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NATUROPA

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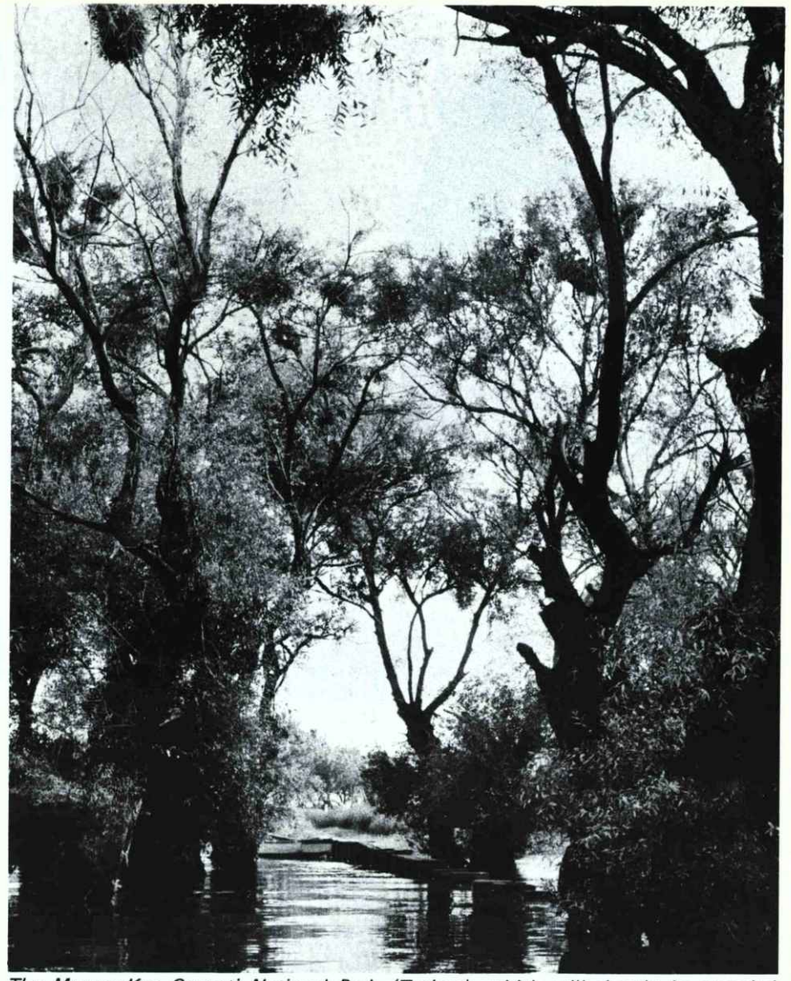
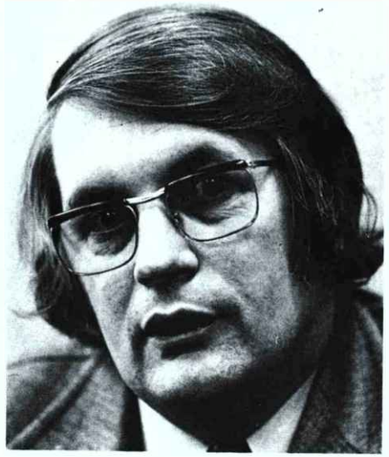
WETLANDS CAMPAIGN 1976

Of all Europe's natural heritage, its wetlands are undoubtedly among the most vulnerable and most endangered types of environment.
These biotopes, drained over the centuries — indeed, over thousands of years — and polluted in recent decades, are currently undergoing a process of decline and degradation whose implications are far more serious than is usually imagined.
Wetlands are a paradise for anglers and fish-breeders, points of attraction for nature-hungry town-dwellers, naturalists' laboratories, not least among the multifarious functions they perform being that of water flow regulators.
For all these reasons, the national agencies of the European Information Centre for Nature Conservation decided two years ago to devote the 1976 campaign to the planning and conservation of wetlands, whether natural or artificial.
For this purpose the Centre contacted experts on the various aspects of the problem, and their contributions have been combined to form this special issue.
May it help to ensure a better understanding and more effective conservation of these irreplaceable natural environments.



The Manyas-Kus Cennati National Park (Turkey), which will shortly be awarded the European Diploma.

The Boschplaat (Netherlands), which received the Diploma 1970. Other wetland areas which have also received the European Diploma include the Camargue (France) in 1966, the Wollmatinger Ried (FRG) in 1968 and the Hautes Fagnes (Belgium) in 1966.

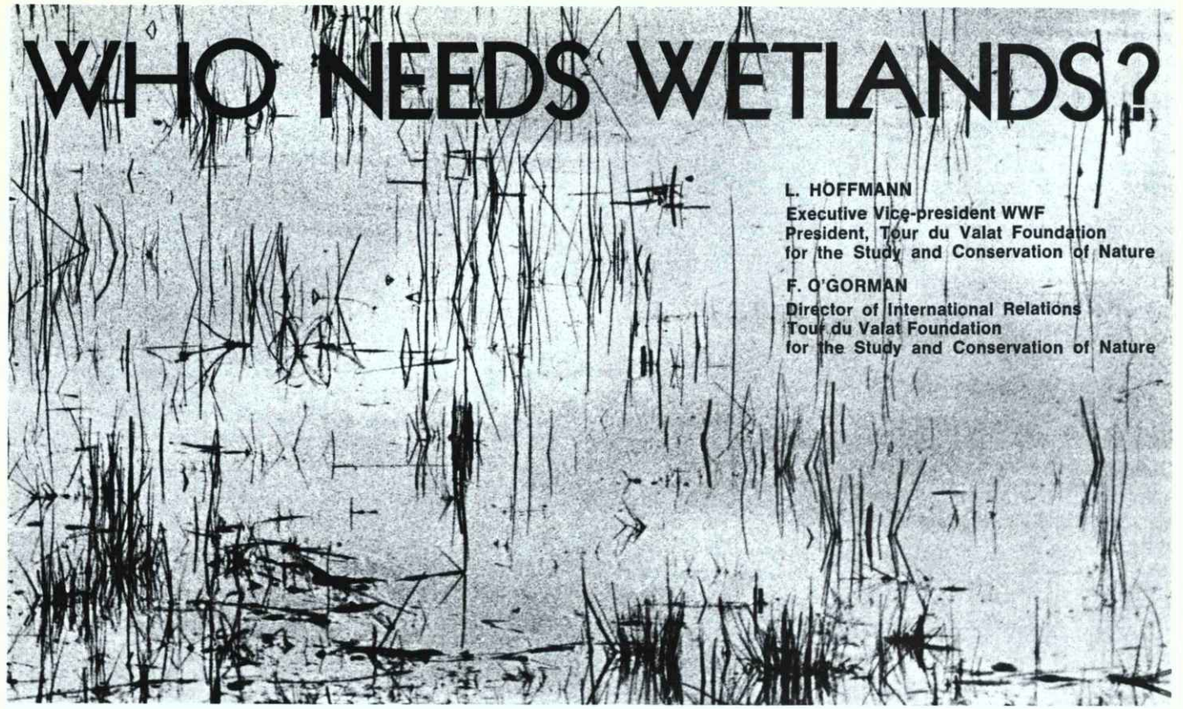


EDITORIAL

W. MEIJER
Secretary of State for Cultural Affairs
Recreation and Social Work, Netherlands

The fact that the Council of Europe is going to mount publicity campaigns in 1976 devoted to the conservation of marshes, fens, peatlands and other areas known collectively as wetlands, seems at first sight remarkable and even surprising. After all, these areas have not always been considered of positive value in the past. For centuries these wetlands were notorious and feared as the home of damned souls, the site of ritual sacrifices, the haunts of fugitives and the breeding grounds of fevers and diseases. But as man learned how to alleviate his hardship through ingenuity he overcame his fear. And then almost as if it were to compensate for his old fear he relentlessly laid hold of this halfland in all its forms. Marshes were drained, fens reclaimed and the waters diverted. The discovery that dried peat makes reasonable fuel led in the low countries to mass reclamation. This devastated the countryside to such an extent in the middle ages that lakes of a catastrophic size were created. Only centuries later did people understand the technique of coping with the calamity by draining the lakes again. Dykes and dams ensure safety and help the economy. The wetlands are gradually becoming scarce. Supported by misplaced optimism based on the belief that nature can look after itself, and still unfamiliar with the way the natural environment depends on a system of checks and balances, industrious man exploited the seemingly inexhaustible natural resources. The disappointing discovery that nature does not tolerate over-exploitation has led to the idea of nature conservation. Gradually nature conservationists have been organising themselves, initially as defenders of threatened species and later as protectors and conservers of the areas in which these species habitually occur.

It was the bird protectors who first realised the international importance of conserving the wetlands which not only serve as a wildfowl habitats but also represent the interconnection and balance between the very different ecosystems, combinations of these and the consequent intermediate zones which make these areas so eminently valuable. Prompted by international bird protection activities, the International Union for Conservation of Nature and Natural Resources is launching the Wetlands Convention on the assumption that the protection of aquatic birds requires a network of reserves and resting places in and outside Europe. Signing the Convention obliges the parties to it to avoid encroaching on areas listed wherever possible. In the event of unavoidable encroachment on these areas, international interests should be considered. It is gratifying to see that the Council of Europe and particularly the European Committee for the Conservation of Nature and Natural Resources has actively co-operated in drawing up this Convention. It is not only worth conserving our wetlands for natural scientific purposes, but also for the wealth of cultural and historical remains they contain. I am thinking here particularly of the function of the wetlands as an archive of ancient settlements and forms of land reclamation. Encouragement of the conservation of all this links up admirably with the objectives of the Council of Europe as a conserver of our natural heritage. It is therefore especially gratifying that the resolutions of the Ministers taking part in the European Ministerial Conference on the Environment at Vienna in 1973 so emphatically acted as a model for the future policy of the Council. No single regional organisation has such specific expertise available. It is possible that the lack of mandatory powers may be seen as a weak point by some. In view of the fact that culture cannot be coerced, however, this very lack of an administrative driving force may help to produce the atmosphere in which the conservation of our cultural heritage can best thrive. It is obvious that it is of the utmost importance for member states to give powerful aid and support to the implementation of such a policy. The conservation of wetlands in the broadest sense has received special attention in my country. Reconsideration of fairly recent government decisions which would restrict the acreage of wetlands is in full swing. The Delta and Wadden areas are the crucial ones. The conservation of the Wadden region in particular, whose international significance is becoming clearer every day, is a joint responsibility. It is for these reasons that the Netherlands as a party to the Convention will give powerful financial and moral support to the wetlands campaign. I wish the European Information Centre for Nature Conservation every success in carrying out their campaign.



