but deleterious effects; the actual data available indicate there are few serious marine pollution problems at present. Thus much of the regulatory action has been taken in advance of a full scientific appreciation of the position, and certainly without (in the majority of cases) sufficient data to quantify effects and to derive an adequate basis for dose/response (exposure/effect) relationships on which to establish satisfactory standards for the controlled introduction of pollutants.

It should be recognised that to be effective, controls must not only be enforced but also be based on a rational appreciation of the nature of the problems involved. Cost of control is an important consideration, especially in relation to the net benefit likely to be achieved by the imposition of controls. In this context it is equally important to recognise that the sea has a capacity to receive finite quantities of waste materials of all kinds. The crux of the problem is to define that capacity and then to limit the input of pollutants within it. In almost all cases the problem will be to define the capacity, not of the sea as a whole, but of some local environment such as a stretch of coastal water, an open sea dumping ground or perhaps a river estuary, and then to develop the requisite control framework for that area, including monitoring of other inputs and effects. For some pollutants which are rapidly degraded or otherwise rendered harmless this will be a needless exercise since they will not persist outside the area of introduction but for others, such as long lived radionuclides, toxic metals or other persistent materials, it will need to be carried out at least in principle.

Applying such scientifically based considerations it is apparent that exposure standards and environmental capacities need to be established individually for different environments and disposal situations even in the context of the same pollutant.[9] Exposure standards for the controlled introduction of pollutants need to be related to critical target organisms, i.e. those most sensitive to the pollutant in question. This sensitivity may be important in an individual sense, as with man, or in a collective population sense, e.g. fishery resources. These standards, when applied to a real environmental situation, need to take account of the particular circumstances relating to that situation. Factors other than the pollutants' innate toxicity to the target organism,[1] which determine a particular environment's capacity to receive waste, such as the degree of dispersion and the nature and uses of the resources involved, must always be taken into account. No two situations are exactly alike and all will require individual assessment, though not always in great detail.

A brief consideration of these points indicates that whilst prohibition of discharge or uniform emission standards may be expedient approaches to regulatory action where the data necessary to generate a proper scientific approach are lacking, their costs to industry and society may be unnecessarily or even prohibitively high. They should certainly never be regarded as anything more than temporary expedients pending a fuller understanding of the real nature of the underlying problems.

Scientific initiatives in the north-east Atlantic area — an outline

In recent years, whilst the initiatives leading to regulatory action have been taken, the scientific community has been attempting to assess the scale of the marine pollution problem in more quantitative terms than existed prior to 1970 or in the years leading immediately to the United Nations Stockholm Conference on the Human Environment. Firstly the Intergovernmental Oceanographic Commission set in motion a series of actions stemming from its proposals for a "Long-term and expanded programme of oceanic exploration and research"[7] by establishing an international co-ordination group to plan a "Global investigation of pollution in the marine environment". From this group came a "Comprehensive plan for the global investigation of pollution in the marine environment".[8] This plan aims to provide a framework within which programmes on marine pollution may be co-ordinated, so as together they can provide an understanding of global pollution problems.

Initially the plan recommends a baseline survey to quantify the rate of input of selected pollutants to the marine environment and to relate this to the observed levels of these pollutants in fish, shellfish, sea-water and sediments. Such relationships, once developed, may be used in conjunction with exposure standards to regulate the input of pollutants to acceptable levels. There of course is a need for parallel research activity to generate the data necessary to establish dose/response relationships and define the appropriate exposure standards. The first regional baseline study undertaken on GIPME lines was in the North Sea and was co-ordinated by the International Council for the Exploration of the Sea (ICES). This

Management of fish stocks

study, which was carried out in 1972, included input pathways and pollutant levels in commercial fish and shellfish and covered trace metals, organochlorine pesticide residues and PCBs. This early North Sea study has helped to set the pattern for subsequent baseline studies by ICES in the wider area of the north-east Atlantic, where a survey has recently been completed at the request of the Oslo Commission, and in the Baltic in conjunction with SCOR.

One of the most important lessons to be learned from these early baseline studies was the need for an effective intercalibration exercise to ensure the accurate and comparable measurement of pollutants in the selected fish and shellfish. It is now widely recognised that such intercalibration activity is an essential component of any internationally co-ordinated marine pollution studies, and similar arrangements to those undertaken within ICES are now being made within the GIPME exercise.

The wider study of the north-east Atlantic was planned in 1975 along lines similar to the North Sea study with the primary emphasis on an evaluation of inputs, and the levels of selected pollutants in fish exploited commercially for human consumption. Special groups were, however, also set up to study the problems involved in the monitoring of biological effects of pollutants in fish and other organisms, to advise on the monitoring of bed sediments and suspended matter and to plan and conduct a survey of heavy metals in sea water.

Results of recent studies in the north-east Atlantic area

The report of the North Sea study was published in 1974[10] and concluded that the levels of the pollutants measured in fish and shellfish were everywhere below the lowest levels established by certain countries as standards for human consumption. Levels were however somewhat higher in the Southern Bight of the North Sea and certain other coastal areas than they were in the open sea, and arrangements were made for regular co-ordinated monitoring of these areas. The results of these co-ordinated monitoring exercises have also been published,[11, 12] and show no adverse changes in the situation.

The results of the later fish and shellfish baseline in the North Atlantic have also been published by ICES[13] and the results of the input study will be published later this year.[14] As with the North Sea baseline study the north-east Atlantic study indicated that the levels of pollutant measured are, with the exception of mercury in some areas, everywhere very low when compared with the lowest levels recommended as safe for human consumption. Fish from Greenland contained rather low levels of mercury, lead and cadmium, as did the fish from the Norwegian and Barents Seas. Levels in the muscle of fish from the middle and northern North Sea are broadly comparable to those in the open ocean. However, levels of mercury in the German Bight, the Bristol Channel, the English Channel and the northern Irish Sea were four to five times higher than in the open ocean areas, and these four areas have been added to the North Sea area as subjects for ICES co-ordinated monitoring exercises.

The levels of pesticides and PCB residues in fish muscle are, for most of the species examined, below 0.01 mg/kg wet weight. Even in species of high lipid content such as herring the highest pesticide level was only 0.076 mg/kg. Levels of most residues were in general so low that little difference could be detected from one area to another. In general PCB concentrations were higher than the total of all pesticide residues in samples taken from the enclosed shallow sea areas and in areas close to land, whereas the opposite tendency was observed in open sea areas. This may suggest that PCB contamination tends to originate from land run-off and coastal discharges whereas pesticide contamination is more widely disseminated by the mode of use and transport through the atmosphere.

Implication for fish stocks

In general terms, the relative importance of the effects of pollutants on marine organisms can be kept in reasonable proportion by a comparison with the losses due to natural mortality or, in the case of fish, with fishing mortality. When considering marine ecosystems or fish stocks, as distinct from human populations, it is not individuals so much as populations which are of interest. The most important effects are likely therefore to be those that operate at the population level, such as effects on development, fertility, fecundity and lifespan. From studies of the mechanisms of recruitment to exploited fish populations, it can be concluded that any effects caused by low levels of exposure to pollutants would be compensated for, at least in the highly fecund species, by density dependent responses. It is thus highly improbable that any effects would be detected when considering natural fluctuations.

Marine ecosystems are inherently very stable, probably because of the complexity of their food webs which permits substantial modification of the pathways of energy flow in the system without detectable effect at the level most commonly monitored by man. Changes at the base of the food web, even if they are taking place, are therefore likely to go undetected. Marine ecosystems are also generally fairly large and it is usually difficult to build up high levels of pollutants because of the flushing action of currents, etc., except perhaps for the relatively closed seas such as the Baltic and Mediterranean. There is also the greater chance in marine ecosystems, as distinct from freshwater systems, of repair of any damage done to the system by the immigration of healthy individuals from other areas.

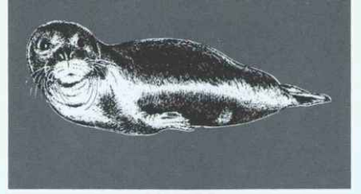
For reasons such as these, co-ordinated monitoring of biological effects within the ICES framework has been deferred pending the acquisition of more detailed knowledge of the factors affecting the stability of marine ecosystems and their dependent fish stocks. However, it is perhaps worth noting in this context that the production of fish measured in terms of the total international catch from the North Sea has as recently as the 1960s doubled in the course of a decade. This in a sea area which is semi-enclosed, with a dense and industrialised coastal population disposing of much of its waste to the sea.

Conclusions

It is not as yet possible, except in the most acute and usually local cases, to either detect or evaluate the effects of marine pollutants on the abundance of fish and shellfish stocks. However, at the levels currently found in the north-east Atlantic area it is unlikely that any deleterious effects exist and virtually certain that they would remain undetected against the background of natural variation and existing stock exploitation.

The concentrations of many pollutants may be fairly readily determined in the tissues of marine organisms, in sea-water and in sediments, but with relatively few exceptions the full significance of these concentrations either for the health of the human consumer or marine organisms is not yet understood. Thus, whilst it is possible to follow the temporal and spatial variations of concentrations of many pollutants in the major compartments of the marine environment, the full significance of the results obtained remains in doubt. Meanwhile movement towards international control of marine pollutants on a regional basis is taking place, much of it within a European framework. It will be some years before the scientific basis for effective regulation within these regional frameworks becomes available. A.P.

A silver flood from the waves – we must learn to harvest not extinguish these resources (Photo C. van der Meulen)



The Parliamentary Assembly of the Council of Europe organised from 26 to 28 October 1977 in Malta a Colloquy on the Conservation of the Living Resources in the North-East Atlantic and the Mediterranean Sea. The aim of this colloquy, which was prepared by the Assembly's Committee on Agriculture, was to review the current urgent problems concerning over-fishing and the means of preserving fish stocks and to examine questions pertaining to rational scientific management and conservation of all fishery resources.

In various recommendations and resolutions adopted earlier on, the Assembly considered that an entirely new situation had arisen in the wake of the establishment in January 1977 of economic coastal zones of 200 miles off the shores of Western Europe. Representatives of science, the fishing industry, governments and competent international organisations were therefore called together to discuss the situation with members of parliament. Scientific experts from several member countries of the Council of Europe presented specialised papers dealing with such topics as the causes of fluctuations in the abundance of fish stocks; the impact of sea pollution on the abundance and quality of fish; fish diseases; fish farming as a solution for the shortage of protein in the world; the enforcement of fishery regulations and the possibilities for a monitoring of fish stocks, as well as the future of fish as a product for human consumption including species at present under-utilised.

The findings of the colloquy will shortly be submitted in a report to the Parliamentary Assembly which will in turn make appropriate recommendations to the Committee of Ministers of the member states of the Council of Europe for action by the governments.

Joern Stegen

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Turbulent waters – turbulent issues (Photo C. van der Meulen)

Ruling the waves

René Jean Dupuy

Until recent years the law of the sea rested on simple and very ancient principles; it was one of the most stable fields of international law. This was because the techniques for using the marine environment and exploiting its resources had undergone few profound changes and the principal beneficiary countries were relatively few in number. These "maritime powers" had good coastlines and, more important, large fleets.

The recent upheavals in the law of the sea are in fact the result of rapid development in maritime techniques and of the greater number and diversity of parties involved.

From navigation to a close grip on the seas

The sea has always been both a medium of communications and a store of wealth. However, the wealth was closely dependent on navigation, which was the principal, indeed virtually the only, use made of the marine environment. The law of the sea was the law of navigation, or movement. The resources exploited were predominantly those available to fishery, an accessory of navigation.

For long ages, man's behaviour on the sea was that of nomads, of whom we have two images: we see them either as peaceful transporters and merchants or as warlike brigands and conquerors. This explains the importance since the 16th century of the law of maritime transport and trade, which is one of the most abundant subject-matters in the law of the sea, and also the long chapters on piracy and belligerence at sea that we find in the traditional textbooks of international law. So it is easy to perceive that the law of the sea arose from the desire to ease navigation, seeing that any delay in sea transport increases its cost.

Thus in traditional law, the product of ancestral custom, which was confirmed and codified by the Geneva Conventions of 1958,[1] the fundamental principle of freedom of the seas seemed to follow from the very nature of things. The sea was open to all for navigation as for fishing, and its resources, mainly biological, were regarded as inexhaustible. At sea every one consulted his own interests.

Centuries passed with hardly any fundamental change in this state of affairs. Man continued his economic exploitation of the sea, based either on transport of wealth drawn from the land or on the pursuit of living creatures. It will be observed that modern man behaves in the same way towards marine fauna as prehistoric man tracking and hunting animals on land. Only very recently has it occurred to him how much more useful breeding would be than just hunting.

Obviously he could not have thought of this as long as it was not technically possible. But while progress has indeed been made in this direction, there has been much greater progress in traditional activities, which has opened the door to practices previously forbidden.