WHO NEEDS WETLANDS?

L. HOFFMANN
Executive Vice-president WWF
President, Tour du Valat Foundation
for the Study and Conservation of Nature

F. O'GORMAN
Director of International Relations
Tour du Valat Foundation
for the Study and Conservation of Nature

Wetlands are by definition wet places. They have one of the essential ingredients of life — water. But it's not water such as comes out of the tap, sterile, chemicalised, it is a milieu which teems with a multitude of living things, with plants and animals, which form an ever changing pattern fluctuating with the seasons and the hydrological cycle of which we are all a part. Living in this elemental medium, be it clear and swift, slow and muddy, or green and stagnant, fresh, brackish or salty, is one of the richest assemblages of animal and plant species to be found on this earth. Many are totally dependent for their existence on the continuing availability of such habitats. The flamingo which clouds the evening skies with a roseate hue would no longer be, if the salt pans of the Mediterranean and elsewhere were no more. Minor changes in wetland conditions could destroy the tiny brine shrimp on which the flamingoes depend. But it is not merely the spectacular elements, the flamingoes, the blackwinged stilts, the ducks and swans, the otters and beavers that are vulnerable. Many of the specially adapted plant species, from the valuable *Phragmites* to the tiny *Azolla,* are as in need of these conditions as is the whole spectrum of life from the barely visible *Paramecium* to the highly visible *Pandion* — the Osprey. Countless hundreds of species go to form this intricate web of life in wetlands. They certainly all *need* wetlands. Without these areas they too would be gone.

If one looks at the map of Europe, or at any other continent for that matter, the percentage of such wet areas can be seen to be a minute part of the great land masses. Yet they harbour an unusually large share of unique plants and animals. To some national planners many of these seem not to be of direct economic importance and therefore can be considered as of marginal value or entirely useless.

But then should one consider the disappearance of thousands of plant and animal species, of wonderful landscapes and highly interesting ecosystems as a major tragedy when the overcrowded world is increasing daily and the energy needs of this human explosion is also increasing exponentially ? Are there not vital needs to use these places for more productive economy such as food growing ? Not everybody will answer this question the same way, but an increasing part of humanity feels that there is something to be said for the production of such economically unimportant objects as spoonbills, cormorants and *Epipactis palustris,* because they are irreplaceable.

As Count Leon Lippens, founder of a world famous wetland reserve in Belgium has said : "It has at last been understood that natural treasures are as much part of the inheritance of humanity as any artistic treasure ; it is as stupid to drain the last of our great marshes, with their wealth of wildlife, as it would be to demolish the Cathedral of Chartres — to plant potatoes".

In this day and age the ethical importance of such questions should be as important as the purely practical ones such as "what use is it ?" Of course ethical considerations are only a part — though an important part — of the raison d'être for maintenance of such areas. There are a whole plethora of values involved.

Some communities understood this long ago and acted. Amsterdam is a good example. In 1904, the expanding city of Amsterdam needed some place to dump household refuse and

Many wildfolw and waders breeding in the arctic and subarctic depend for their very existence on the food and shelter provided on migration and in winter on the wetlands of temperate, Mediterranean and tropical regions. To drain or otherwise destroy such wetlands would have repercussions in the bird populations in countries far away.

proposed to buy the nearby "Naardermeer", a complex of unspoilt freshwater lakes and marshes. To the amazement of the corporation, some naturalists started to write letters to the papers claiming that in order to save a few guilders one should not bury spoonbills, purple herons and bearded tits, marsh harriers and a host of typical and rare plants under rubbish.

Conservation was not fashionable 70 years ago but there was a realisation that something irreplaceable was about to be destroyed for ever. The protests became a kind of popular movement. There can be little doubt that in those days before television, cars and a spate of books popularising natural history, few protesters had ever seen a spoonbill or a cormorant, or indeed the obscure lake itself. To everybody's surprise the Amsterdam city fathers voted against the plan with a slim majority and in 1906 the lakes were bought by public subscription for the, at the time, enormous sum of £ 16,000 and "Natuurmonumenteen", the Dutch Nature Conservancy was born. Holland's first "Nature Monument" was a wetland. Thanks to the action of a few farseeing people spoonbills are still breeding in Western Europe. Now, £ 16,000 would not buy an acre of Naardermeer, nor indeed one single spoonbill or marsh harrier.

The value of such areas for recreation is now largely realised in Europe. Wetlands often provide a wide range of recreational use which in the frenetic life of urbanised man is increasingly vital to his continued social, mental, and physical health. Who cannot appreciate the tranquility of sitting on a bank fishing or bird watching and soaking up the sounds of nature, or watching the ever changing patterns on the water ? Others may get the same feelings of renewal from sailing, swimming, skiing or hunting. So even in this respect alone wetlands can no longer be regarded as wastelands.

While wetlands used in such a multi-

purpose way can provide personal satisfaction to the user, these same uses can be equally as important to the local or national economy. Recreation is the basis of tourism whether it merely transfers cash from the urban to the rural dweller, or interregionally, or internationally helps to correct the financial deficits so many countries now have.

In the last decade half a million Britons have travelled all the way to Scotland to see a pair of breeding ospreys. It is not difficult to realise the economic benefits of just this one instance ; the hotels occupied, the trains and buses filled, the jobs provided.

Tourism has become such a vital element in so many economies that no resource which can provide a sustained tourist service should be squandered. Wetlands are one such resource, one such valuable asset (often unrealised) in a country's resource basket.

But to maintain this resource it is not enough to keep just the odd wet field or marsh. Not only are the individuals and species interlocked in an intimate relationship in each wetland but the scattered distribution of wetlands forms a network which is essential to the maintainance of many of the visible and visually attractive elements of such habitats, in particular migratory birds. Many wildfowl and waders breeding in the arctic and subarctic depend for their very existence on the food and shelter provided on migration and in winter on the wetlands of temperate, Mediterranean and tropical regions. To drain or otherwise destroy such wetlands will have repercussions in the bird populations of countries far away.

If the Wexford Slobs in Ireland were to be destroyed, the very existence of the Greenland White-fronted Geese would be in jeopardy as half the world population winters there. Many waterfowl of Western Europe would be in dire straights if the Guadalquivir were canalised, the Coto Doñana drained and covered in vines, rice or holiday resorts. If all the Camargue were planted in rice and its coastal strip drained and covered in hotels and industry, Europe would lose not only its unique large flamingo colony but the Camargue its million and a half tourists who enjoy the feeling of wilderness ; and the loss of waders and duck would eventually be felt in Siberia and Northern Europe.

Europe's wetlands are diminishing at an alarming rate. Deltas, salt and freshwater marshes, lakes and rivers are the victims of the demands of industry, agriculture and even tourism. Wetlands are not merely areas of great aesthetic or recreational value but also often provide vital biological links for other economic activities such as coastal fisheries. Many such areas are the favoured spawning grounds of these fisheries which can, and do, provide people often in economically depressed areas with a major source of livelyhood as well as a basic supply of protein.

Research has demonstrated that the natural productivity of some marshlands can be as great, if not greater, than the most intensive and sophisticated farming practised by man. Where this is true it is obvious that such natural (and free !) productivity should be availed of rather than very expensive conversion to other land uses. These are rarely as productive as the original areas even if one leaves out the drain on capital resources of large scale drainage schemes and the continuing cost of maintainance of such activities. With the decline in extensive farming, the economic value of drainage is becoming even more doubtful in many countries. Often the long-term effects of drainage are not understood sufficiently and therefore not calculable in advance. Marshes and lakes act as reservoirs and water-regulators. The canalisation of rivers, the emptying of wetlands, and the rapid disposal of surface water increase the run-off into the sea and cause drying out and loss of productivity of land often far beyond the expected areas. This in turn can cause the dessication and death of the soil holding vegetation and the acceleration of such processes as erosion, salinisation and even desertification.

Even now many of the potential values of wetlands are not realised or fully understood. Wetlands are complex ecosystems full of intricate interrelationships. Our present understanding of them is often superficial. Much research is needed to extend our understanding. Nearly inevitably the value of such research not merely increases our understanding of the system but often points out a new potential value or use for such areas. Obviously the discovery of such potential will only be possible if there are wetlands available in which research can be undertaken in the future. Research has also demonstrated the physical value of wetlands in maintaining water regimes, in absorbing flood water and releasing them gradually downstream and in providing a source for underground water supplies. The impact of man's unthinking destruction of such assets is all around us.

In Europe a classical example of man's lack of understanding of the complexity of wetland ecosystems is a lake in Sweden — Lake Hornborga. It is a story worth repeating as it typifies how tenaciously attitudes can be held over generations despite the contrary evidence accumulated yearly. Lake Hornborga was — 150 years ago — the finest bird lake in Sweden. It was 30 km² and only 2 metres deep and surrounded by 20 km² of swamps and bogs. The first attempt to drain it was made in 1803, then in 1850, also 1874 and again in 1903. Every time it was hugely expensive and showed virtually no success. By the mid 1930's the lake was dry in summer and the unique flora and fauna largely destroyed. It was planned to cover the whole area in corn. That was the vision. The effort that was to "finish" the job began then and by 1958 had cost another four million Swedish crowns. But not a single hectare of ground had been gained and the lake area was now merely 20 km² of reeds on calcareous soil without value which was still only dry in summer. Today the wheel has come full circle and a part of the lake has been restored. The ultimate cost of restoration may be in excess of 4 million $.

One of the reasons the generations of effort never worked was that the lake acted as a reservoir for melt water which may have amounted to one million cubic metres a day.

One would not have to look far to find similar examples in most European countries. Fortunately, today our understanding of the long-term consequences of these actions is greatly improved and there is hope that the Swedish example will prevent others from undertaking ill conceived projects and encourage restoration of areas having been drained without economic success. Careful planning should not only estimate cost of drainage and expected yields. It should also take into account ethical, social and economic values of wetlands in their original state and add their regional and international importance to the balance sheet.

The coming into force in December last of the Convention on Wetlands of International Importance is a giant step forward for mankind in this area of human endeavour. Some of the most important places are now protected by this international treaty. However at the local and national level much remains to be done.

The pressing needs of increased food production, of urban sprawl and effluent disposal, can be solved without further degrading the human environment providing people can see beyond the monoculture of farming or the urban cement jungle to the whole

needs of the community and to those of the distant generations yet to come whose survival — like the wildlife — will depend on the decisions we take now.
Not only some beautiful wild animals and plants need wetlands. Mankind would lose something irreplaceable if they would go. We would be much poorer than is generally realised today.
But there is still time. Let us strive, specially in this Wetland Year, to save a little more of this unique heritage.

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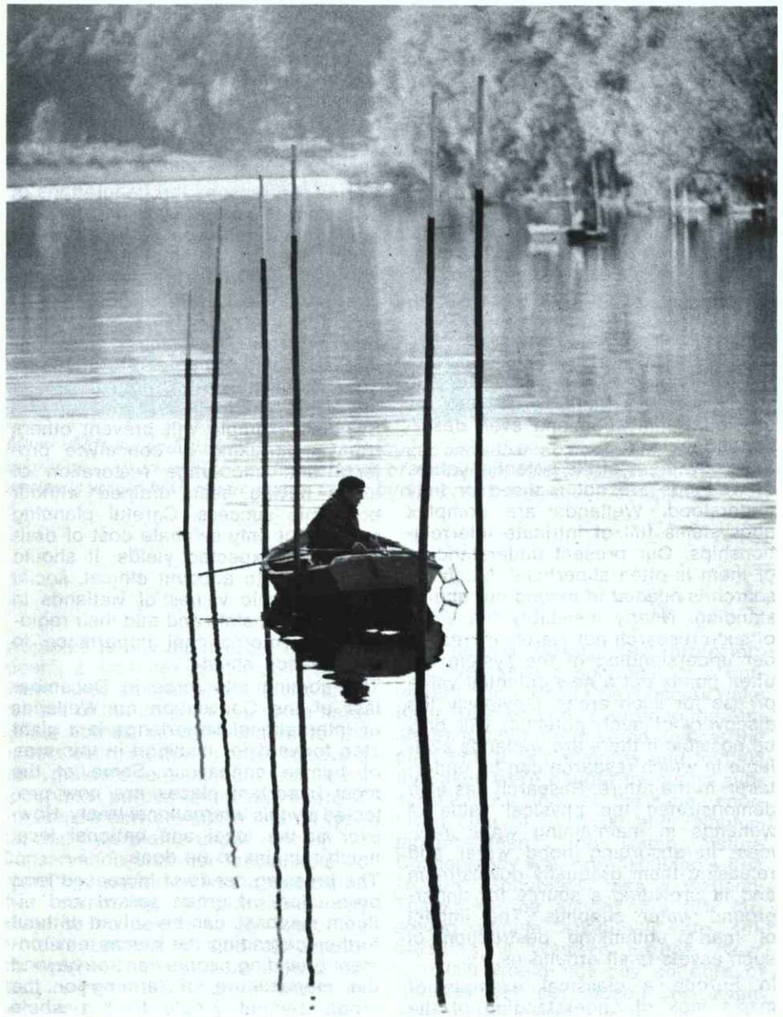


INTERNATIONAL PROTECTION OF WETLANDS

Cyril de KLEMM

As a habitat, wetlands have considerable importance in several respects : conservation of water resources, recreational uses, preservation of the plant and animal associations living in them. Their protection, after centuries of neglect and destruction, is becoming a matter of increasing urgency.

In the ordinary way, this is something that can be done as part of the general conservation measures which each state adopts to preserve its natural resources. In some cases, however, international action will probably be necessary, as when a wetland zone is located on a frontier. In such cases, agreements between the two countries concerned are clearly the only means of settling the problems of water use and protection against pollution which may arise. Many states have already concluded agreements of this type. We find particularly interesting examples in the Canadian-American treaties on frontier water, especially the Great Lakes, and in Europe, in the conventions concluded between the states bordering on Lake Constance and Lake Geneva.

There are other instances in which wetlands may be considered to have international importance, by virtue of some exceptional ecological features of great scientific interest. It is this aspect of the problem of wetland conservation which we are going to discuss here.

I. The international ecological importance of wetlands

a) Wetlands, in which highly specialised plant and animal associations may flourish, form a particularly interesting type of habitat from the ecological point of view. For this reason, the preservation of certain of the most representative wetlands, and all of which are of outstanding scientific value, must be ensured, as must that of all other types of habitat on our planet. They are features of the world's heritage whose conservation is of such scientific importance that some commitment on the part of the states in whose territory they are situated seems indispensable.

b) Some wetlands harbour endemic plant or animal species, that is, ones which are found nowhere else in the world, such as the giant grebe of Lake Atitlan in Guatemala, or rare or threatened species — some tiny flower, a fern, bullrush or moss — which cannot survive outside that habitat. Their disappearance would mean a great loss, an impoverishment of man's biological heritage which we must avoid. The states on whose territories such species exist should be thought of as being responsible for them to the community of nations, as being their keepers, and as such committed to safeguarding them.

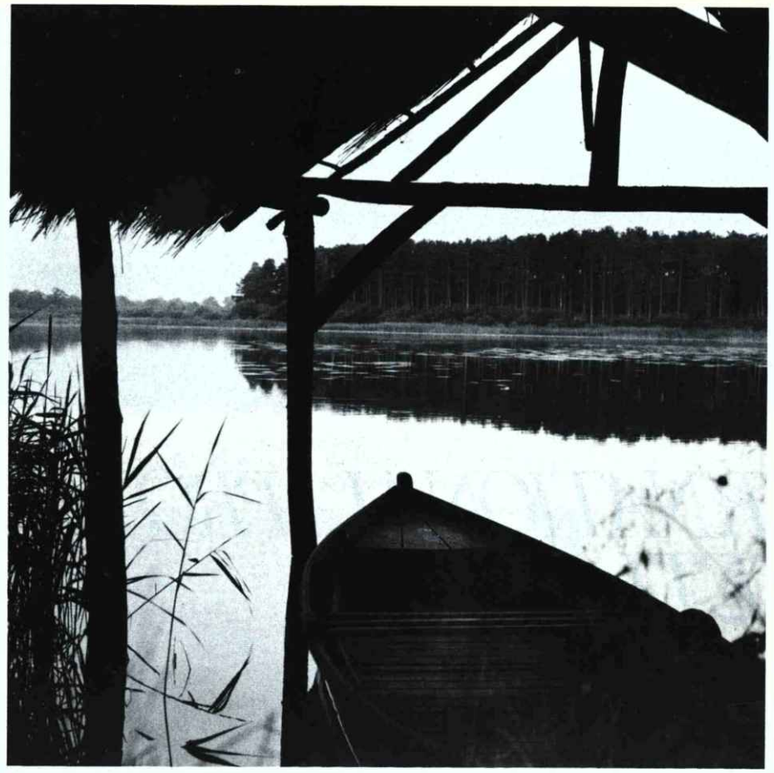
c) Wetlands are essential stages in the migratory flights of waterfowl, chiefly geese, ducks and waders. Not only do birds nest and winter there, but they also often make quite long stays in order to rest and feed during migration. If some wetlands were to disappear, the birds' migratory routes would be perturbed, and those using such areas would be threatened with extinction. This is also true with respect to their nesting and wintering sites.

It can be considered that each of the states across whose territory a migration route passes is responsible for the species in its territory at any given time. It is accordingly the duty of those states to preserve the wetlands, without which migration would no longer be possible.

II. The present position with respect to the international protection of wetlands

There are two main aspects to the international protection of wetlands. First, the wetlands whose importance justifies the adoption of protective measures must be identified ; secondly, their preservation must be ensured by asking states to undertake to protect them, either unilaterally or, preferably, by means of an international convention.

A first catalogue of wetlands of prime scientific importance was drawn up as part of the International Biological Programme, in co-operation with the International Union for the Conservation of Nature (IUCN) and the Inter-



national Waterfowl Research Bureau (IWRB). The relevant projects are : AQUA, for inland waters ; TELMA, for peatlands, and MAR for European and North African wetlands, especially those used by migratory waterfowl. When the International Biological Programme came to an end, its work was taken over by the UNESCO MAB programme, project 5 of which is concerned with the study of non-oceanic aquatic ecosystems, the influence of human activities on such environments and the means of preserving them. Some work is already in hand and more will follow, chiefly on the deltas of the major Mediterranean rivers. As a corollary to this, MAB project 8 involves a plan for an international network of protected areas, to be known as "Biosphere Reserves", designed to ensure the preservation of representative samples of every type of ecosystem found on earth. Criteria for the selection and institution of these reserves have been worked out. Some states have already designated such areas : France, for example, has chosen a wetland of great international importance — the Camargue — to be a biosphere reserve.

A particularly interesting Council of Europe scheme to establish a "European network of biogenetic reserves" should be mentioned here. This project is intended to ensure the conservation, potential, genetic diversity and representativity of different types of habitat, biocenosis and ecosystem. Once the relevant resolution has been adopted by the Committee of Ministers, member countries of the Council of Europe will select biogenetic reserves and undertake to comply with and respect the principles which have been laid down. These are more specific than the MAB project 8 criteria, and are more particularly suited to conditions in Europe. Good choices, it is suggested, for the European network would be a small habitat, such as a typical, unique, rare or endangered peat-bog, or a complete ecosystem such as a large wetland complying with one or more of the above-mentioned criteria.