Fishing techniques nowadays make it possible for enormous fleets of ships to occupy large areas and engage in intensive exploitation which is giving rise to grave concern for the protection of fish species, and this at the time when our end-of-century population growth calls for their rational management.

But of course it is the sea and ocean beds and their subsoil that are experiencing the most striking technological development, as a result of which they are now having to be brought under law for the first time. In 1970 offshore petroleum production reached the same figure as world production for 1946. Experimental drillings have been made to a depth of 6 000 metres. Although at present platforms are normally situated above sea beds that are less than 100 metres down, a rapid and spectacular increase in the possibilities of petroleum extraction at sea is to be expected.

The sea bed, whose sole riches in the past lay in the wrecks of sunken ships, apart from sponges, pearls and coral in certain regions, has proved to contain considerable mineral wealth: the ocean beds are covered with polymetallic nodules. These contain manganese, nickel, copper, cobalt and aluminium in proportions that are virtually inexhaustible in the foreseeable future.

Thus, in addition to those activities which presupposed navigation, there are now activities that call for fixed equipment and control over settled perimeters for the exploitation of petroleum or nodules.

[1] The Convention on the High Seas, the Convention on the Territorial Sea and the Contiguous Zone and the Convention on Fishing and Conservation of the Living Resources of the High Seas.

At the same time, the law is having to take cognisance of an additional dimension. Up till now the law of the sea covered only activities carried out on or from the surface. Even submarines were disregarded, in peace as in war, except when they navigated on the surface or attacked ships navigating on the surface. Today, working of the sea bed is adding to the risks of pollution, which hitherto came from the land or from ships, especially oil tankers. Accidents at submarine oil wells are a sensational example of this. In view of the singleness of the marine environment, the sea bed, the body of water above it and the surface are ecologically interdependent and the law must cover all three levels if the environment is to be protected.

Since the problems created by these far-reaching technological changes demand adjustments to the law of the sea, it is to be expected that they shall inevitably give rise to political problems, whose gravity is increased by the growth in recent decades in the number of parties active on the international scene.

The traditional law, being concerned with navigation, was naturally the work of those states that had transport and fishing fleets. Since the second world war the number of states in the international community has trebled, and the new protagonists are developing countries. Thus the fact that the law of the sea is being questioned must be seen as a challenge to the system set up so long ago by the Great Powers; the wind of change is blowing over the sea too.

From freedom of the seas to their appropriation

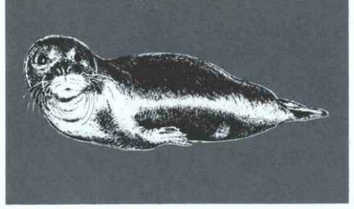
The principle of freedom of the seas left only a small place in the marine environment for sovereignty, which in fact, where most coastal states were concerned, covered only a three-mile wide strip of territorial sea. As long as the major use of the seas and oceans was for navigation, the maritime powers were more interested in having the use of immense tracts of the high seas under a system of free access than in possessing wide areas adjoining their coasts. Three miles of territorial waters were enough to safeguard a coastal state's security, whether military, political and economic (through customs control and exclusive fishing rights). The technological development that has made possible the establishment of fixed installations, in particular those for the working of petroleum resources, was bound to change the attitude of coastal states, just as the population explosion and food requirements were to make them want to control the living resources of the sea, which are mainly to be found in an area stretching a few dozen miles from the coast.

However, the first claim to sovereign rights over large areas of sea was made by the United States, concerned mainly with energy resources. In 1945 President Truman, in a declaration never forgotten since, affirmed such rights over the American continental shelf. His example was very quickly followed by the Latin American states, which unlike the government in Washington did not confine their claims to the continental shelf but extended them to the sea above the shelf and to its biological resources. In 1947 Chile, Peru and Ecuador, having been deprived by nature of a continental shelf, claimed by way of compensation full sovereignty over a 200-mile zone of the surface and ocean bed.

The 1958 Geneva Conference did not accept their pretensions. It merely recognised the notion of the continental shelf and the sovereign rights of coastal states over its sea bed and subsoil; the water over the shelf remained part of the high seas and therefore free of access. However, the convention adopted on that occasion gave an ambiguous definition of the continental shelf, applying two criteria: the first of these, a very simple one, was that the shelf extended to a depth of 200 metres, whereas according to the second, which was much vaguer, the shelf's limit was the limit of the workable area. This was to give rise to serious difficulties when technical progress unforeseen in 1958 made it possible, less than ten years later, to drill to a depth of several thousand metres: should the continental shelf extend to the median line of the sea or ocean or should it be considered as adjoining the coast and so confined in law to coastal areas?

The question became especially acute when the United Nations General Assembly, in a Declaration of Principles passed on 17 December 1970, proclaimed the sea bed and ocean floor outside the limits of national jurisdiction to be "the common heritage of mankind". Where did the powers of the coastal states end and this common heritage begin?

The need for a conference to answer this question was obvious. A Committee on the Sea Bed set up in 1968 was given the job of preparing for it. At the United Nations it seemed inevitable that the conference should not be limited to this one problem but should undertake a general review of the law of the sea. This is hardly surprising if it is remembered that a considerable number of states resulting from decolonisation had not taken part in either the 1958 or the 1960 Conference. The 3rd Conference on the Law of the Sea therefore provided an opportunity for the third world to challenge the traditional law, and also for the entire membership of the international community to join in working out a new law. As could have been foreseen, this proved a highly difficult undertaking.



Ruling the waves

The 3rd Conference on the Law of the Sea

The grand debate on the sea, formally opened in the General Assembly in December 1973, began to produce results at Caracas in the summer of 1974. After that ten-week session it resumed at Geneva in 1975 for eight weeks, followed by two sessions of the same length in New York in 1976 and 1977.

At present a further session is planned at Geneva in the spring of 1978. However, there is some doubt about the ultimate success of the undertaking. Can a convention be worked out within the next few years, and if so will it obtain a significantly high number of ratifications among the industrial states, the principal users of the seas, or will it rally only developing countries?

The conference is faced with two sets of problems, relating to individual and collective appropriation of the seas.

Extension of the rights of coastal states

The coastal states intend that the convention which the conference is expected to produce should confirm the extension of their rights in the areas of sea adjoining them.

To start with, the territorial seas, on whose extent states were unable to agree at the 2nd Conference on the Law of the Sea at Geneva in 1960, is to be extended to twelve miles in accordance with the consensus already reached at the 3rd Conference in 1974. Several countries have already effected such extensions unilaterally. This, while natural in view of present-day requirements and the techniques available for meeting them, nevertheless raises serious problems. In particular, such a rule will change the status of more than a hundred straits which previously contained a corridor forming part of the high seas and open to navigation between bands of territorial waters three miles wide. The straits in question will henceforth fall entirely within the territorial seas of the two coastal states, or of a single state bordering the strait on both sides. In particular this will affect the movements of nuclear submarines which, both for reasons of security and because of ecological considerations, coastal states wish to make subject to the rules governing the territorial sea. These rules require such vessels to navigate on the surface flying their flags, whereas the Great Powers maintain that the straits are international waterways which should be freely accessible to all and that the world military balance requires mobility of forces and secrecy for their movements, and hence navigation in deep water to make detection, or at any rate identification, impossible.

A drilling platform arrives over the horizon – who rules the ocean floor and its resources?
(Photo C. van der Meulen)

The most spectacular manifestation of the phenomenon of appropriation of the seas is the new notion of an exclusive economic zone 200 miles wide. It will be remembered that after the second world war Chile, Peru and Ecuador claimed full sovereignty over zones of this width. Several other developing countries subsequently followed their example, arguing the need for their own economic and social advancement. Whereas in the case of the Latin American countries bordering the Pacific the figure of 200 miles was chosen because it would reach as far as the Humboldt Current, which is very rich in fish, the other countries made equal claims without having access to any such current, the 200-mile limit having acquired the value and potency of an indestructible political myth.

Following the Caracas meeting in 1964, the question arose whether the maritime powers would ultimately accept such an extension of the sovereignty of the coastal states: it seemed most unlikely. A compromise was therefore worked out by the moderate Latin American states and the African states involving an exclusive economic zone distinct from the territorial sea. The coastal state exercises full sovereignty over the twelve miles of territorial waters, whereas in the 188 miles beyond these it has only special rights relating to fishing, exploitation of the mineral resources of the sea bed and its subsoil, scientific research, pollution control and the installation of artificial islands and other equipment. Hence the economic zone still differs from territorial waters in that foreign navigation there, including over-flying and the laying of underground cables and pipelines, remains unrestricted.

Fishing rights have become a world-wide topic
(Photo C. van der Meulen)

But the economic zone does not form part of the high seas. The coastal states again succeeded at the 1977 meeting in securing a provision, in the text providing the basis for negotiation at the conference, that the high seas should only start at the 200-mile limit. The result is that the economic zone is considered as being in a category of its own, and this involves the risk that, with time, the rights of coastal states will come close to full sovereignty, with the residual exception of freedom of navigation and freedom of communications.

Within its exclusive economic zone the powers of the coastal state are considerable. In the matter of fisheries, for example, it may stipulate authorised catches and also decide how much it may catch itself. The great majority of species are found within the 200-mile limit; hitherto they were in the high seas and could be fished by all. This represents a considerable challenge to the world's entire fisheries system, for states that traditionally fished in such regions will now have to pay dues or taxes to the coastal states.

The great maritime powers have accepted this notion, despite the hardship to fishers, because of the exclusive rights it gives them off their own coastlines. On the other hand, inland states and states with geographically disadvantageous coastlines or with coastal waters poor in fish are against allowing the coastal states excessive rights. Their countries have joined in the "Group of 77", which comprises third world and industrial states. Thus the conference is witnessing the break-up of the traditional regional or socio-economic groups into which the United Nations usually divide. The inland and geographically less favoured states, whether developing or industrialised countries, would have preferred the economic zone to form part of the high seas, where the principle of freedom of the seas prevails. The rights of the coastal states would then have been treated as exceptions to this principle and would have had to be interpreted restrictively. The failure of the other states to achieve this makes them afraid that the compromise represented by the economic zone will prove fragile. It also appears that the countries of the third world are very divided on the status of the economic zone. Some inland developing states claim not just access to the resources of the nearby economic zones, but rights in them equal to those of the riparian states; they consider such areas as regional or subregional zones rather than extensions of the coastal states.

The need for international rules establishing differentials or categories to take account of states' varying relationships to the marine environment is apparent also in the definition of the continental shelf. If in theory this is identical with the sea bed of the economic zone, the fact remains that any state with a shelf going beyond 200 miles will want to keep control over it.

Similarly, states consisting of archipelagos are not merely claiming the status

Ruling the waves

of interior waters for the vast expanses between their islands; having drawn straight base lines between the islands' extreme points they are seeking to obtain recognition for an economic zone of 200 miles beyond this immense polygon. Their immediate neighbours and other states at a geographical disadvantage are obviously protesting, in anger at this constant whittling away of the "common heritage of mankind".

The individual situations of the participating states seem to have received less consideration in the conference's proceedings on a scheme for collective appropriation of ocean depths beyond the economic zone, beneath the high seas.

A common heritage of mankind

Negotiations on the ocean depths are an occasion for the third world countries to manifest their unity in the face of the developed countries. The principles laid down by the United Nations in 1970 seem to have inspired the approach to these depths, stating that they are to be used solely for peaceful purposes and calling for the establishment of an international organisation to ensure their rational and programmed management in such a way as to meet the needs of mankind whose "common heritage" they are.

The notion of a "common heritage of mankind" undoubtedly indicates an international public domain, mankind being understood in the intemporal sense that present generations are responsible for preserving this heritage for generations to come. However, implementation of the principles is giving rise to a strategic confrontation between the power blocs and those who have the advantage of numbers, between the countries which have wealth and technology and those whose economies are underdeveloped. The issue is: who is to have the power in the international authority that is to ensure the supranational management of the resources of the ocean depths?

The disagreements become manifest over the constitution of the authority's organs. The plenary assembly will certainly follow the traditional pattern of inter-state democracy, with one vote for each state. But will the council, which is to have fewer members, be based on the same principle, as the developing countries wish, or on a representation of interests with states grouped according to whether they are consumers or producers of raw materials or according to other economic factors, as the industrial countries want, whether capitalist or socialist?

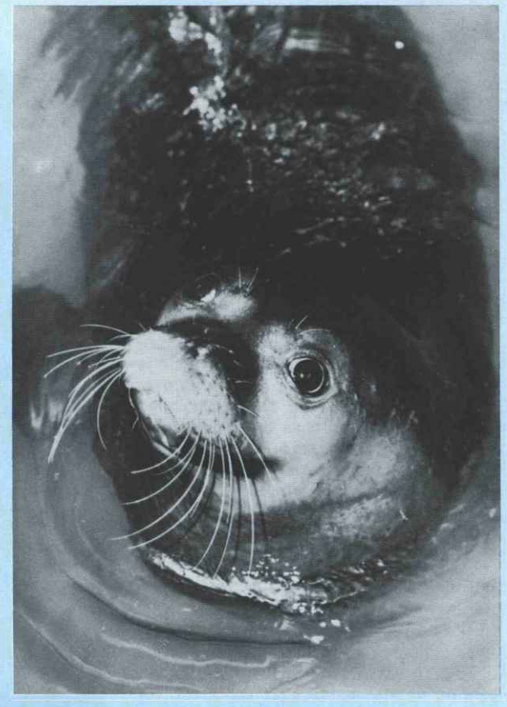
At present the most difficult problem is the rules for exploitation of this international zone. Such exploitation will be mainly concerned with plurimetallic nodules. Will states or the companies they sponsor have a guaranteed right of access to such areas, as the industrial countries demand? Or will the developing countries get their way and secure the principle that the international authority, which they hope to control, is to have sole charge of activities in the zone, subject to its discretionary right to lay down conditions in which it may associate states or private undertakings in any operations it decides to undertake?

The states of the third world tend to wish to control management of the resources of the ocean depths in the international zone in order to secure any profit for their own development, whereas the industrialised countries answer that the international organisation envisaged will not have adequate financial and technological resources to undertake such extensive activities alone. It is on this problem that the two sides are at present having the sharpest disagreements, and the last session, which ended in July 1977, came nowhere near solving them, the industrial states finding the latest version of the text for negotiation, published at the end of the session, unacceptable since they consider it unduly favourable to the arguments of the "Group of 77".

Since it is intended that a single convention should cover all the problems examined by the conference, persistent disagreement on the system for exploitation of the international zone would entail the conference's failure. To be sure, after all these long debates, the law of the sea as such will no longer be the same as was codified in 1958. Several states will legislate unilaterally to give effect to various notions that came to be accepted during the conference. Thus already more than thirty states have arrogated fishing zones, economic zones or even territorial waters 200 miles wide. Similarly, for the ocean depths beyond the economic zone the United States, at present the only power in a position to dredge and exploit plurimetallic nodules in the immediate future, has on several occasions threatened its partners with unilateral action if the conference should fail or drag on unduly.

The efforts made to secure a convention on the law of the sea are running into the same difficulties as states are encountering more generally when trying to overcome all the disparities and discrepancies between them in order to establish the international community that the coming century demands. R.J.D.

Symbolic airview of mother and calf. Southern Right Whale (Eubalaena australis): must they disappear into cosmetics and motor oil?
(Photo Des and Jan Bartlett, *Survival*, Anglia Television Ltd)



Monachus monachus
(Photo Aquario Vasco da Gama, WWF)

Warm blood in cold waters

Jon Barzdo and Joanna Gordon Clark

Marine mammals attract a good deal of attention, not only because they are generally attractive, but also because an important source of future protein may lie in their stocks and because with few exceptions their numbers are diminishing, with incalculable consequences for the ecosystems in which they occur. At the Scientific Consultation on Marine Mammals organised by the Food and Agriculture Organisation in Bergen last year, a resolution was passed urging that the objectives of man for marine mammals should be decided in the United Nations system. In European waters the species include dolphins, whales, seals and polar bears.

The world population of polar bears (thalarctos maritimus) is estimated to be between 5 and 10 thousand, and in 1973 an agreement on their conservation was signed by Denmark, Norway, USSR, USA and Canada, allowing only aboriginal hunting and on a quota basis. Killing is forbidden in King Karl's Land (near Spitzbergen). The seals in Europe include the Common (phoca vitulina), Grey (halichoerus gryphus), and Mediterranean monk (monachus monachus), all of which are killed by man for their skin, meat, oil and alleged damage to fisheries. In the case of the Monk seal the resulting reduction in population means that the species is now endangered, numbering less than 500 individuals.

Greatest mammals

However, possibly the greatest concern at the moment focuses on whales. Europe is involved because of her extensive use of whale products, and because the Netherlands, Denmark, France, Iceland, Norway, USSR and the UK are all members of the International Whaling Commission (IWC). Of these, Denmark, Iceland, Norway and USSR are all whaling countries. While the UK has protected whales within its 200-mile coastal zone, it is likely that this will be relinquished in exchange for Norwegian fisheries.

Last year the Ministry of Agriculture, Fisheries and Food of Great Britain received more letters about whales than on any other subject. Throughout the world interest in their plight is increasing but not a moment too soon for the whales. For the great whales, one by one, are being exploited to the edge of existence.

Since 1946 the IWC has been trying to manage whale populations, but only half of the whaling nations belong to the Commission (including Russia and Japan, who account for 75% of the overall catch), and none are bound by its recommendations. While claiming to abide by the IWC's recommendations, Japan is moving against the spirit of the whaling convention by financing whaling fleets in non-IWC countries. The latest of these moves is in Chile. A Japanese fishing vessel has been sold to a Chilean company fitted out to catch whales and the Chilean Ministry of Agriculture has issued a licence for it to kill 1 500 Sperm (physeter catodon) and Sei (balenoptera borealis) whales in the next three years.

The IWC's present management system is based on an entirely theoretical concept — the maximum sustainable yield level (MSY). This is the theoretical population level at which the largest kill of whales can be sustained without causing a further decline in the population, and it is the aim of the IWC to reduce whale populations to that level. But the system is constantly under attack from scientists and conservation bodies such as Friends of the Earth and the International Union for the Conservation of Nature and Natural Resources, not least because it doesn't work. The IWC is constantly over-exploiting whales. In calculating MSY there are too many errors involved, and resulting estimates may be as much as 50% inaccurate. The evidence lies in the catches:

in 1972 38 600 whales were caught; this year's quotas are 17 830 and the whales being caught are smaller.

When the IWC was formed Right (balaena mysticetus) and Grey whale (Eschrichtius gibbosus) populations were already so depleted that the Commission offered them immediate protection. But the management of whales seems to have done little more than slow down the rate of depletion. Even so, the catch has been excessive, so that it has been necessary for the IWC to set zero quotas for Fin (balenoptera physallus) and Bryde's (balenoptera edeni) whales and some areas of Sperm whales in the southern hemisphere and Fin, Sei and male Sperm whales in the North Pacific.

Significantly, this year the IWC made the greatest reduction of catch quotas in its thirty-one-year history; an overall reduction of more than 10 000 from last year's 27 939. This largely reflects the past overhunting of whales but also, especially for Minke whales, the lack of sufficient knowledge of whale populations and ecology; a clear indication that whales are not being killed on a "sustainable" basis. And here it is worth remarking that no species of whale has yet been totally protected until it has become endangered. Not a good sign for the stocks and species currently exploited. When the Blue (balenoptera musculus) and Humpback (megaptera novae-angliae) whales were finally protected in the mid 1960s their populations had been reduced to 6% and 7% respectively of their initial numbers, and there is no sign that they are recovering.

Whales are not the only animals whose populations are disturbed. In the Antarctic all the evidence is that, as a result of the massive depletion of Blue and Fin whales and others, their chief food — the shrimp-like krill — in increasing has led to a population growth of other species which feed on krill. These include penguins and Fur (arctocephalini) and Crabeater (dobodon carcinophagus) seals. The complexity of the Antarctic ecosystem is such that the outcome of this disturbance is unpredictable. And the problem is enlarged by the growing fishery of krill, experimentally by Japan, Chile, Poland, Norway and the Federal Republic of Germany, and commercially by the USSR.

Thalarctos maritimus – protected throughout its range
(Photo Jeffrey C. Stoll, "Jacana")

Scientific values

Until 1977, the Sperm whale was the species of which greatest numbers were killed by the whalers. For the North Pacific this year's IWC found it necessary to cut the quotas from 7 200 to 763, including complete protection for males. The average weight of Sperm whales caught has declined markedly in every area of the Antarctic. This, the only toothed "great whale", has a special feature. "The enormous surface of the brain cortex and its luxuriant and highly convoluted appearance still appear to be sound arguments for considering the cetaceans as potential intelligent and highly developed fellow-beings . . . we are dealing with special creatures with remarkably developed brains . . . their kinship with man at the level of neurological development holds us in awe and fascination." So says Peter Morgane, senior scientist at the Worcester Foundation for Experimental Biology. The fact that the Sperm whale may be one of the most intelligent species of animals, possibly even more intelligent than man, is powerful support for the moral argument against their slaughter. They may be thinking animals in the true sense.

Whale derivatives are used in the manufacture of many products in Europe, and the only positive action on trade taken by any European nation was in 1973 when the UK banned the import of primary Baleen whale products. From Baleen whales (e.g. Minke, Sei, Bryde's — those filter feeders which take krill and other small species) particularly oil and meat are used. France, Germany and Netherlands between them imported over 13 098 tonnes of whale oil in 1976, but this figure from H.M. Customs data may include some Sperm whale oil.

Most of the meat from Sperm whales is used in animal foods, for instance to feed mink on Norwegian fur farms. The customs data indicate that France is the main user of spermaceti which comes from the forehead of the Sperm whale and is used in the manufacture of cosmetics, 123 000 kg having been imported to that country last year. Sperm oil from the head and blubber is used in softening tanned leather for clothes (especially fashion gloves and some shoe uppers) and as a lubricant in some gear oils. In the UK and France the major objector to a ban on the import of sperm oil is the leather industry. Britain imported 8 527.7 tonnes of sperm oil last year, worth £ 2 078 344. Japan exported a very similar amount to the Netherlands and 2 000 tonnes less to Germany. The centres of the fashion leather industry are UK, France, Italy and Germany, and all use quantities of sperm oil. Yet substitutes are available for all essential uses.

The lack of substitution is the more surprising because sperm oil is expensive (UK price, September 1977: £ 680 per tonne) and the cost is rising rapidly. This is not surprising in the light of the decreased catch per unit effort and the annual reduction of the quotas; if this year's enormous cuts are upheld the price can reasonably be expected to rocket. Those whose employment relies on the use of sperm oil may find themselves redundant if their employers don't change to substitutes very soon.

H.M. Customs statistics available indicate that European countries account for over 50% of the annual production of sperm oil. USA and New Zealand have banned the import of all whale products, setting an example for other conservation-minded nations. While the Sperm whale may not yet be in danger of extinction it is undoubtedly over-exploited, and we can at least hope that those who demand the slaughter by requiring the products will let up before the species becomes endangered this time. Regrettably there is no precedent for this. Friends of the Earth in the UK are encouraging consumers to boycott leather products until they can be sure that no sperm oil has been used in the process of their production. The labelling of leather goods to indicate whether or not they contained whale oil would indicate a reasonable degree of good will on the part of the manufacturers; it would also give consumers the opportunity to choose.

European countries that are concerned about marine mammals could conserve them now by protecting them in their newly declared 200-mile essential economic zones. Preferably without a proviso for killing in exchange for other resources.

J.B. and J.G.C.

THE SEAS MUST LIVE

John H. Loudon

We need the riches of the seas today as never before. Over half the people in our world are under-nourished, and even if we are successful in controlling the population increase, which so far we are not, human numbers are almost certain to double by the end of the century.

Strenuous efforts are being made to improve the productivity of food crops and to raise more livestock, but only 10% of the land on our planet is suitable for cultivation and there is a limit to what it can support. Thus the possibility of increasing harvests of seafood is seen as the best solution to feeding hungry mouths.

Several years ago the marine fish harvest reached 60 million tonnes a year. But it has remained more or less static since then, and while some argue that the take could be doubled, others believe that only a relatively small increase can be achieved. Both sides agree on one thing: we shall only raise the harvest if we conserve the seas and the life in them.

But what is happening? Over-fishing to the point of destruction of once rich fisheries, and pollution with industrial effluent and oil spills, which kills marine organisms. At the same time we are turning many coasts, whose marshes and tidal areas are the foundation of many of the world's richest fisheries, into concrete barriers between sea and land by industrial and other development.

No good farmer would treat his land like this, nor would an industrialist destroy the machinery which produces his livelihood.