It should also be mentioned that the "Wetlands" group of the European Committee for the Conservation of Nature and Natural Resources is planning to establish a system for the evaluation of wetlands and is considering the possibility of carrying out specific studies aimed at introducing concrete wetland protection measures. Wetland protection by international convention is not very far advanced as yet, and is mainly concerned with the protection of migratory birds. The Convention for the Protection of Migratory Birds signed by the United States and Mexico at Mexico City on 7 February 1936 and the International Convention for the Protection of Birds signed in Paris on 18 October 1950 both contain a general clause providing for or encouraging the establishment of reserves, but do not specify their nature or the standards that should apply to them.

On 2 February 1971, a conference held in Iran at Ramsar on the shore of the Caspian Sea, adopted a draft convention on the conservation of wetlands. This text has now been signed by a number of states but has not yet come into force.

The most important part of the Ramsar Convention involves the designation by each contracting party of at least one wetland in its territory, whose name, boundaries and map are to be recorded in an inventory to be kept by a central bureau responsible for the implementation of the convention. Of course, states are not asked to abandon their sovereign rights over these wetlands, and the convention provides that in the event of urgent national interests states may remove wetlands from the inventory of alter the boundaries of areas previously designated, but not without doing their utmost to offset the loss by designating a new reserve with similar features or enlarging a previously designated area.

Hailed by many nature conservationists as a major step towards the improved protection of these highly vulnerable habitats, and of the wildfowl to which they are vital, the Ramsar convention has also given rise to criticism which does not appear to be wholly unjustified.

One question that arises, for example, is : what will be the legal consequences of the designation of a wetland area by a contracting state, and its inclusion in the inventory ? They would appear to be relatively slight, as the state's only obligation in this respect is to take into account the need to preserve listed wetlands when planning and pursuing regional development schemes. This is an important obligation, no doubt, but one may ask whether it is enough.

Another weakness in the convention is that it contains no provision relating to the creation of a network of protected wetlands along waterfowl migration routes. A convention whose object is to protect wetlands that are important to birds should have been able, one would have supposed, to lay the foundations for such a network. Yet it has done nothing of the kind. Perhaps the delegates at Ramsar felt that public opinion was not yet ready for so vital a step.

As it stands, however, the Ramsar convention represents definite progress. It emphasises the need for states to protect their wetlands — not only those listed — and to create reserves, promote research, and train the staff needed to manage and guard protected wetlands.

III. The future of the international protection of wetlands in Europe

Establishing the world network of biosphere reserves and extending the Ramsar convention to all the parties concerned will be long-term efforts. It would seem possible, by remaining within the smaller geographical unit of Europe, to set up machinery for the effective protection of wetlands faster.

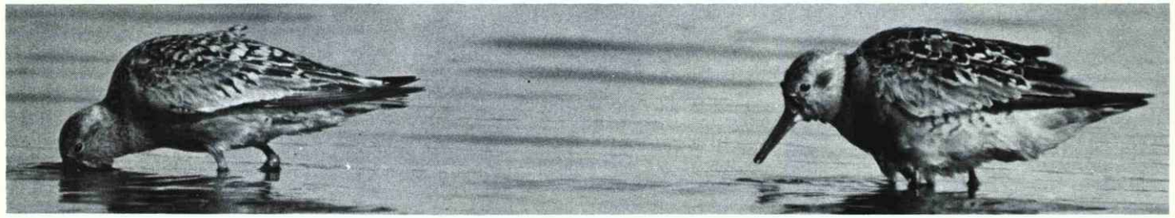
Compiling a list of European wetlands to be preserved, and those in Asia and Africa which are extensions of European migration routes, might be the first step. This task, which has already been largely completed, could be centralised by the Council of Europe, which could then, acting on scientific information supplied by such competent non-governmental organisations as IUCN and IWRB, decide which wetlands should be given priority with regard to protection. Afterwards, following the established order of priority and the possibilities of the different states, these wetlands would be incorporated into a European network of protected areas.

This network will probably be set up in the relatively near future, for many European states now seem to support the idea. Links will undoubtedly have to be established with the biosphere reserves network, for it would plainly be foolish to conceive two parallel and independent ones. Furthermore, it is likely that the European network will be created as a result of an international convention, in which the criteria and rules to be applied in the selection, establishment, equipment, management and wardening of reserves can be laid down by agreement between the countries concerned. The Council of Europe is now considering the desirability of a European convention on the conservation of the entire natural heritage, that is to say, all the fauna, flora and habitats found in Europe. A network of European reserves would find its place readily in such a convention.

Where wetlands are used as resting-places, stopping-places or wintering-places by migratory waterfowl, matters are somewhat more complicated, for it would seem difficult to dissociate the creation and equipment of reserves from the management of the various populations of migratory waterfowl.

It should be observed here that, in pursuance of a recommendation of the Stockholm Conference, IUCN has drawn up a preliminary draft outline convention on the protection of migratory birds. It establishes the principle of the joint management of migrating populations by all the states situated on their migration routes and provides, in respect of individual species, groups of species or all the species in a single region, for specific agreements setting out in full the steps necessary for their preservation and management. The convention further stipulates that these individual or regional agreements must contain certain provisions, including one for the creation of reserves along migration routes so that the passage of migratory birds will never be interrupted.

If this draft convention were adopted, the conclusion of a European agreement on migratory birds would become a "must". It might very well form part of the broader European convention mentioned earlier, and wetlands protected under it could certainly form part of the proposed European network of reserves. It will then be necessary to find the legal and financial means of associating the non-European states whose territories lie along European migration routes with this project, for without their co-operation, whatever conservation measures might be taken in Europe — especially in regard to wetlands — could easily be useless.



Wetlands, Waterbirds and Conservation

Prof. M. F. MÖRZER BRUYNS
Chairman European Continental Section
International Council for Bird Preservation
Dept. Nature Management
Agricultural University
Wageningen, Netherlands

The conservation, rational use and wise management of nature and natural resources have become points of increasing concern in many countries over recent years, especially since European Conservation Year in 1970. But it is the conservation of natural ecosystems, such as wetlands, that have been causing the greatest concern since these areas are becoming more and more rare, not least in the densely populated and highly cultivated regions of Europe. Wetlands are of particular interest not only because of their characteristic plant and animal life but also because they are extremely vulnerable. Valuable wetlands have all too often been lost due to disturbances by man, such as drainage, and at the present time many wetlands are in danger for this reason. The problem is that whereas scientists, conservationists, ecologists etc. generally appreciate the threats to wetlands and the need for conservation, the local inhabitants and more important, the local authorities and decision makers often do not. Moreover, the latter also tend to be unaware that wetlands may be conserved in such a way as to both preserve them and at the same time make use of their numerous natural resources and functions for the benefit of man. However, the existing and future dangers to wetlands are well known to nature conservation organisations, whose activities over the last few years, including campaigns, conferences, etc. have resulted in the highly important wetlands convention of Ramsar (Iran) 1971. This convention alone proves the exclusive status of wetlands since it is the only one to date aiming at the conservation of one particular category of ecosystems.

The history of wetlands conservation

The conservation of wetlands has long since been an essential part of the programmes of national and international conservation organisations, as well as the governmental and the non-governmental ones. The International Council for Bird Preservation (ICBP) was the first to include it as early as 1922, followed by the International Union for the Conservation of Nature and Natural Resources (IUCN) in 1948. In the same year the International Waterfowl Research Bureau (IWRB) began its activities as the daughter organisation of ICBP. Since then, there has always been a close co-operation between ICBP, IUCN and IWRB together with the hunters' organisations — the Conseil International de la Chasse (CIC) and the International Union of Game Biologists (IUGB).

FAO and UNESCO have been in contact with these conservation programmes from the beginning. Special attention has also been given to conservation, including conservation of wetlands, by UN organisations, for example following on from the UNESCO-Biosphere conference, held in Paris in 1968, and even more so after the UN conference on the human environment at Stockholm in 1972 and the establishment of UNEP.

The Council of Europe has given attention to different aspects of the conservation of wetlands since the existence of its European Committee for the Conservation of Nature and Natural Resources in 1963 : it was the first governmental organisation to recognise the importance of the establishment of protected areas and the necessity of international co-operation to preserve them on a continental scale.

Further stimulation to the conservation of wetlands has been provided by the organisation of a series of " wetlands conferences ". They began in 1962 with the MAR conference held in St. Marie de la Mer in the Camargue, organised by IWRB, IUCN, ICBP and CIC and which dealt with marshes and wetlands. This was followed by conferences organised by IWRB in St. Andrews (UK, Scotland) in 1963, in Noordwijk (Netherlands) in 1966, in Leningrad (USSR) in 1969, in Ramsar (Iran) in 1971 and in Heiligenhafen (Germany) in 1974. The major results of these conferences was the " Wetlands Convention ", of which the Final Act was signed in 1971 at Ramsar. It has now been open for signature and ratification since 1974.

The most important aspect of the Wetlands Convention is that it provides valid means for international co-operation, although its efficacity will of course depend on as many countries as possible joining the convention : internationally important wetland-areas must be preserved on the basis of international co-ordination. Furthermore, an optimal functioning of the Convention requires not only the signature of individual countries, but also the active co-operation of groups of countries and the co-ordination of their efforts. In this way wetlands may be preserved in the framework of international networks, rather than as separate entities. This is international conservation on a higher level. The initiative of the Council of Europe in organising for 1976 a wetlands campaign is thus an important step and a good example.

Wetland functions

Whilst the primary task of conservation is to preserve ecosystems and their characteristics, it may also serve other purposes. In other words, conservation should be considered as " conservation for development ", for multiple use, rather than simply for its own sake. Wetlands may be used rationally in many different ways for the benefit of mankind at the same time conserving their resources (particularly the valuable elements, the gene pools) without irreversible damage.

For example, springs, rivers, lakes and marshes are in many places indispensable as water sources for drinking purposes, for agriculture, horticulture and animal husbandry. Water is also necessary for industry, is of utmost importance for transport, for energy and for the dumping of our waste water. As well as these essential needs, the natural water resources of wetlands can and should be used to provide for other functions, including recreation and tourism, art, education and scientific research. Fish and waterbirds are last but not least among the most important elements of marshes and wetlands, playing a role in different functions. However the basis for all functions is the existence of intact ecosystems.