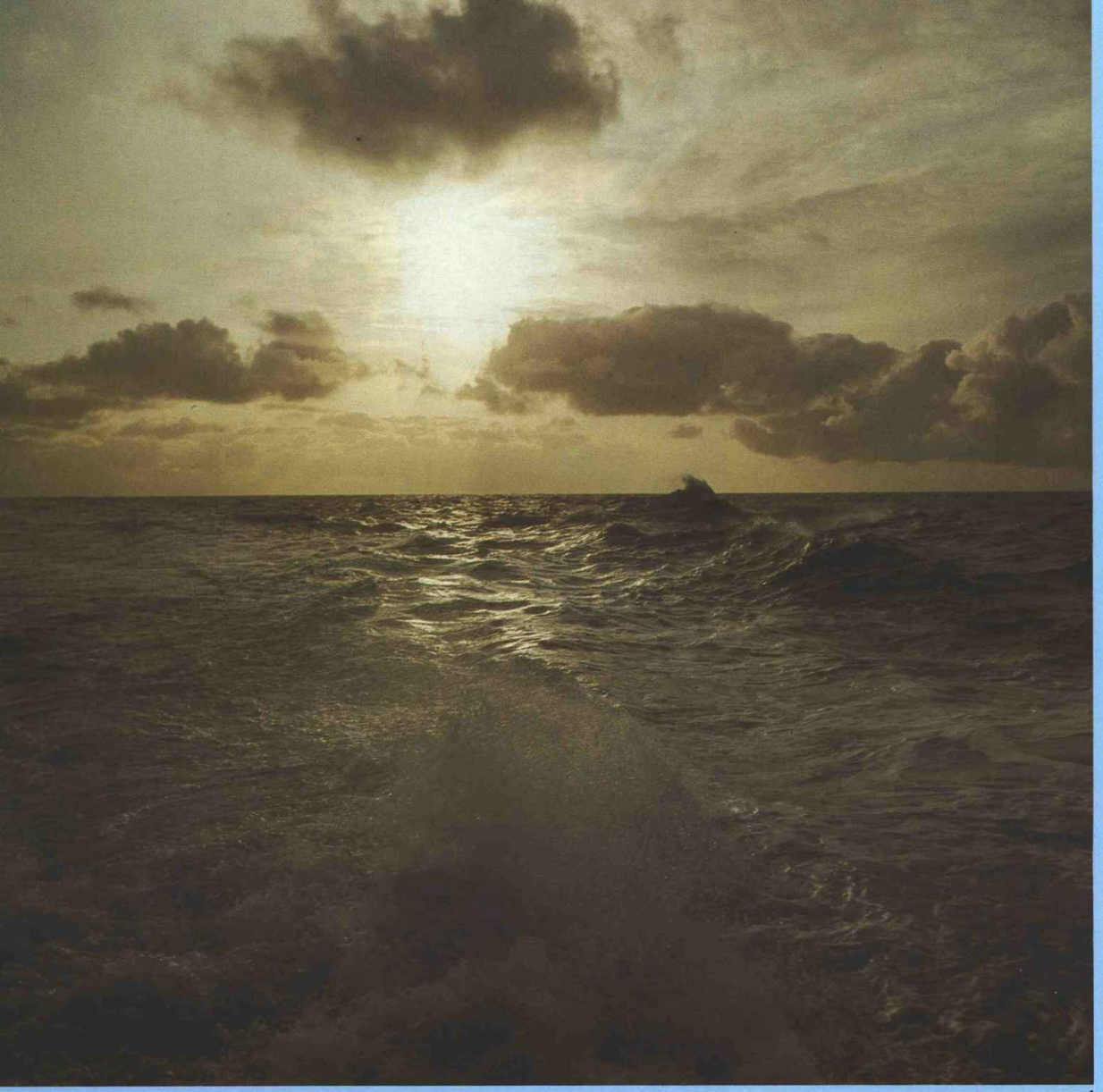
The poisoning of the seas is one of the most critical situations. The extreme case was at Minamata in Japan, where industrial effluent poured into the bay was taken up by fish, and many people who ate them died and others were severely crippled. In a number of other places fish have been declared unfit for human consumption because they have accumulated dangerous levels of poisons from pesticides and effluent which has gone into the seas.

The dangers of new man-made poisons first became apparent during the 1950s when large numbers of birds, especially birds of prey, were found dead. The cause was traced to pesticides used to protect crops which got into the chain of plants and smaller animals on which they lived. Because we too are higher animals living at the head of food chains, action was taken to control the use of pesticides, especially in Western Europe and North America.

The birds of prey were a dramatic example of how wild animals act for us like the miner's traditional canary whose collapse indicated the presence of dangerous gas.

The World Wildlife Fund's campaign "The seas must live" was launched to ensure that action is taken in time to stop the destruction of marine life and to maintain its potential to provide us with food. The programme has been prepared by leading world marine scientists brought together by the International Union for Conservation of Nature and Natural Resources

(Photo G. Vienne, WWF)



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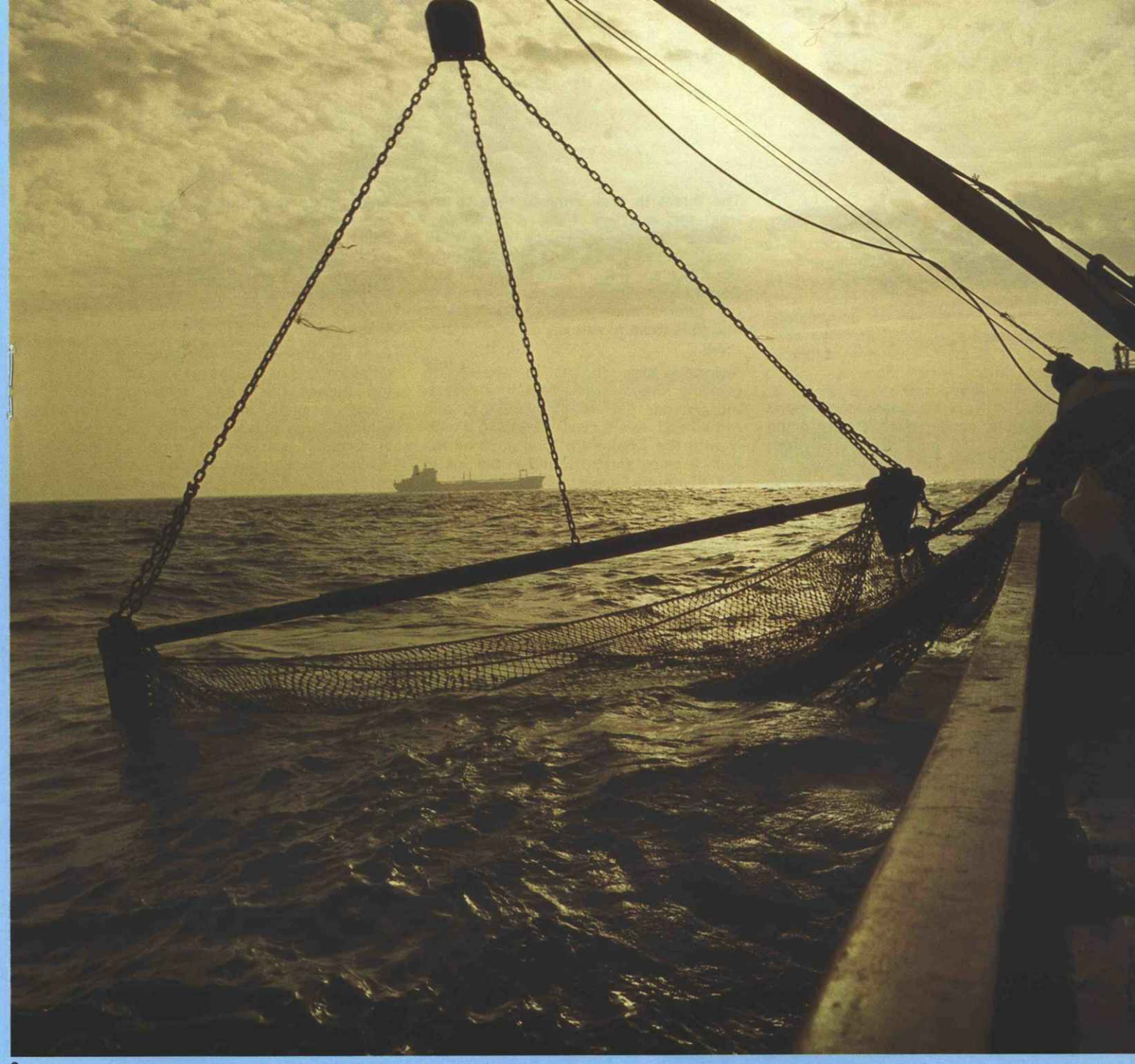

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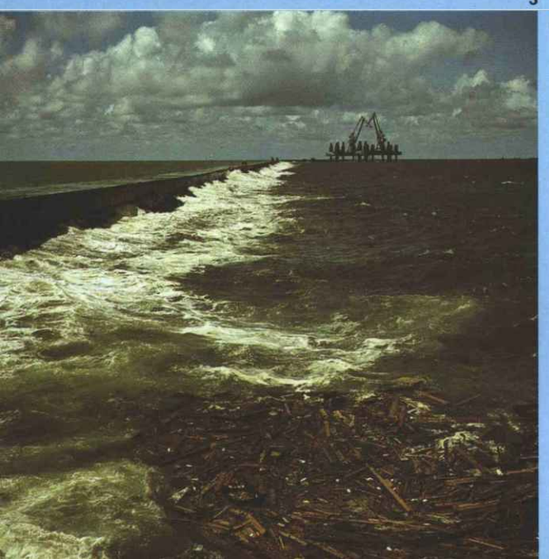

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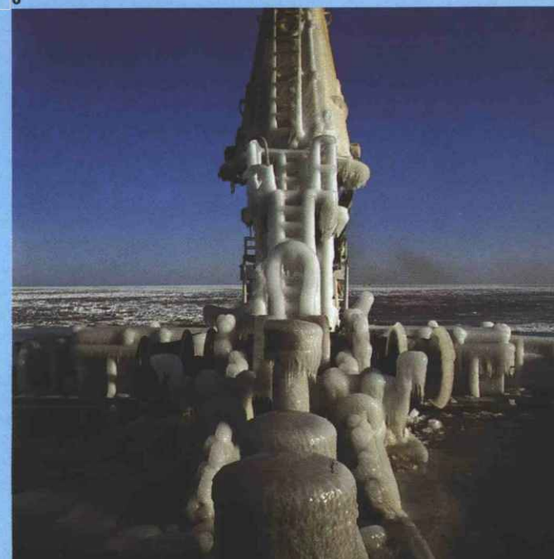


(IUCN). The work has been co-ordinated with marine conservation efforts being carried out by the United Nations Environment Programme, FAO and Unesco.

Many of the projects and priorities for action concern spectacular sea animals, such as whales, dolphins, seals, turtles, and seabirds — and they are in trouble. Action to save them is action to conserve the health and productivity of the seas on which we rely. This aim is also reflected in projects to promote rational management of resources and marine areas.

The warm-blooded, air-breathing whales have been slaughtered for lighting and lubricating oils, whalebone, soap, margarine, cosmetics and catfood.

Some species are still being driven towards extinction, notably the Blue whale (balenoptera musculus), the greatest creature known to have lived on earth, growing to 30 metres and weighing up to 130 tons. And this despite the fact that whaling has declined in the past ten years.

Protection attempts

In 1965 a turning point was reached when the major whaling nations, having practically wiped out the Blue whale, agreed that it should be hunted no more. Only Japan and the Soviet Union now send out annual whaling expeditions, and under pressure they have been forced year by year to reduce the numbers they catch.

By now, however, the whale populations have been decimated to a critical degree. Of an estimated 200 000 Blue whales at the beginning of this century, only about 5% remain, and others such as the Humpback (megaptera) and Fin whales (balenoptera physallus) have fared little better.

Captions to colour illustrations

1. C. van der Meulen
2. C. van der Meulen
3. C. van der Meulen
4. *Sepia officinalis* (C. Pétron)
5. *Antiopella cristata* (Winner – "Jacana")
6. C. van der Meulen

The threat to their survival now comes from two quarters. First, a number of nations still catch whales along their coasts, notably Australia, Brazil, Chile, South Korea, Peru, Portugal, Spain and South Africa. Several are not members of the International Whaling Commission and thus there is virtually no control over them.

Secondly, new threats to whales are growing: their feeding, calving and resting grounds are being increasingly disturbed and we are even competing directly with the whales for food such as the Krill. A small shrimp found in billions in the Southern Ocean around Antarctica, the Krill is the sustenance of the great baleen whales.

The World Wildlife Fund's whale conservation programme is actively seeking answers to these problems, complicated as they are by our relative ignorance about the whales' life patterns and behaviour.

The programme is bringing together the world's leading whale scientists to plan and promote an international system of whale sanctuaries. It is also helping to support research in order to provide a firm scientific basis for conservation measures, and it is pressing national and international authorities for action to save whales.

THE SEAS MUST LIVE

Apart from the great whales there are many smaller species, including the dolphins and porpoises, in equal need of protection. Some are hunted for food and oil. But the worst toll of dolphins and porpoises results from tuna fishing, where they are not the quarry but merely an aid to finding it.

Tuna fishermen discovered long ago that dolphins and porpoises leaping about on the surface often had yellow-fin tuna shoals beneath them. They have developed huge purse nets which succeed in catching not only the tuna but also many of the dolphins, which are trapped in the mesh and drown because they cannot breathe.

It is estimated that well over 100 000 dolphins and porpoises are still uselessly slaughtered like this every year, and the figure used to be much higher. But while United States' tuna fishermen are being controlled and pressured to adopt methods to save the dolphins, no one is doing anything about the tuna fishermen of other nations.

A tribute paid by other species

This casual slaughter of non-target species also affects other marine animals (seals, sea-cows, turtles and birds) and so the World Wildlife Fund programme will pursue a dialogue between scientists and push forward remedial measures. Effective steps will help the fishermen themselves because they waste time disposing of the unwanted animals and suffer costly damage to gear.

The small whales and other marine animals also face a threat from sea pollution by industrial effluent in some areas. A study of the problem is being undertaken in the North Sea and the Baltic Sea, which are particularly affected.

The seals are in general less severely threatened than the whales, but the only warm water species, the Monk seal (monachus spp), is in serious trouble. The Caribbean monk seal is considered extinct, and the Hawaiian has been placed on the US Endangered Species List. The Mediterranean monk seal survives, and numbers about 500 in scattered groups round the basin and along the Atlantic coast of north-west Africa. Only a concentrated effort to establish viable sanctuaries and to educate fishermen not to regard the seals as dangerous competitors can save the Monk seal.

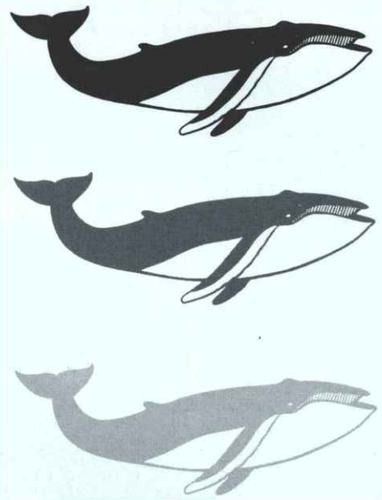
Around north-western and northern Europe, from the Wadden Sea to the Baltic, the seals are badly affected by human disturbance, industrial effluent, and pesticide pollution of the shallow seas. In the Baltic there have been many still-births and many adult females have damaged reproductive systems. The World Wildlife Fund is therefore promoting population, breeding and pollution studies and the establishment of sanctuaries.

Sea mammals that could be of great value to mankind are the Dugongs (dugong dugong) and Manatees (trichechus senegalensis) of the fringes of the tropical Atlantic and Indo-Pacific oceans. Known as sea-cows, they browse on sea grasses and other aquatic vegetation and turn them into red meat. Furthermore the Manatees have already demonstrated that they can be used to keep waterways free of choking weed. But almost everywhere the sea-cows are under severe pressure, their habitat being destroyed by reclamation and pollution, while they are actively hunted, besides being incidentally caught and drowned in fishing nets, or killed or injured by power boat propellers. We must make a major effort to protect the survivors and try to rebuild the numbers with a view to both the survival of species and productive farming of a wild animal.

The Marine turtles too are another extremely valuable natural resource which is mismanaged and over-exploited. The Green turtle yields red meat, and, along with other species, its eggs are good to eat. Local peoples have traditionally exploited the turtles, but in recent years this has got out of hand as human populations have grown and spread to previously undisturbed areas. Breeding beaches have been destroyed or are disturbed so that the turtles no longer use them. A new problem is the devastating toll of turtles caught incidentally in the nets of shrimp trawlers, whose numbers have exploded in recent years.

The World Wildlife Fund has long been supporting turtle conservation work and, in the marine programme, projects are under way or planned in the western Indian Ocean, including Oman, Seychelles, India, Pakistan and Sri Lanka, and in Malaysia, Mexico, Panama, Solomon Islands and Turkey.

THE SEAS MUST LIVE



Projects of special interest to Europe include proposals for a "Green Route" for waders migrating along the coast to and from their breeding and wintering areas. Estuaries and wetlands in Denmark, Germany, the Netherlands, Belgium, France, England, Scotland, Wales and Ireland, Portugal, Morocco and Mauritania support tens of thousands of birds at a time, which are completely dependent on them for feeding, resting and moulting. The birds play an important role in the ecology of the coastal wetlands, which are usually the basis of rich commercial fisheries. The plan is to achieve the conservation of these important wetlands and to promote public awareness of their importance.

Conservation efforts are continuing for the White-tailed sea eagle in northern Europe in which the World Wildlife Fund and other conservation organisations in Denmark, Finland, the Federal Republic of Germany, Norway, and Sweden are collaborating. This magnificent eagle is gravely menaced by pollution which is affecting its reproduction, and by disturbance of nest sites and feeding areas. Protection of a number of key sites has already been achieved, and feeding with unpolluted offal has provided a respite, although in the long term the major problem of polluted seas has to be solved if conservation is to be successful.

Apart from tackling the problem of species, the World Wildlife Fund and the IUCN are working to establish good management of rich and highly productive marine areas. A prime example is the Southern Ocean, which girdles the globe between Antarctica and the southern tips of South America, South Africa, Australia and New Zealand. It is the home of whales, seals, penguins, seabirds and fish, where man has been a comparatively recent intruder. At the heart of the wealth of the Southern Ocean are the Krill, the food that fuels the growth of the great whales and supports the abundance of other animals. It has the same protein composition as beef steak, and it has been estimated that an annual catch of 70 million tonnes — equal to current global fish catches — could provide 20 grams of animal protein daily for 1 000 million people.

The harvest of krill has already started, and although the take is currently small we are on the verge of an explosive growth. The Southern Ocean also contains large stocks of Antarctic cod and other fish, which are about to be exploited, while the Antarctic continental shelf appears likely to become a source of oil. The Antarctic Treaty, which froze territorial claims and was to promote international co-operation in scientific research, was not designed and is not adequate to control the imminent explosion of natural resource exploitation, particularly on the high seas.

It is obvious that the massive harvesting of krill will have wide ecological implications, involving the whales, seals, penguins and fish, even though its full significance has still to be investigated. A scientific basis for rational exploitation of Antarctic resources is urgently required, to ensure that their productivity is maintained *in perpetuum* for the benefit of our growing human population and for the animals which form part of the ecosystem.

In seeking to provide this basis the World Wildlife Fund and the IUCN are collaborating with the International Institute for Environment and Development, headed by the eminent economist and conservationist, Barbara Ward (Baroness Jackson). The Institute has already started studies of the political and legal aspects of resource exploitation in the Southern Ocean and Antarctica, and these will be supplemented by scientific studies covering ecology and biology to make an interdisciplinary project. It is intended that the study should establish how krill can be used to alleviate the world food crisis without gravely jeopardising the critical ecology and therefore the ultimate productivity of the region.

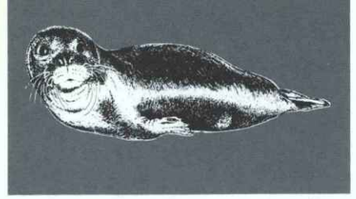
The project will also contribute to establishing patterns of management of natural resources in other parts of the world.

I feel that it is especially appropriate to close this article by stressing the importance of management. For too long we humans have been conducting a sort of "smash and grab" raid on natural resources, and only because we were able to go further and further afield have we been able to continue. But now we know the limitations of our environment, and it is clear that, unless we change our ways and act as good managers of all resources, disaster lies ahead. J.H.L.

Superships

Transport of energy

Pierre Carfantan



For twenty-nine years, almost half of them as a ship's captain, I have been faced with the problems of transporting petroleum products by sea. To the majority of laymen, the captain of an oil tanker is almost automatically a "polluter". Although justified in some cases, the description cannot be applied to the great majority of us who endeavour, within the limits of the technical means available, to keep such pollution to the unavoidable minimum dictated by operating accidents. The scale of the problem, and its repercussions on the world biological equilibrium, justify measures to preserve the life of the oceans, upon which the balance of life on land depends. Criticism is rife, easy to make, and strikes a profound chord of sympathy with the public at large. But what has been done to help us reduce, and perhaps eliminate, such pollution?

In their constructive aspects, the regulations governing the transport of oil products by sea are designed to ensure the safety of the vessel and its crew. The only rules governing pollution are of a restrictive kind. They are all intended to deter, but do not offer a means of tackling the problem. The captain of an oil tanker which pollutes the sea, more often than not by accident, lays himself open to fines or imprisonment or both. It is rather like a penalty imposed on a driver forced to drive a vehicle with faulty brakes and unable to stop at a traffic light.

It is mainly on the high seas that pollution by oil waste occurs. Apart from a few spectacular accidents, like the *Torrey Canyon* and *Bohlen* cases, pollution near the coast is caused not by oil tankers but by such things as:

— chemical waste (e.g. the "red mud" discharged in the Mediterranean and the Straits of Dover);

— bilge waste from freighters, trawlers and pleasure craft;

— spent oil deposited on roads by vehicles, insecticides and fertilisers washed out by rainwater, and refuse of every kind from urban areas, all carried to the sea by streams and rivers.

Near the coasts of the industrialised countries, these forms of pollution, though small when taken in isolation, together add up to an enormous volume far in excess of the pollution due to oil tankers. The Baltic has practically become a dead sea.

The instances of oil pollution recorded by the French authorities in 1976 were caused by cargo ships and fishing vessels. It is not uncommon to see tramp steamers, fishing boats and pleasure craft keeping astern of us in order to discharge their slops in our wake. It eases a great many consciences!

Transport by sea of petroleum products has kept pace with the development of energy requirements in the modern world. Since the commissioning in 1886 of the *Glückauf,* the first specially built tanker, shipbuilding and transport techniques have evolved as a function of various parameters, namely:

— engineering techniques;

— the cost price of the vessel, which determines the running costs;

— in the case of responsible shipowners, the safety and comfort of the crew;

— international regulations.

Attempts to control pollution

The regulations in force, at both national and international level, are for the most part centered around the penalties that may be inflicted upon a "dirty captain".

The fact remains, however, that once a cargo has been unloaded there are certain imperative technical preparations that have to be made before the vessel can receive its next cargo. The tanks have to be cleaned to remove as much as possible of the deposits and unpumpable solids from the last load. Depending on the type of hydrocarbon carried and the care with which the tanks have been dried at the end of the discharging operations, these deposits and solids can be estimated at between 1% and 3% of cargo volume, in other words, for a vessel of 270 000 tons dead weight, today's average displacement, between 3 000 and 9 000 cubic metres of oil products and sediment. It is a huge figure, but fortunately only a small proportion of the waste is discharged into the sea. Nevertheless, experts estimate that 5 to 6 million tons are discharged every year, either by oil tankers (cleaning operations and accidents), or through leaks from land-based or offshore installations (drilling platforms, etc.).

Apart from the waste of energy this represents, the repercussions on marine animal and plant life are incalculable. Some authors even state that the recent major drought in the Sahel was partly due to an exchange deficit in evaporation and photosynthesis over the Atlantic Ocean.

To the Cartesian mind, it seems logical that nothing should be discharged at sea, but that residues and unpumpable solids should be recovered for processing at the port of discharge, the vessel not being allowed to sail except with clean tanks. Port facilities being what they are, this is out of the question at the present time. By reason of their high cost, waste recovery installations are rare, and their capacity is low. Further, if tankers were to spend longer in them, oil ports would be insufficient to ensure supplies to consumers. So the habit has grown up of transferring responsibility for pollution to the captain. If he pollutes, the culprit is easy to identify and consciences are untroubled.

Until the 1950s, the water used for washing out tanks was discharged straight into the sea with the slops. General awareness of oil pollution only came about with the increase in the number and size of ships (which meant that the scale of pollution was greater in each case), plus a few spectacular disasters, the best-known to the general public being that of the *Torrey Canyon,* a tanker of 120 000 TDW, in the 1960s.

Measures taken

It was therefore decided that certain measures should be taken, as follows:

— regulations were issued on discharge areas, which are being extended further and further away from coasts;

— the permissible amount of discharge per nautical mile was laid down;

— some countries, such as the Republic of South Africa, forbade oil tankers to sail near their coasts;

— in order to monitor discharge rates, captains were required to keep a special log recording the origin, quantity, place and date of all discharges.

All these measures place reliance on the captain's honesty, but take no account of the constraints of every kind to which he is also subject.

At the instigation of the big international oil companies (BP, CFR, Esso, Shell, Texaco and others), efforts have been made to reduce the volume of waste discharged into the sea while obtaining a satisfactory standard of tank washing. The first result of these efforts was the so-called "load on top" technique.

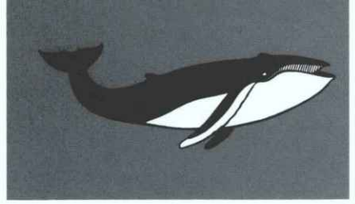
What is the "load on top" method?

Cleaning of tanks is done in such a way as to avoid discharging the waste into the sea. The waste, or "slops", is recovered in one or more settling tanks. After several days the oil is drawn off and the theoretically clean water is discharged into the sea, either direct or through a separator. At the next loading port, the new cargo is loaded on top of the recovered oil, hence the name "load on top".

This process, though perfect in theory, does not offer all the requisite safeguards either in respect of the vessel's safety or from the point of view of pollution control.