So although these functions are seemingly well known and their importance recognised, why is it that wetlands ecosystems are being threatened so alarmingly in too many places and in too many ways ? The main reason is that, according to the case, priority is given to the development and use of one or two functions, all the others being given secondary or even less importance. The result of this is deterioration, sometimes reversible, sometimes irreversible. But whereas this is well known to scientists, especially the conservationists, it is all too often not known to or realised by decision makers.

The threats to wetlands, leading to the degradation and loss of natural resources and biological richness (gene pools) can be grouped into three categories :

1. loss of habitat
2. loss of populations of species
3. loss of environment.

The loss of wetland habitat is caused by reclamation, urbanisation, industry, recreation, etc. Species (animals and plants) are endangered in many cases by overfishing, overshooting, collecting, etc. Loss of environment became one of the most serious threats due to the pollution of the environment and the disturbance of nature by human activities for instance in relation to tourism.

It is thus important that all organisations, persons and institutions concerned know that in principle all uses of wetlands are possible without harming the ecosystems in an unacceptable way. It all depends on how the ecosystems are used. Overuse and misuse should never be tolerated. The Water Charter of the Council of Europe gives the most essential points in a nutshell.

Wetlands ecosystems

The diversity of wetland ecosystems is incredible. In each country many types of wetlands exist, all of them being of interest from the point of view of conservation. The plant and animal life of ecosystems varies according to climate, topography and soil and water. It is also influenced by other lesser factors, such as available nutrients and minerals.

Wetland area "De Haeck", Nieuwkoop, the Netherlands (with Nymphaea alba, Circula virosa *and* Alnus glutinosa).

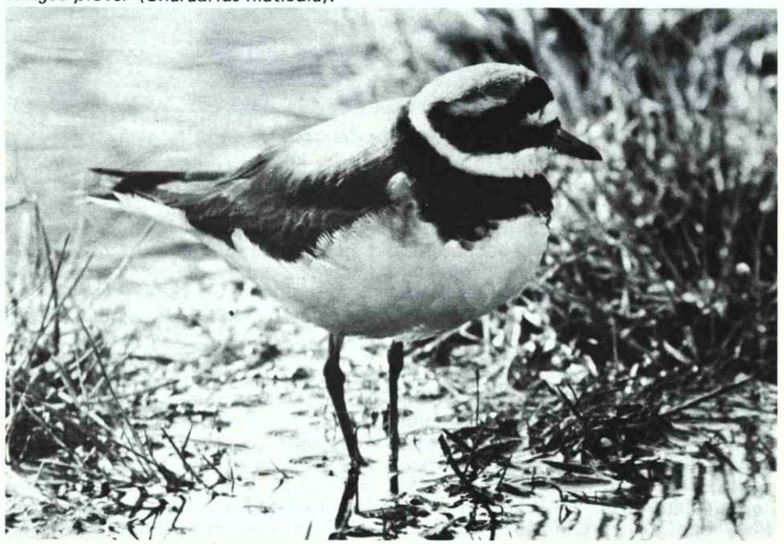
Thus lakes for instance differ not only according to their size and form, to whether they are shallow or deep and to how the shore is developed, but also according to the quality or state of the water. A lake may be fresh, brackish or salt, oligotrophic, mesotrophic, eutrophic or even hypertrophic due to eutrophication or pollution. Different types of pollution (saproby) all exert different effects. The same principles apply to smaller waters — ponds, gravel-pits etc. and for rivers, small and large. Coastal wetlands often differ from comparable inland wetlands.

Another important aspect of the conservation of wetlands is that different types of wetlands may be identified with different ecosystems. Each ecosystem has its own characteristic biocenosis of plants and animals. In wetlands the microscopic plant and animal communities of the phytoplankton and the zooplankton play an important role, being the basis for the foodchains and energy flow. The plant communities of the phanerogames or higher plants form what is usually known as the " vegetation ", correlated with the differences in character already mentioned. This vegetation occurs in astonishing diversity, which is well known to plant ecologists although perhaps not so conspicuous to the average nature lover. The same is true for all fauna elements : mammals, birds, reptiles and amphibians, fish and the invertebratae such as insects.

The birds are an exceptional group to which special attention should be paid. The wetland bird fauna also show the same characteristic pattern of diversity, although the number of species involved is much smaller than the number of plant or insect species. Birdlife, particularly the birdlife of wetlands, has been studied for years for several reasons ; one of them being that they are attractive and easily observed, another that they are of great international importance as wildfowl for professional and sport hunters all over the world. In the third place birds are a most interesting group for scientists. The great number of ornithological books, papers and journals prove that one of the most notable

Alder trees (Alnus glutinosa) *and reedlands* (Phragmitis australis).

Ringed plover (Charadrius hiaticula).



aspects of zoological ornithological research developed during the last decades, is the investigation of birds as indicator species for human impact on the natural environment. Birds and especially the birds of prey and other species of the end of the foodchain, among them waterbirds, are for instance used as indicator species in international research programmes into the distribution of persistent pesticides and other persistent dangerous chemical compounds, such as PCB's. Birds and especially waterbirds have also an indicator function to evaluate the value and significance of wetland-areas. For many years the diversity and the numbers of bird populations of wetlands have been used as the most reliable parameters for the international comparison of wetlands. The pioneer work of IWRB is greatly based on this.

Wetland bird populations consist of many ecological groups, representing a considerable number of niches : plant eating birds, omniverous birds and many groups of carnivorous birds (fish-eaters, insect-eaters etc.) and birds of prey, all of which are nearly always represented. The number of families of water and marsh birds gives an indication of the potential diversity of a wetlands avifauna. Just counting the families and groups of the divers, grebes, ducks, swans and geese, herons, cranes, storks, cormorants and pelicans, gulls, terns, birds of prey and owls and the group of the reed-warblers, reed-buntings, etc., it is clear that in relation to the ecological situation of the sites, very rich and diverse avifauna can exist. This diversity has a high indication value and is used for that very purpose. Changes in the circumstances due to loss of habitat, loss of bird numbers or deterioration of the environment, but also improvement in the circumstances of life have an almost immediate effect on birdlife. This phenomenon is already made use of in a number of countries, but could and should be developed much further for general use in nature conservation and management. It is obvious that the above information is of utmost importance for the conservation of birds, in this case wetland birds. It is not by accident that ICBP and IWRB are so much involved in this work and that waterbirds are relatively important in the Council of Europe's publication " Birds in need of special protection in Europe " by Dr. Parslov for ICBP.

Conservation

Nature conservation aims in principle at the preservation of representative examples of all plant and animal life communities in their own ecosystems and in their natural landscapes. It should furthermore aim at maintaining these ecosystems into the future. Ecosystems needing preservation have representative areas in all countries, even in the smallest ones. Nature conservation for that reason is in any case a national responsibility. It is at the same time an international one, because the natural distribution of ecosystem-types is hardly ever to be found inside the boundary of one single country. Due to climate, topography and other factors, ecosystems of one type, for instance freshwater lakes, lowland-peatmarshes, peatbogs, vary in the different parts of their distribution range. This is a well known biogeographical fact. For this reason nature reserves should be established for each ecosystem in each of the different parts of the distribution area. In this way networks of nature reserves can be established as is for instance already one of the main aspects of the Conservation Section of the International Biological Program (IBP).

The necessity of having networks of ecosystems all over the whole distribution areas counts in different ways for the birds. The avifauna of comparable types of wetlands, as is already discussed, differ from one country to the other, so avifauna reserves should be preserved per ecosystem-type, at least one per country, often more so that the complete breeding bird avifauna of those ecosystems — for instance lowland peat ecosystems — will be preserved in areas large enough to guarantee more than minimum populations.

Bird preservation however is more complex. The preservation of breeding bird-populations in their characteristic habitats is not enough. Bird migration makes it a far more international matter than the preservation of other fauna groups. Birds are vulnerable because of their size and their way of living and because many migratory birds are especially endangered which is why the efforts of ICBP and IWRB are often concentrated on migratory species, flyways and migration routes and wintering quarters. Migratory birds are also in this respect excellent parameters for the nature reserve situation in different countries. This is especially the case for wetlands and wetland birds, because of the concentration of sometimes very large populations in relatively small areas.

Preservation of waterbirds has to take into account the preservation of populations in the breeding area, in the moulting areas, in the wintering area and on their migration routes. This implies in all cases the need for many waterbird reserves systematically distributed in the whole area in and inbetween breeding areas and wintering grounds. This could be realised as networks of reserves or so-called " green routes ", deliberately established, proposed more than once on different occasions during ICBP and IWRB conferences.

It has been extremely difficult to establish such networks up till now, partly because the necessary scientific facts are not available (although for a number of species much information already exists), but mainly because of the differences in structure and organisation of nature conservation and hunting legislation in neighbouring countries, which make co-ordination and joint actions at least very difficult or almost impossible.

It is thus of great importance that supra-national governmental organisations recognise that they have a role to play in this field : it is of interest that the Council of Europe is already active on this point, for instance in its programme for the establishment of a European network of biogenetic reserves.

Wetland conservation in Europe : a challenge

Wetlands conservation could easily be included in this European network of biogenetic reserves, although special features of the wetland reserves may exist which do not meet the criteria demanded for the biogenetic reserves. Nonetheless the principle is of essential importance and all institutions concerned should co-operate to create an international network of reserves for all categories.

However, nature conservation authorities should still bear in mind that it is not immediately possible because important and indispensable information, which must form the basis, is still lacking.

Although it is possible to start on the basis of the available information, more research is needed to establish such networks in a satisfactory way. Another difficulty is that whereas much valuable research is done in different countries, it is not always comparable : the interests of one country may be totally different from interests of another. In this respect the work of IWRB may be mentioned as an exception, since waterfowl research has already been internationally coordinated for many years, although more scientific information is still needed for the establishment of networks. Ideally, then, international surveys should be organised to determine a) types of eco-systems and b) species and in such a way as to become a supra-national project paid by international funds, and which does not consist of collecting and combing information from individual countries. This could be done under the auspices for instance of the Council of Europe and in close co-operation with the international nature conservation organisations mentioned above. These organisations could provide the experts. They have no funds available however to finance the projects.