When the tanks of a large vessel are cleaned under pressure, the water is partly atomised and large quantities of static electricity build up in the atmosphere inside the tanks. This was a probable cause of the explosions of the very large crude carriers *Mactra, Marpessa* and *King Haakon.*

The water which is sprayed into the tanks under pressure removes the protective



Superships
Transport of energy

film of oil deposited on the tank walls and promotes the formation of ferrous sulphide — all hydrocarbons contain traces of sulphur — which can become incandescent through rapid oxidation. This theory was put forward by Dr Bernard Lewis, President of Combustion and Explosive Research of Pittsburg, Pennsylvania, as an explanation for the explosion of the *Stanvac Japan*.

A ship is a tool of trade whose productivity is measured in terms of the quantity of freight carried. Slop is not shown on bills of lading, so its carriage produces no return. Some shipowners, particularly at times of crisis such as the present, unquestionably put pressure on their captains to reduce the quantity of slop kept on board. This appears to be a fairly widespread practice judging from the oil slicks encountered on the high seas.

Receiving agents at unloading ports sometimes make difficulties about accepting slops because of storage and processing problems.

Some captains give in to these various pressures and restrict the quantity of slop carried on board, to the detriment of the biological equilibrium of the sea.

Although oil is biodegradable, it does represent a danger to the various forms of marine life. A small quantity spreads out over a large area as a very thin film, and forms a screen which limits exchanges by evaporation and photosynthesis. Marine life is interfered with and in turn plankton, spawn, fish fry, fish and seabirds die.

The conclusion is put forward in a report by the British Field Studies Council that the sum total of small pollutant discharges every day has a greater effect on the ecology than disasters of the *Torrey Canyon* kind. In connection with that accident, Mr Robert Spencer, a member of the Council of the British Trust for Ornithology, wrote in the magazine *Birds* that of 5 800 birds dealt with in different centres, only 500 survived and the number of dead birds could be estimated at a minimum of 10 000. The figures speak for themselves. In 1970, the World Wildlife Fund and the Royal Society for the Protection of Birds stated that persistent pollution in the vicinity of the British coast could lead to the extinction of several species, including guillemots and divers. The Jackass penguin, among the most vulnerable of seabirds because it moves about in the water, is indeed already faced with extinction. It is a native of the Cape of Good Hope, and before the second world war its numbers were estimated at several million. Today only a few thousand survive.

Must this disaster be regarded as inevitable? Accidents at sea and deliberate pollution for operational reasons are the two main causes, and it is to them that action must be directed. In order to reduce the risk of accidents, only properly equipped and well maintained tankers with competent crews should be authorised to carry oil. The classification companies (Lloyd's, American Bureau, Bureau Veritas, etc.) should apply more stringent controls so as to maintain vessel standards. All ships should be equipped with facilities for the production of inert gases enabling the atmosphere in the tanks to be kept constantly neutral, and with separators for the processing of slops.

Safety equipment on board must be abundant, in good condition and well suited to its purpose. Regulations on the protection of human life at sea lay down a minimum only. Shipowners should therefore be encouraged to go beyond that minimum.

Whatever the flag under which a ship sails, the crew must be highly competent. In particular, the officers must be properly trained to discharge the navigational and maintenance tasks with which they are entrusted. Even on ships flying the flags of reputedly reliable states it is not uncommon to find officers who lack the requisite experience and know-how for the job they are doing. The qualifications of crew members on ships flying flags of convenience can only be imagined.

Measures of the kind suggested depend solely on shipowners, and can only be objected to by irresponsible owners spending the minimum of money to fit out elderly vessels which their original owners regard as obsolete.

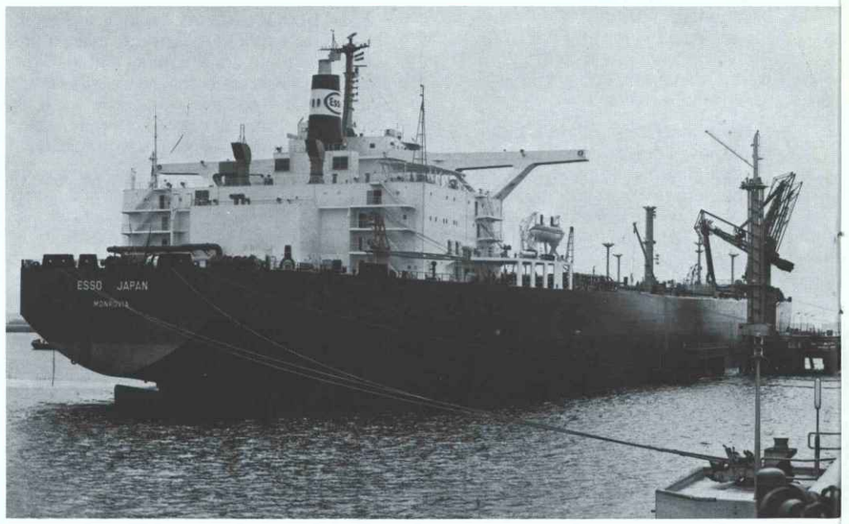
Deliberate pollution for operational reasons, which according to the various reports on the subject is the kind of pollution that does most harm, must be outlawed by every possible means.

The "load on top" method, when it is employed, must not be impeded in any way, whatever the resultant dead weight or the constraints placed on receiving agents.

However, the real solution continues to be cleaning of the vessel at the unloading port. Only in port can an effective check be made.

In recent years, the BP group has developed a very safe technique for the cleaning of tanks in port which does not entail a prohibitive increase in turn-round time. The water is not polluted at all except in the case of an accident, such as leakage or breakage of a valve or pipe.

The results obtained from two years and a half's continuous practical experience of this method on a vessel of 270 000 TDW lead me to think that it should be extended to all modern oil tankers.



". . . the real solution continues to be cleaning of the vessel at the unloading port. Only in port can an effective check be made"
(Photo Fotobureau C. Kramer)

The cleaning technique

In the course of a voyage the heavy fractions suspended in the crude oil settle out on the bottom and the projecting parts of the ship's structure. The best solvent for the dispersal of these deposits is without any doubt the original cargo.

Oil from the cargo is pumped back under pressure into the tanks while they are being emptied, every possible security precaution being taken (skilled personnel, continuous monitoring of the quality of the inert gases pumped into the tanks). As a result, the cargo is stirred up and the deposits that have built up during the voyage are put back into suspension. After drying, the tanks can then be regarded as clean. The results obtained speak for themselves: a tanker of 270 000 TDW yields about 3 000 cubic metres of slop by traditional washing with sea water, but only 600 cubic metres after mixing with crude oil.

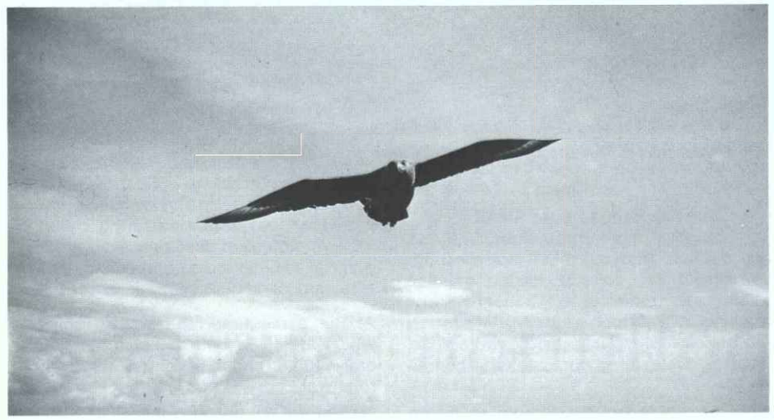
No sea-water is used when tanks are cleaned by this method. The vessel's safety is enhanced by the decrease in the static electricity charge, which diminishes the explosion risk. A further advantage is that since the formation of ferrous sulphide is negligible, the structure of the vessel is less affected by corrosion.

Unfortunately the technique is not accepted in all ports, probably because not enough is known about it. It is authorised in Rotterdam, some United Kingdom ports, all French ports, and in Kiire, Japan, by permission of the port authorities.

As an addition to mixing with crude oil, experiments are being carried out whereby the ballast is no longer changed during the voyage. Barring accidents (which are always possible), no slops at all are discharged into the sea.

Europe thirsts for oil. Mammoth tankers like the French Chinon *try to satisfy our needs*
(Photo Skyfotos Ltd)

Stercorarius skua – birds of the high seas have greatly suffered from oil slicks
(Photo Edouard, "Jacana")



Is this not the best solution?

The size of modern vessels is a cause of concern to a great many people, even in shipping circles. Yet:

— the limits on the size of individual tanks imposed by international regulations reduce the risks of leakages in the event of an accident at sea;

— the large unit tonnage has the effect of reducing the number of vessels and improving navigational safety on the routes used by tankers. The manoeuvrability of these large vessels is certainly reduced in the vicinity of coasts and in narrow passages (e.g. the Dover Strait, Gibraltar and the Strait of Malacca). Their manœuvrability is restricted by the proximity of other hazards and their great inertia and deep draught. The new rules designed to prevent collisions at sea (put into effect in July 1977), and especially the widespread use of the routes recommended by IMCO, are significant factors in the improvement of safety in these areas. But better training for the crews on ships of this type would offer further guarantees of safety.

It is important to note in this connection that these large vessels offer substantial energy savings: a turbine-driven oil tanker of 30 000 TDW uses about seventy tons of fuel per day at a speed of 16 knots, whereas a turbine-driven tanker of 270 000 TDW sailing at the same speed consumes only one hundred and seventy tons per day. Thus the final cost price per ton transported is lower, and this is a positive factor in the European economic balance.

What worries me and many of my colleagues is not the size of ships or the means to be employed to preserve the natural environment. If we are given the means, we can very effectively prevent and avert pollution arising from the transport of hydrocarbons by sea.

The real problem at the present time is the decline in the level of qualifications of sea-going personnel. The devaluation of the seaman's job and its unattractiveness in modern conditions has lead to a shortfall, in the advanced countries, of adequately qualified and dedicated seamen. This shortfall is all the more marked as the difference in wage levels on shore and at sea is negligible for people with equivalent training, and does not compensate for the sacrifices (of a family and cultural kind, etc.) which seamen make.

The opportunities for travel and adventure which the navy used to offer no longer exist. Shorter stays in port, the monotony of life on board ship, and the similarity of one voyage to another, mean that there is no chance of discovering new places, horizons and countries, and that opportunities for communication with other people are curtailed. If in addition we have to sail a dead sea, then our profession, where there is ample room for a sense of responsibility, will cease to have any attraction.

It is preferable to admire the grace of a porpoise playing in the ship's wake, the flight of an albatross or seagull, or any of the charming little scenes one can encounter at sea, than to contemplate a mass of drifting debris of every kind. Life on board modern ships entails enough stress without our adding to it. Combating pollution is for us a means of participating in the conservation of marine life, and also of preserving that small area of beauty and poetry which every man needs.

P.C.

Nowadays tankers carry up to half a million tons of cargo. Past accidents have spread death and pollution on the seas and the shores
(Photo C. van der Meulen)

Marine pollution by ships

C.P. Srivastava

In 1970 the Secretary General of the United Nations prepared a report for the Economic and Social Council on prevention and control of marine pollution. In it he stated, "The global ocean is the world's sink".

The sea has traditionally been a dumping ground for wastes produced by man, and the amount of wastes produced is going up all the time. The growth of population alone, from 2½ thousand million in 1954 to 4 thousand million today, has seen to that, but the increasing growth and spread of technology has also been a factor.

Much of the pollution which threatens the oceans of the world comes from the land, from factories and homes, cities and fields. But a significant proportion results from shipping, and this threat has been subject to the same processes of growth as pollution from other sources.

In 1954 approximately 250 million tons of crude oil was transported by sea. Twenty years later the total was 1 507 million tons, and the movement of crude oil alone had gone up by no less than ten times.[1]

At the same time, the size of ships in which the oil was carried also rose. In the early 1950s ships of 20 000 deadweight tons were considered big: but the largest tankers today are around 550 000 deadweight tons.

The dangers which these developments have created are obvious, and accidents have, of course, already occurred. Of these by far the best known was the sinking of the *Torrey Canyon* off the Cornish coast in 1967. This tanker was carrying more than 100 000 tons of crude oil. Attempts to clean up the pollution which resulted lasted for more than two months, but despite this hundreds of miles of coastline were covered with oil in both England and France. Tens of thousands of birds died, and marine life was affected by the oil and the chemicals used to disperse it.

Since that date there have been many more incidents which have helped to emphasise the danger of oil pollution from tankers. In August 1974 the tanker *Metula* spilled around 54 000 metric tons of oil after running aground in the Straits of Magellan.

In January 1975 the supertanker *Jakob Maersk* struck a sand bar while attempting to enter the port of Oporto in Portugal, and the jolt set off a series of explosions which resulted in the spillage of 84 000 tons of crude oil, of which a considerable portion burned. In the same month, the tanker *Showa Maru* ran aground in the Straits of Singapore, subsequently spilling 3 066 metric tons of crude oil.

These incidents (and several others as well) all occured within a few months of each other, but pollution incidents take place regularly, and while none has so far been on the scale of the *Torrey Canyon* disaster, the threat of something even worse happening is continually present.

Yet even so, most oil pollution from ships is the result not of accidents but of operational discharges. After unloading their cargoes, oil tankers have traditionally cleaned their tanks of residues on the return voyage to the oil fields. Much of this waste matter is simply washed into the sea.

According to an estimate by the United States National Academy of Science, just over one million tons of the oil which entered the sea in 1973 came from tankers in the course of normal operations. Only 200 000 tons came from tanker accidents.

During his celebrated crossing of the Atlantic in 1970 on the raft *Ra II*, Thor Heyerdahl noticed numerous instances of heavy surface pollution, most of it oil. He wrote of one sighting: "The coasts of Africa and America were now almost equally distant when we suddenly entered another area so polluted that we had to be attentive in washing ourselves, due to seemingly endless quantities of oil clots of sizes ranging from that of a grain or pea to that of a sandwich".

It seems likely that most of this oil came from routine tank-cleaning operations, probably by tankers off the coast of Africa: the prevailing winds and currents would tend to move it across the Atlantic from east to west.

Oil pollution of the sea always gets plenty of publicity, partly because it makes for good television and good newspaper photographs. It gets on to beaches, and ruins people's holidays. It often results in long slicks of oil stretching for miles. If it comes from a wrecked tanker, then the accident itself tends to generate publicity.

How dangerous is pollution?

A great deal of work on this subject has been done by the Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP), a group which includes independent experts nominated by the United Nations and six UN agencies, including the Intergovernmental Maritime Consultative Organisation.

This year (1977) GESAMP published its sixth report, dealing with the impact of oil on the marine environment. One conclusion which the group reached was that crude oils, the ones that tend to ruin beaches, were probably less harmful than light refined oils, which tend to vanish more rapidly. The report states: "Light oils disappear, in part, by going into solution or becoming dispersed in the water column and thereby become more readily available to many species of marine organisms than if they remained floating on the surface of the sea. Since the more soluble components are often the more toxic, light oils may present a more serious threat to living marine resources than the persistent black oils."

The GESAMP report concludes that "only sea bird populations have suffered from oil pollution to the extent that certain species or sub-species are threatened with extinction. For example, there is little doubt that the more southern colonies of puffins, razorbills, and guillemots are declining rapidly on both sides of the Atlantic . . ."

As far as other creatures are concerned, the situation seems to be rather more hopeful. The report states: "There is no evidence in the literature to suggest that existing levels of oil pollution present any serious threat of extinction to marine mammals, fish, benthos or plants, except in the vicinity of a spill or an area of chronic pollution where the effects on all forms of marine life may be disastrous."

Despite the generally optimistic conclusion, the last part of that sentence is important. An oil spill may not have a serious long-term effect if it occurs in the open sea: but a similar spillage in confined, already-polluted waters could be disastrous, just as the last straw was to the camel's back.

Unfortunately, many areas of the world are already chronically polluted, both from shipping and from land-based sources. Estuaries, enclosed bays and gulfs are particularly susceptible, because the pollution which enters the water cannot easily escape.

In some cases, however, whole seas are affected. Five have been identified by the United Nations Environment Programme as being in particular danger, including the Mediterranean, the Gulfs region, and the waters off the coast of West Africa.

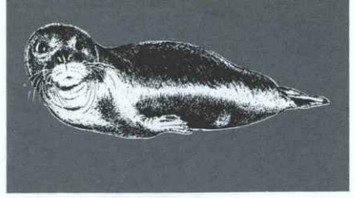
Of these, perhaps the problems associated with the Mediterranean are the best known, if only because so many people go there for their annual holidays. While much of the pollution in the sea comes from land-based sources, problems are compounded by the fact that the Mediterranean is an important shipping route, particularly since the re-opening of the Suez Canal.

Because the Mediterranean has only one narrow outlet to the Atlantic and is virtually tideless, it may take about eighty years for a complete transfer of water to take place, according to the most widely accepted estimates.

Consequently pollution tends to accumulate, and thus there is not only a greater risk that concentrations will reach levels where they threaten marine life but the floating residuals arising from pollution by sewage, garbage and persistent oils will have a detrimental effect on the aesthetic value of the sea.

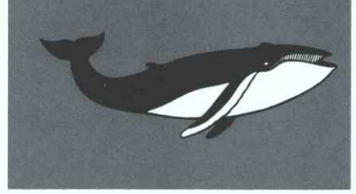
This type of pollution in the short term is perhaps just as significant from the point of view of the region's economy as the more insidious effects of pesticides and similarly constituted chemicals.

In this context it may be surmised that a major oil spill, with its attendant worldwide publicity, could have a serious effect



Heavily laden towards port (Photo C. van der Meulen)

[1] Y. Sasamura, *Environmental Impact of the Transportation of Oil.*



Marine pollution by ships

on an area as a major centre of tourism. Similarly, an accumulation of persistent oil arising from operational discharges can also have a damaging effect on the reputation of a tourist area because of the serious nuisance afforded by the constant recurrence of tarry deposits along pleasure beaches.

The danger is made even more acute by the fact that oil is by no means the only threat to the environment which is carried on board ships. Modern industry is extremely complex in the materials it uses, and many of these materials are transported from one area to another by sea. Some of them are far more harmful than oil, and an accident to a chemical carrier, for example, could be far more damaging than one involving an oil tanker.

A well-known example is tetraethyl lead, which forms the cargo of the *Caytat,* which sank in the Adriatic three years ago. The total amounted to only 250 tons, yet its effect on marine life could be disastrous. Like many other chemicals, tetraethyl lead tends to enter the life cycle, slowly building up into ever more dangerous quantities.

The GESAMP Review of Harmful Substances says of this product: "Acute toxicity to marine life is of the order of one part per million . . . there is likely to be short-term bioaccumulation, although this is not yet well understood. This substance causes injury to the brain, liver and kidneys when absorbed through the skin, gastrointestinal tract and lungs following contact with liquid or vapour . . ."

Clearly, a most unpleasant thing to have lying at the bottom of the sea, and there are many other substances at least as dangerous as tetraethyl lead being carried across the world's sea routes every day.

The extent of the threat of pollution to the oceans has become a matter of public concern particularly in the last decade, partly because of the publicity which followed the *Torrey Canyon* incident, and partly because of growth in awareness of environmental issues generally. One result is that there has been a growing consensus of opinion that action had to be taken as a matter of urgency. Moreover, it is now generally accepted that this action needs to be carried out at an international level if it is to be effective.

The existence of the United Nations systems has undoubtedly been of great assistance in helping to devise and co-ordinate countermeasures, and IMCO has become the focal point of action designed to combat pollution of the seas from ships.

This has in fact always been a major part of the organisation's work since it came into existence in 1959. A major convention designed to restrict the amount of oil which can be discharged into the sea from ships had already been introduced (in 1954) and in 1962 this was amended by IMCO and the restrictions tightened. A further amendment will come into force next year.

A spate of legislation was introduced from the end of the 1960s dealing with various legal aspects involving pollution from oil and other substances. This work culminated in the adoption of the 1973 Convention for the Prevention of Pollution from Ships.

This is an extremely complex instrument which makes considerable demands on those nations which accept it. Yet it is also recognised as being the most important instrument ever introduced in the fight against marine pollution. It is certainly the most ambitious, for the signatories declared that their objective was "to achieve complete elimination of intentional pollution of the marine environment by oil and other harmful substances and the minimisation of accidental discharges of such substances".

At the same time, IMCO is trying to combat pollution of the seas in other ways, by providing practical assistance to governments, in the shape of pollution advisers and expert missions, and also by tightening up procedures regarding the safety of shipping in general. Next February a world conference is being convened by IMCO with the specific intention of introducing new measures designed to improve the safety of tankers.

Another important development came last December, when the world's first regional oil-combating centre was opened in Malta. It is being operated by IMCO on behalf of UNEP.

The aim of this centre is to develop and co-ordinate countermeasures in the event of a major oil pollution spillage occurring in the Mediterranean. The centre is part of an overall plan for combating pollution in the Mediterranean, which is being carried out by UNEP with the co-operation of sixteen of the seventeen countries bordering on the Mediterranean.

It is hoped that the centre will become the forerunner of similar centres in other parts of the world where oil pollution is a major danger.

It would be wrong to pretend, however, that the threat to the world's oceans will soon be over. The danger is probably just as great as ever, and in some ways is still growing. But it is fair to say that nowadays governments and the public generally are more aware than ever before of the dangers threatening the seas and are willing to co-operate in fighting them. And that at least improves the chances of finding a solution before the oceans of the world are irreparably damaged. C.P.S.

Europe's clogged coasts

Louis J. Saliba

Introduction

The coastline of Europe extends from the Arctic in a complex anticlockwise curve to the north-west part of the Black Sea. It borders on the North Sea, the Irish Sea, the north-east Atlantic and the northern shores of the Mediterranean, branching along its course to encompass the similarly practically enclosed Baltic. The coastal fauna and flora are influenced along its range by a wide variety of temperature and salinity conditions, tidal characteristics, and bottom and shoreline type and topography. Practically every type of ecosystem is represented in some region or other. These are now, or rather have been for the last few decades, undergoing a variety of changes, abrupt or gradual, in their composition. These changes sometimes affect their existence. The main cause is the ever-increasing quantity of organic and inorganic pollutants European coastal waters are receiving from a variety of sources.

Perhaps the problem is felt more acutely than elsewhere in the Baltic and Mediterranean Seas which are virtually enclosed, and thus have a limited amount of water-exchange with open ocean systems. The whole coastal zone of Europe, however, except perhaps in those areas which are still relatively undeveloped, is suffering to very much the same extent.

Pollution sources

The sources of pollution prevailing in Europe vary slightly from region to region, but are similar from the overall viewpoint. Increasing industrialisation is resulting in all types of organic and inorganic effluents discharged either at point sources along the coastline or indirectly through municipal sewage systems or rivers. The mechanisation of agricultural practice is producing a large amount of synthetic pesticides, and it has been estimated that 50% of all such pesticides used eventually reach the sea. Aerial transport of pollutants, particularly pesticides and some metals such as mercury, is now a proven pathway, resulting in deep inland pollution sources being able to affect the sea. Dumping of industrial and other wastes at sea has resulted in these materials eventually reaching the coast, even when dumped far offshore. At one time, this was a serious problem in the North Sea. Oil pollution of surface waters through leakages, other accidents and tanker discharge is another serious and prevalent problem. Another major threat to littoral ecosystems is extensive coastal development for tourist and associated purposes, which is producing ribbon-type urbanisation with its associated sewage effluent problem. This is not being felt very much in northern waters, but is now spreading along nearly all the northern Mediterranean littoral.

Serious concern is now being felt by all European states at the steady deterioration of coastal waters. This of course varies with prevailing hydrodynamic conditions. Several Norwegian fjord systems are becoming increasingly polluted by sewage, agriculture and mining drainage and industrial effluents, mainly from pulp-mills. The condition in the Baltic is also precarious, and many coastal waters of this sea are now seriously polluted, and relatively high amounts of pollutants have accumulated even in pelagic organisms. The same concern has been felt in the Mediterranean where several zones, particularly in the north-western part, have now become totally devoid of marine life except a few highly resistant species. The situation elsewhere varies from region to region, but is not confined solely to the immediate zones of human activity.

Effects on natural ecosystems

It would not be possible to enumerate and tabulate all the effects of pollution on the natural marine fauna and flora along the European coastline, but the abundance of scientific research and monitoring currently under way along its whole length affords an accurate index to the gravity of the problem. Effects vary with the type of pollutant. It has been estimated that several thousand birds die every year mainly because of oil pollution. Apart from mass mortalities caused by accidents at sea, such as the *Torrey Canyon* incident in March 1967, there are the long-term chronic effects, which can never be accurately estimated. Counts are made of oiled birds washed ashore, but many marine species remain at sea if they are only partially oiled, and eventually die there. The actual time of pollution is also important for birds. A heavy mortality among the relatively small spring population, before breeding begins, can be catastrophic.