It will be one of the most important achievements in the field of nature conservation in the 20th Century, if it became possible to realise in the 1976 wetlands campaign on the basis of the Wetlands Convention, the European network of biogenetic reserves and the results of fundamental survey research work, the establishment of European networks of some of the most important wetland ecosystem-types.

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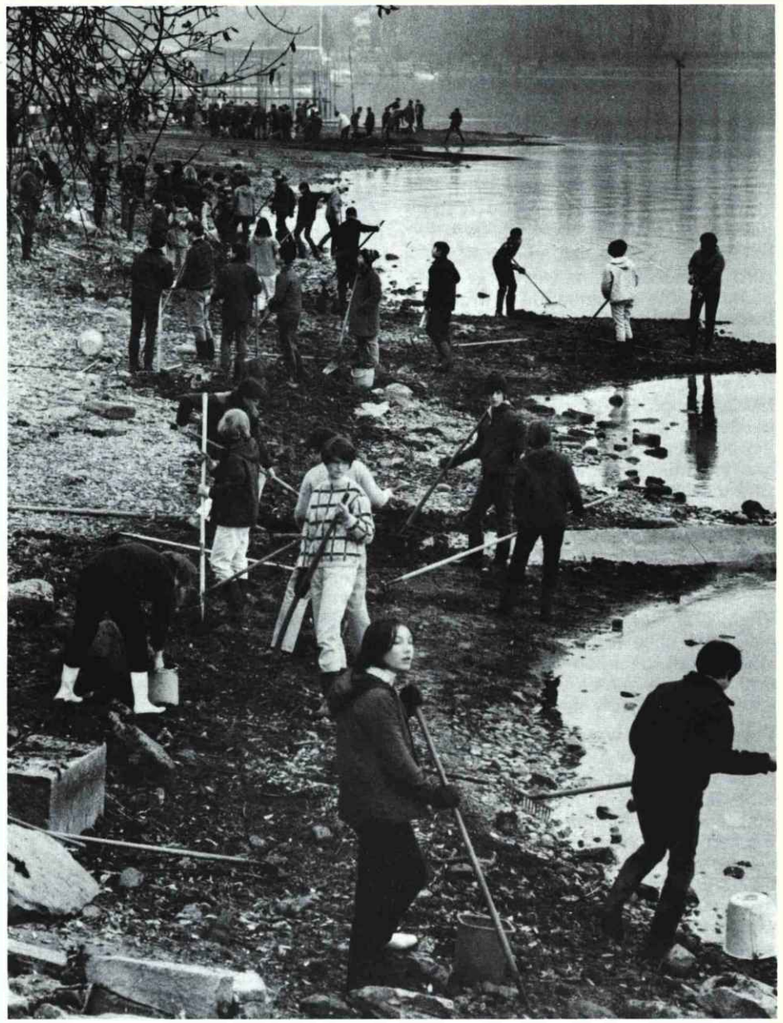
Shore cleaning on Lake Constance

Hans STEHLE
Secretary of the Inter-Cantonal Lake Constance Shore Cleaning Association
St Gallen, Switzerland



When the first Lake Constance shore cleaning operation was mounted with St Gallen school-children in 1964, their efforts were greeted by many with no more than a pitying smile. The operation has now grown into a 2-week international lake improvement campaign in which thousands of volunteers take part every year.

Fortunately, the authorities were extremely co-operative from the outset, so that the venture enjoyed some success from the very first year. In the second year, troops were used to help with shore clearance, but that was exceptional. In February 1966 an association was formed on the Swiss side, with the following purposes :

A. Winter season

— general cleaning of shores, removal of refuse, etc.
— removal of plant remains washed up onto the shore, in order to prevent further sludge formation
— cutting and cleaning of reed-beds
— removal of sludge at exposed points
— support for scientific investigations.

B. Growth season

— removal of algae
— cutting of aquatic plants which are a nuisance
— removal of refuse in exceptional circumstances (floods, storms, fish dying in large numbers).

C. Support for action to deal with oil spillage

It soon became clear that general cleaning requires large numbers of helpers. It also became clear that to be complete, the operation must include the Austrian and German shores. And so an International Working Party was formed, which organises the international campaign in November of each year. Winter is the best time for cleaning, because of the lower water level in the lake, but now that sufficient helpers are available, cleaning also extends to nearby inland streams, ponds and woods.

The International Working Party approaches the local authorities some time in advance and asks for their co-operation. The schools are also asked to help and lectures are arranged on request, as a means of pursuing educational objectives. At the height of the campaign numerous local building firms provide lorries, conveyor belts, wheelbarrows and other equipment. The campaign is given wide publicity well in advance by means of posters and reports in the mass media. The extensive preparations are co-ordinated by the International Working Party.

Over the years, the operation has been extended from one day to two weeks. The climax is the last day, when thousands of schoolchildren and other helpers flock to the lakeside to gather the refuse together at collecting points under the direction of local authority representatives. The catering is done by women's associations and other organisations and there are first-aid posts for tending minor cuts and scratches.

Despite co-ordination by the International Working Party there is plenty of scope for individuality and originality and the operation often affords an opportunity for bringing the whole population together and enhancing their sense of responsibility for "their" lake.

The operation's sponsors have no illusions about their work alone being sufficient to save Lake Constance. They realise that they are only treating the symptoms, which is no substitute for pointing out the causes of water pollution and building sewage treatment plants. But they do believe that their both practical and idealist efforts make a worthwhile contribution to landscape conservation.

Note : The author will be pleased to answer any inquiries about shore clearance on Lake Constance.

The Management of an English Gravel Pit Waterfowl Reserve

Illustrated by PAMELA HARRISON (See pages 16 and 17)
Text by JEFFERY HARRISON

Illustration No 1 *(General View)*
A gravel pit complex of five lakes covering 110 acres of water, with a maximum depth of 30 metres at Sevenoaks, Kent, England, and owned by Redland Ltd. has been managed as a joint experimental waterfowl reserve of WAGBI and the Wildfowl Trust since 1956. Although on the outskirts of the town and closely surrounded by industrial development, the results of management have proved spectacularly successful.

Illustration No 2 *(Hole in the Ground)*
Ideally, management starts as soon as the sand and gravel have been extracted for sale to industry. This has the great advantage of establishing a new habitat as it is required, whereas if left to natural plant sucession, the main colonists would be willows (Salix sp.) *and Willow Herbs* (Epilobium sp.).

Illustration No 3 *(Planters at Work)*
For the first three years, no planting was undertaken and during this time, food analysis was carried out on the crop contents of about 250 locally shot duck. In this way, the main food preferences of the local duck were established.

Illustration No 4 *(A mature shore line)*
Main food preferences of dabbling duck included the seeds of Alder (Alnus glutinosa), *Silver Birch* (Betula sp.), *Glaucous Club Rush* (Scirpus tabernacmontani), *the sedges* (Carex sp.), *Burr-reed* (Spargenium), *Spike Rush* (Eleocheris palustris) *etc. and when planted and mature, the shoreline is landscaped and provides both cover and a wide range of foods, including submergent plants, such as the Stoneworts* (Clara) *and Pondweeds* (Potomogeton) *of importance for diving duck* (Aythya sp.) *such as Pochard* (A. ferina) *and because these plants attract invertebrates and crustacea, Tufted Duck* (A. fuligula).

Illustration No 5 *(A loafing spot)*
Duck and geese like to be able to swim ashore and sit out to rest, sunbathe and preen on what the Americans have called "loafing spots". On the Sevenoaks Reserve, ideal "loafing spots" are provided by sandbanks, formed by the very fine unmarketable particles of sand which flow back into the lake from the washing and grading machinery.

Illustration No 6 *(A spit)*
In order to encourage as large a nesting population as possible, it is important to understand that a drake defends a shoreline territory for as far as it can see and will bring its mate back to this part of the lake to feed when she leaves the nest. If a spit can either be left, or in this case at Sevenoaks, back-filled, then the visual shoreline is decreased and more duck will nest.

Illustration No 7 *(The ideal nesting shoreline)*
This mature and irregular shoreline will hold several drakes in their own discreet territories invisible to each other. It does not matter that their mates may share the same nesting site in cover some way off; it is only on return to the shoreline that spacing out is necessary.

Illustration No 8 *(An artificial raft island)*
At Sevenoaks, it is uneconomical to leave natural islands on the top of a cone of sand and gravel which may be 30 metres in depth. Therefore artificial raft islands, consisting of a bouyancy tank at each end, on a metal frame, with a grid in between, covered with soil and planted, so that water is available from the lake, have proved most successful.
Willow Herbs do well and provide nesting cover for Greylag Geese, (Anser anser), *Mallard* (Anas platyrhynchos), *Tufted Duck* (Aythya fuligula) *and Great Crested Grebe* (Podiceps cristatus) *etc.*

Illustration No 9 *(Duckling Survival habitat)*
Once hatched, the ducklings need warmth and an abundance of insect life for early development. This is provided by shallows, well sheltered bytrees and emergent water plants, of which Amphibious Bistort (Polygonum amphibium) *is an excellent example, being much favoured as a nesting place for insects on its floating leaves, which tend to conceal the feeding ducklings from maurauding crows.*

Illustration No 10 *(A sandbank to be managed for waders)*
This illustration shows a sand bank before being partly flooded by digging and by the use of explosives, the new wet area then being treated by the addition of large quantities of cow slurry to attract an abundance of invertebrates - insects and worms - to provide food for various wading bird species.

Illustration No 11 *(The same sandbank after management).*
This same area is now proving most attractive to wading bird species, of which no less than 23 have been recorded here in the past three years, including such uncommon ones as the Pectoral Sandpiper, (Calidris melanotus) *and Avocet,* (Recurvirostra avocetta).

Illustration No 12 *(Snipe feeding in the new habitat)*
Snipe have been particularly attracted to the new wader habitat and the loss of 16 acres of prime Snipe habitat due to nearby agricultural drainage has been almost compensated for by the management of three acres of land on the Reserve. In three winters, 487 individuals have been caught and ringed, of which 18 % have been recaptured in subsequent winters, showing the value of even the smallest areas of ideal habitat to these specialised birds.

Reference: J. G. Harrison (1974) **The Sevenoaks Gravel Pit Reserve** Wagbi Conservation Publication pp. 1-116. Published by WAGBI, 104 Watergate Street, Chester, England. Price 50 p. postage extra.

The Management of an English Gravel Pit Waterfowl Reserve

Illustrated by PAMELA HARRISON
Text by JEFFERY HARRISON **(See page 15)**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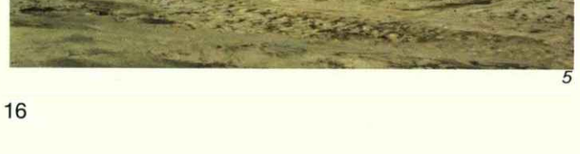
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MANAGEMENT OF WETLANDS FOR WATERFOWL

Jørgen FOG
Co-ordinator of the Wetland Management Research Group of the International Waterfowl Research Bureau
c/o Game Biology Staticn
Kalö, 8410 Rönde, Denmark

By way of introduction it would perhaps be appropriate to explain the meaning of the three nouns in the title.
As defined by the Ramsar Convention (see Naturopa 1975 No. 22, p. 16) wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, bracksish or salt, including areas of marine water, the depth of which at low tide does not exceed six metres. The term waterfowl refers to birds dependent on wetlands for breeding, moulting, resting and wintering. The meaning of the English/American term "management" is difficult to explain in few words. In my view the management of a given locality may be divided in to :

1. Object.
2. Organization.
3. Active efforts on the basis of research achievements as regards maintenance and improvement of the area.
4. Utilization in relation to the object.

According to Article 4, subsection 4 of the Ramsar Convention, the Contracting Parties shall endeavour through management to increase waterfowl populations on appropriate wetlands. I would like to make a few comments on each of the four aspects of management as defined above.

Object

The object of managing a wetland for waterfowl should of course be defined in relation to those particular bird species one wishes to establish, maintain, and/or improve the conditions of. Thus it should be decided whether the locality is to serve primarily as a breeding, moulting, resting or wintering area, or a combination of these ; to which human utilisation (commercial use, recreation, research, education) the area will be subjected ; whether the avian interests are to be given priority, so that only human activity which in no way affects the bird life will be tolerated ; or whether the human activity in the area will have a greater importance. The object or aim is often badly defined or too vague when the management of a new-established wetland reserve or an area to be protected is considered.

Organization

Irrespective of the ownership of wetlands, whether they be private properties or state-run, it is necessary to establish an organization that actually looks after the wetland and the observance of the object. Who is going to have the final responsibility for it ? Who is to be charged with the task of drawing up the concrete working plan ? Who is going to realise it ? Who is going to be the warden ? These are some of the organizing questions under consideration in each individual case.

Active efforts

Almost every landscape is affected by human activity. Therefore the well-being of the birds is determined not only by climate, soils etc., but also to a large extent, by human activity. Furthermore, human influence is no less static than the natural factors. The traditional methods of protection do not suffice if certain flora and fauna are to be maintained in a particular area. It is necessary to follow up with active management to maintain, improve, and renew the environment of the waterfowl. Below I shall draw attention to just a few examples of active management in different countries.

Restoration of a lake

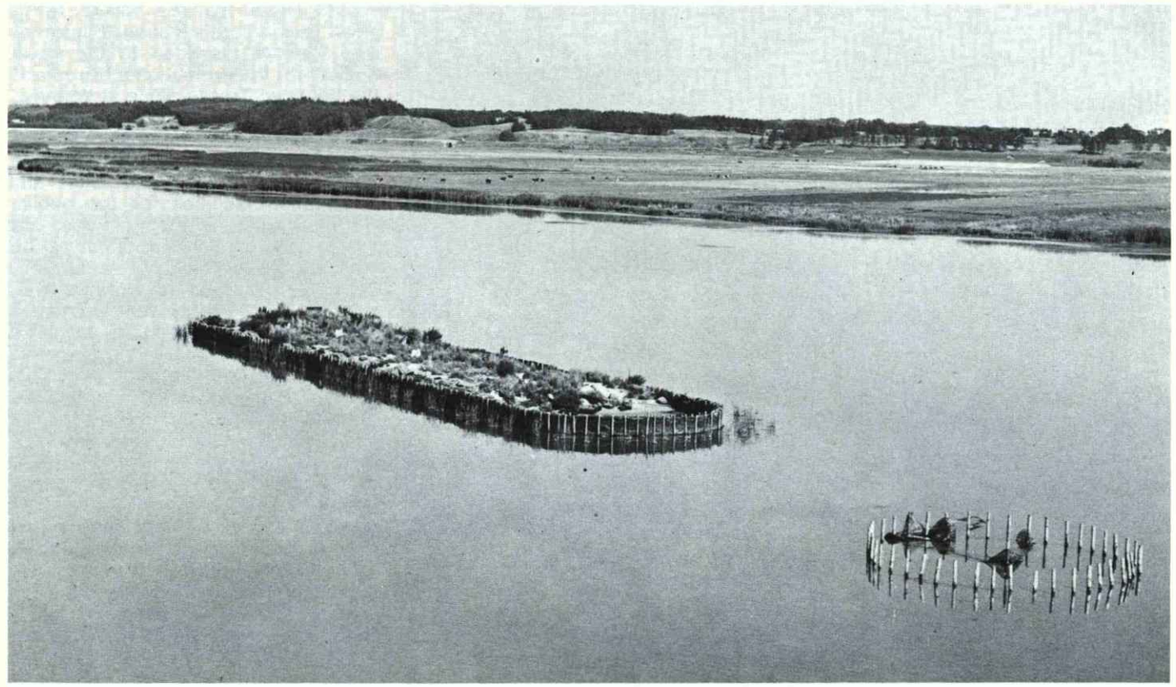
During the period 1802-1933, Lake Hornborga, Sweden, was consistently drained and its water level lowered until it became apparent that it was impossible to cultivate the area. Following the last lowerings of the water level an almost complete overgrowth of emergent macrophyte vegetation, especially reeds and sedge, took place, and a rapid decrease in avian value was observed. As a result, the Swedish Government realised that an urgent conservancy project was needed to save the lake. A team was therefore formed to determine whether the lake could be restored and again function as an important bird lake. It found that restoration was realistic for quite a large area if, before the raising of the water level, the accumulated masses of coarse reed detritus and the rhizomes were eliminated. In experimental sections there is now open water where underwater vegetation has replaced reeds etc. Sv. Björk has described the working processes, where pontoon-equipped amphibious movking machines were used. P. O. Swanberg has described the effect on the fauna in the water and on the bird life. For instance the breeding population of Tufted Duck has increased to four times the earlier number of pairs, while the number of breeding Pochard has exceeded 5 times the initial number. Crested Grebe and Coot have increased even more.

Grazing

In addition to the lowering of the water level, the discontinuation of the grazing of marshes is also responsible for the formation of a dense growth of reeds, to such an extent that the composition as regards species and the number of individuals may be changed completely.
Along the Western Jutland fjords and the Limfjord, Denmark, cattle grazed marshes are often found with breeding conditions for Dunlin, Oyster-Catcher, Black-tailed Godwit, Ruff, Avocet, and other wading birds, and in spring and autumn resting possibilities for both wading birds and Teal, Wigeon, other ducks, and some species of geese. If the grazing stops in such areas, reeds often become dominant. The breeding birds in question are replaced by other species, for instance Greylag Goose, Bittern, and Marsh Harrier, while the amount of resting birds spring and autumn decreases sharply. Thus a few fencing posts and a roll of barbed-wire may change a landscape radically. So cattle represent an important management tool. If the object of the management concerns birds whose habitat is grazed marshes, grazing intensity should be carefully determined, not forgetting that grazing is responsible not only for the length of the grass but also the overall composition of the vegetation species.

Control of reeds by herbicides

It will often be the aim to maintain a mosaic of scenic facets so that most possible bird species are considered. At the West Jutland fjords variation can be created and maintained by means of cattle. But other methods may be used.
The continual passage of traffic with heavy machinery prevents the growth of the reeds for some years. According to the water level canals with underwater vegetation or stripes with grasses and other low vegetation are made. In certain parts of Minsmere Bird Reserve, England, the reeds are killed by means of the herbicide dalapon, which is primarily effective when applied to green active growth. The technique is described by H. E. Axell in the Manual of Wetland Management, a loose-leaf handbook prepared and distributed by the International Waterfowl Research Bureau (see list of references).



Nesting and loafing island constructed in a shallow, brackish lagoon, Hjarbaek Fjord, Denmark. Avocets and Black-Headed Gulls are the most common breeding birds on the island.

Mixing fresh- and sea-water

In this Manual Mr. Axell further describes the establishment of an artificial brackish lake with nesting islands in the Minsmere Reserve. Here sea water and fresh-water are mixed to maintain a certain salinity, which is ideal in relation to the object for the area as regards birds. The water level is also controlled. Less than five years after the establishment of the lake, 1,500 pairs of 20 species of birds were breeding in an area which previously had supported no more than 40 pairs of 6-7 species.

Creating and improving deep inland water

In the same Manual J. G. Harrison describes how they have experimented with methods of increasing the holding capacity for the waterfowl of a gravel pit in Sevenoaks, England. An account is given of the construction of artificial raft islands for nesting, small islets or spits for loafing, together with details of the planting programme. An extremely interesting link in the management procedure is the creation of a habitat for Common Snipe and other wading birds. Dr. Harrison's model could be used to advantage in many countries where barren gravel pit lakes could be turned into important areas for waterfowl and for human recreation, for instance angling and shooting.

A hide in the Parc Ornithologique du Marquenterre, France. From such a hide it is possible to observe the birds without disturbing them.

Breeding conditions for wading birds can only be maintained in the saltmarshes of Vejlerne, Denmark, if the areas are grazed (to the right of the barbed wire may be seen high reeds).

Utilization in relation to the object

When considering the human utilization of wetlands that are managed for waterfowl efforts should always be made to avoid disturbing the birds as far as possible. On the other hand it is not necessary to go to the extreme of turning nature into a museum where nothing must be used. Often wetlands and the flora and fauna that compose them may be subjected to multiple uses without excessive harm being caused as far as the birds are concerned, and as mentioned, certain forms of utilisation may be a condition for the maintenance of the bird populations. But multiple use requires a wise planning and an effective warden system.