Oil pollution is prevalent along the whole European coastline, including the area round the British Isles, and oiled sea-birds have been found from year to year in the immediate coastal zone. Areas still relatively unaffected are the northern part of the Scandinavian coast. Less oiled sea-birds have been encountered in the Mediterranean than along the rest of the coastline; but this is possibly due to the lesser abundance of natural populations in this area. Apart from birds, on which one of the main effects of oil pollution is felt, oil slicks and tar balls are also responsible for the deaths of countless millions of intertidal invertebrates and algae, and several sandy beaches have been completely destroyed by oil covering the top layers when the tide recedes. Luckily, some ecosystems are renewable when the pollutant is removed, although this takes time. In the Mediterranean, where there is practically no tide, a similar effect is being felt through oil being washed against beaches through wave action. The problems of oil pollution are accentuated by the use of chemical dispersants for their "neutralisation". Though this operation does remove the nuisance aspect to a large extent in so far as recreational amenities are concerned, and possibly reduces oil damage to sea-birds, the resultant oil-dispersant mixture is more toxic to marine life in general than the oil itself, both specifically, and by its spread, in vertical extent. This problem is now being alleviated by the use of relatively less toxic dispersants.

Perhaps the most spectacular damage is being evidenced in those coastal zones which are continually receiving large amounts of industrial effluents or untreated sewage or both. In some off-harbour areas of the Mediterranean, the only marine life visible consists of some algae, bacteria, and certain protozoa. Similar conditions prevail in some parts of the Baltic, and elsewhere along the "open sea" coasts where the rate of discharge exceeds the rate of dispersion and dilution. Other less dramatic effects have been recorded in various countries where natural ecosystems are undergoing a slow change, resulting in a steady diminution in the number of species, and the gradual replacement of most by a few newly-dominant resistant ones.

One major effect is less dramatic, but equally significant. In general, pollution sources are unevenly distributed, and a major length of the coastline of Europe is (apparently) free from direct pollution sources. Continuous dispersal through currents and other water movements carry most pollutants into other parts of the coastal zone, often in "invisible" amounts. This has the disadvantage of producing a false sense of security in many areas. Even here, however, studies are revealing not actual changes in ecosystem components, but a slow reduction in marine life. Here, analysis is made more difficult by the fact that marine populations undergo considerable fluctuations due to purely natural causes, and it is therefore not possible to ascribe reductions in numbers following short-term studies to the effects of pollution. Nevertheless, evidence is accumulating of marine organisms, in areas far removed from the nearest pollution source, containing excessive amounts of heavy metals and other pollutants in their tissues, and several behavioural abnormalities have similarly been recorded.

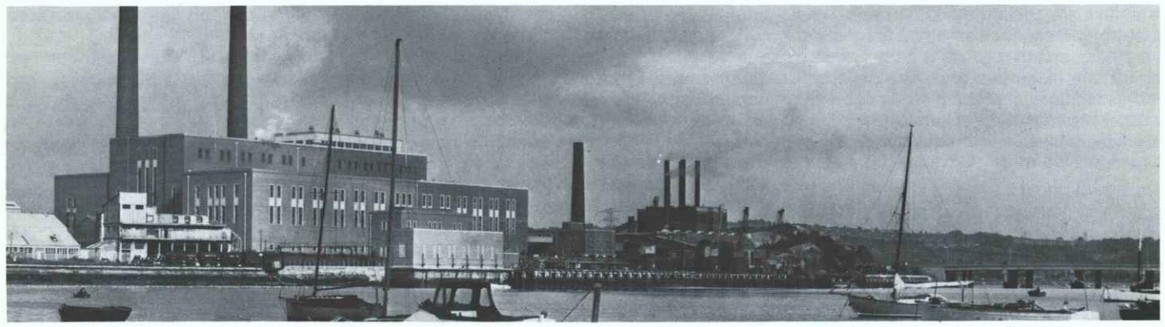
Although pollution research in the European region is currently at its peak, we are still very uncertain as to the exact position in overall terms. In many regions, the necessary baseline studies on naturally occurring ecosystems only commenced when pollution had already become significant. In some regions of the coastline, the basic hydrological data by which a knowledge of the dispersal and fate of pollutants can be obtained is still only in its initial phases. In the North Sea, for instance, the conditions are more accurately known than in the Mediterranean, where co-operative regional studies began in 1975. There is still an enormous amount of work in front of us before we can fully appreciate the specific mode of action, not only of individual pollutants, but of various combinations of these at sublethal levels, on marine organisms' vital functions.

Preventive and control measures

It is however reassuring to note the comparatively strict control measures being applied at national, regional and global levels over the last few years. National legislation protecting the coastline still varies among the different European countries, each state having its own special problems and conditions to cope with, but these are gradually tightening up, partly due to the realisation that action had to be taken to abate coastal water deterioration, and partly to satisfy the requirements of international legal instruments. Coastal pollution from sources at sea, first tackled by the IMCO 1954 Convention for the Prevention of Pollution of the Sea by Oil, has now become more effectively controlled by the 1962 and 1969 amendments to this convention. Both oil and other hazardous substances in bulk are catered for in the 1973 London Convention on the Prevention of Pollution of the Sea from Ships, though this is not yet in force. The London 1972 Convention for the Prevention of Pollution by Dumping of Wastes is another important legal instrument. Within the European region itself, apart from various conventions aimed either at protecting specific forms of marine life or at controlling the discharge of specific substances such as detergents, some major items of subregional

And we then go home!
(Photo John G. Walmsley)

Where land and sea meet–our coastlines are too beautiful to be spoiled (Photo S. Gicquel)



Where land and sea meet–Plymouth power station (Great Britain). (Photo BICC)

Europe's clogged coasts

or regional legislation are evident. The main ones are the 1972 Oslo Convention on Dumping from Ships and Aircraft, which should go a long way towards solving this problem in the North Sea area, the 1973 Helsinki Convention which affects the Baltic Sea area, and caters for the control of pollution of this region from most sources; and finally the 1976 Barcelona Convention, together with its associated protocols, which is aimed at the protection of the Mediterranean Sea from pollution. This already caters for dumping of wastes at sea and co-operation in cases of pollution emergencies, and is shortly being extended to cover land-based sources of pollution. This is only one component of a comprehensive action plan for the whole of the Mediterranean region, which also includes a scientific assessment programme and an integrated planning component to integrate socio-economic development with environmental preservation.

The coastline of Europe, in so far as its living content is concerned, has reached a critical stage, although with few exceptions it has not yet reached the point of no return. The success or otherwise of the several control measures which are either being actually applied, or so projected, to prevent and minimise further pollution, will be reflected in the future state of the coastal fauna and flora, and whether or not this will gradually return to its former natural richness. It does not appear that this will be impossible if fast organised action continues to be taken.

L.J.S.

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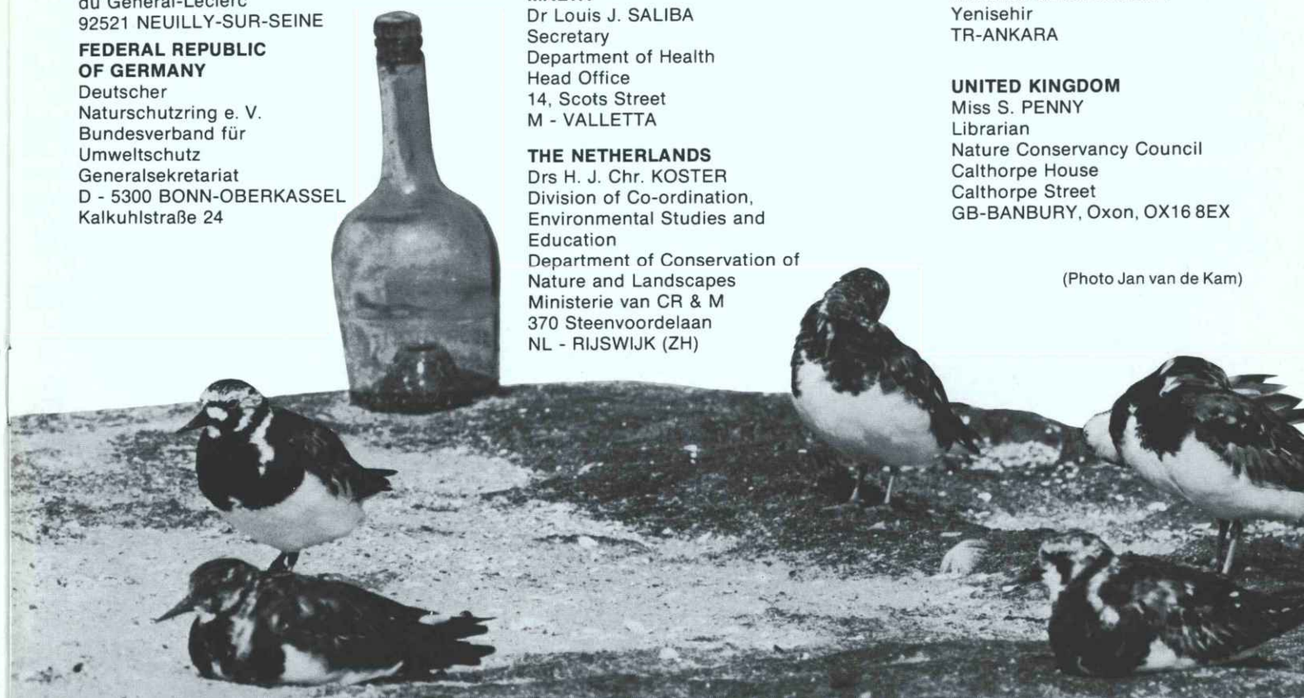
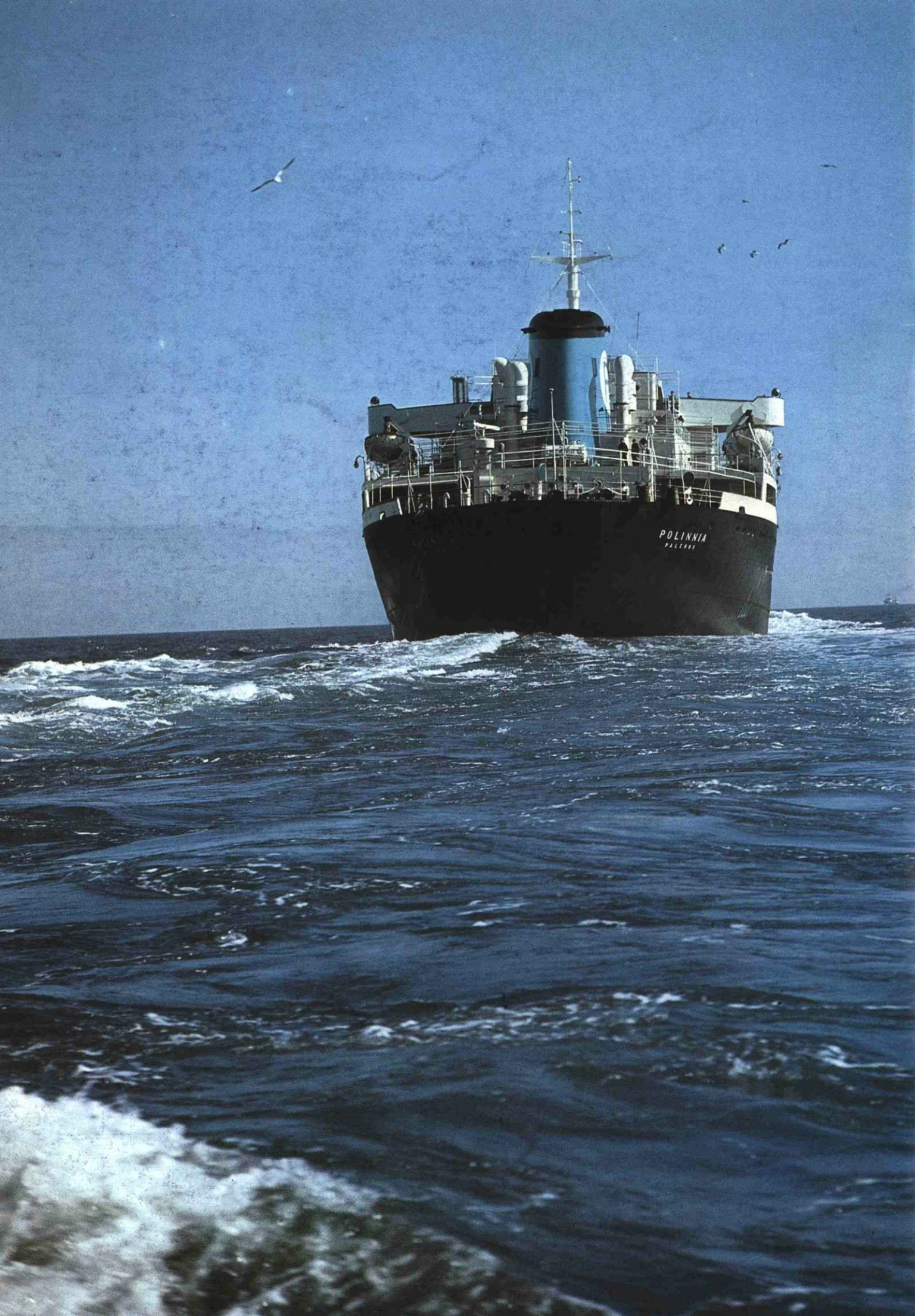


(Photo Jan van de Kam)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