An example of multiple use is to be found in the marshland area of Vejlerne, in N. W. Jutland, Denmark. The area is privately owned and includes nearly 6,000 ha., which consists of lakes, reed beds, and grazed marshes. The owners have entered into a voluntary agreement with the Danish State for protection of the environment of the waterfowl. According to the agreement, the following different activities are possible :

1. Reed harvesting from September 1st to February 29th.
2. Cattle grazing.
3. Commercial fishing.
4. Wildfowling. The shooting renters must not exceed 20 and each of them has the right to shoot not more than 10 times yearly.
5. During the birds' breeding period traffic may pass through the area only with the permission of both the owners and the Nature Conservation Council. The rest of the year the permission of the owners is required.

In addition to the regulations of the agreement other statutory instruments should be mentioned, which the owners and the shooting renters maintain : the use of a motor boat is limited to the official who looks after the fishing and to the warden. The season for geese opens 2 weeks later than the date given by the Danish Game Act. In a large grazed marshland of several hundred ha. shooting is never practised.

In addition, for many years the Game Biology Station has been allowed to carry out the ringing of waterfowl and other investigations in Vejlerne, due to the great interest shown by the owners in this research. Biology students, visiting game consultants and other people as part of their training have been involved in the investigations and have become acquainted with the multiple use system.

Every year permission is granted to groups of interested bodies, such as biology teachers and ornithologists, who under the guidance of the warden have the opportunity for extensive field studies.

In England systems of paths, hides, and other facilities in wetland reserves have been established in many cases. These may be visited for a small sum (for instance Minsmere Bird Reserve managed by the Royal Society for the Protection of Birds and the Wildfowl Trust's place at Welney). In France le Parc Ornithologique du Marquenterre at the river Somme estuary should be mentioned. Here the owner has made artificial lakes and observation facilities for the public. If visitors to a wetland reserve do not respect and understand its natural resources with which they are at close quarters, a system of effective wardens is needed to prevent any undue damage. Often it is more advisable to let the public look at the birds and the biotopes from the periphery of the areas.

Although the subject in this article has been maintenance, improvement, and restoration of wetlands as regards waterfowl, we must not forget that the wetlands also include other elements of fauna as well as flora, the conservation of which should be both a local, national, and an international task to preserve. "Wetlands are a natural asset. Exploit them... don't destroy them" (from Liquid Assets - see list of references). It must further be strongly emphasized that no management operations should be started on any locality before it is absolutely evident that no interest of zoological, botanical, or historical nature is violated.

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THE WADDENSEA
Europe's largest marine wetland

J. J. ZIJLSTRA
Biological director of the Netherlands Institute of Marine Research Texel, Netherlands

Aerial photograph of a part of the Waddensea near the isles of Rottum. On the mainland (bottom part of the picture) plots of agricultural land can be observed.

Location and general morphology

In the south-eastern corner of the North Sea, along the coasts of southern Denmark, Germany and northern Holland, lies a vast wetland area, of about 10 thousand km² in size, in which mainly natural forces, in particular the tides, determine shape and structure of the " landscape ". Most of the area is protected against the destructive action of open sea waves by a belt of barrier-islands. In some parts, mainly outside the estuaries of the rivers Elb and Weser, the islands are lacking and protection is provided by sand-bars. Between islands and sand-bars deep tidal channels allow the sea to enter the area with every tide, maintaining thereby the structure of the system and providing nourishment for its numerous permanent and temporary inhabitants. These tidal inlets, with depths of up to 40 metres, branch into smaller channels, gullies and creeks, becoming gradually shallower and merging eventually into large tidal flats. The tidal flats, sandy at the seaside and muddy at the landside, cover about two-thirds of the area and form one of most characteristic features of the Waddensea. Submerged at high tide, the area evidently belongs to the sea, but at low tide vast bare stretches of sea-bottom, in which creeks have cut intricate systems, are exposed to the eye. At low tide hundreds

of thousands of birds can be observed foraging on the invertebrate fauna of the tidal flats. The presence of most of these fauna, extremely rich in numbers but poor in species, can only be observed by tracks and small holes in the wet bottom and by small faecal mounds. At the land-side of the tidal flats, in places undisturbed by man, an at first frugal, higher up more lustrous vegetation has developped, still within reach of the sea at high tides — the salt-marshes.

Historical

The present form of the Waddensea is the result both of natural forces and action by man. An important natural force is a general advance of the sea caused by a rise in sea level (transgression), tending to destroy the coast and push it landwards. This destructive force is counteracted by a continuous reconstruction of the coast by sedimentation of sand and silt, due to the action of tides and waves. The rise in sea level started after the last glacial period and at first the coast quickly retreated over a distance of more than a 100 miles. However, since about 5000 B. C. the destructive and constructive forces were more or less balanced and the coast-line tended to remain stationary. Under these conditions peatland could be formed in many places behind a protecting sand-barrier of blown-up dunes fixed by pioneer-vegetations, and interrupted at places by river outfalls with extensive Wadden-like areas. But although stationary on average, the two natural forces affecting the coast tended to dominate in turn, long periods of relative rest and construction alternating with transgression periods.

Human life in this naturally fertile border-land along the sea must have been hazardous with floods swept up by storm surges. Before the middle ages the only protection of man against the freakish sea consisted in the construction of mounds, thousands of which are to be found in land now defended by heavy dikes. Only on some isles in the German Waddensea (halligen) are these mounds still in function. In the middle ages, in a period of transgression, people started building dykes, probably to protect their agricultural land against the adverse effect of sea-water inundation. They also interfered with the peatland by draining it for agricultural and other uses (fuel) with canals and ditches, thereby lowering the land and making it more accessible to the sea. It is mainly in the middle ages that great floods gave the Waddensea its largest dimensions, engulfing more and more land, drowning thousands of people and destroying villages and small towns. Large inlets as the Zuidersea, the Dollard, the Jade and others, now reclaimed, were formed in that period. It seems likely that man at that time had inadvertently intensified the effect of the transgression period by meddling with the peatland. In the centuries that followed much of what was lost to the sea was reclaimed. A period of relative rest, with a natural reconstruction of the coast and progressively improving techniques of dyke-building assisted in this process. However, from the floods in the middle-ages people learned to treat the sea with caution, never to trust its apparent quietness and be aware of its forces during great storms. Occasional catastrophes helped them to remember this lesson. Is it any wonder that in the light of this history of a continuous fight against the sea, with even recent storm-floods keeping the memory alive, that reclaiming land and closing off the sea had a high priority with the inhabitants of the low lands bordering the Waddensea ? Years of experience have provided for the present the technique to attack the sea seriously and close off large parts or even the whole of the Waddensea in one big operation. Large engineering works in our century such as the closing of the Zuidersea and large inlets in the southern delta in Holland and coastal corrections on the northern German coasts since the floods of 1962 in that area proved the feasibility of such projects. The idea is the more tempting, because we are now experiencing again a period of transgression.

However, there is another side to the problem which more and more people are beginning to realise. With the increase in population most of the land in Europe has been used for cultivation, leaving few refuges for nature. The Waddensea, with its typical landscape and natural richness, represents one of the largest areas in Europe in which natural forces rule and human interference, though increasing is still small. Therefore the idea of conserving the area in its present state, instead of destroying it either gradually or in one big blow, is gaining in impetus.

Biological characteristics

A full description of the biological richness of the Waddensea would be beyond the scope of this article, but a brief outline serves to give an impression.

The area regularly under the influence of the tides abounds with animal life, most of which lives on or in the tidal flats and shallows. The number of animals per unit area is far higher than in the North Sea, already a rich marine area according to world standards considering the yield of its fisheries. The obvious reason for the richness is the amount of food available. Part of this food is produced locally, by microscopic plants floating in the water or attached to sandgrains on the bottom. However, a large part enters the area from the North Sea as suspended material. By special mechanisms, physical and biological in nature, this suspended material is trapped in the Waddensea. The tides provide for a continuous supply of organic suspended matter, so that the system is in fact heavily subsidized with food produced elsewhere. The bottom fauna molluscs, worms and crustacea obtain their food either by filtering the water (suspension-feeders) or by consuming the surface-layers of the bottom, rich in food by sedimentation of organic matter (deposit-feeders). Most of the fauna, poor as measured by species but abundant in numbers, live sheltered in the bottom. Outside the locally numerous mussel-beds the tidal flats look lifeless at low tide, but are in reality teeming with animals.

Among those who profit from this bounty, birds are the most conspicious, notably waders, ducks and geese. Some of these birds breed in the vicinity. The majority, however, come from breeding sites in the subarctic regions of Europe and Asia and use the area as a feeding station or wintering ground. The Waddensea represents about half the amount of feeding area available for this type of bird in Europe and north-Africa and evidence is mounting that the area fulfils a vital rôle in the lifecycle of many species. As birds can hardly be overlooked and the presence of hundreds of thousands of them, with many species represented, is one of the most attractive features of the Waddensea.

Another group of animals, preying on the rich bottom fauna, are the fish, living a more obscure life in the turbid waters of the area. The most numerous among them are juveniles of species, inhabiting the open North Sea as adults, the Waddensea thus acting as a major nursery area.

Indications are that between them the birds and fish share a large part of the available production of the abundant invertebrate fauna, the fish at high tide, the birds mainly during low water. If this is indeed the case a reduction in size of the area would have serious consequences for the populations of birds and fish relying on the area for their food supply.

A true ornament of the area is the harbour seal, which declines for reasons unknown, but can still be observed resting at low tide on the edges of the tidal channels.

Not only has the tide-affected part of the Waddensea great virtues, but also the edges, the islands and the coast, which are unique in Europe due to the magnificient salt-marshes with their lush and diversified flora (although much of this area has been lost due to reclamation projects).

The island vegetation, found in areas with transitions from fresh to salt, from wet to dry, from sandy to silty, heavily grazed to nongrazed, is also of unequalled value and beauty. Beauty too is found in the ancient human elements in the region, in particular on the islands with their often picturesque villages.

The edge of the Waddensea with salt-marshes.

Conservation

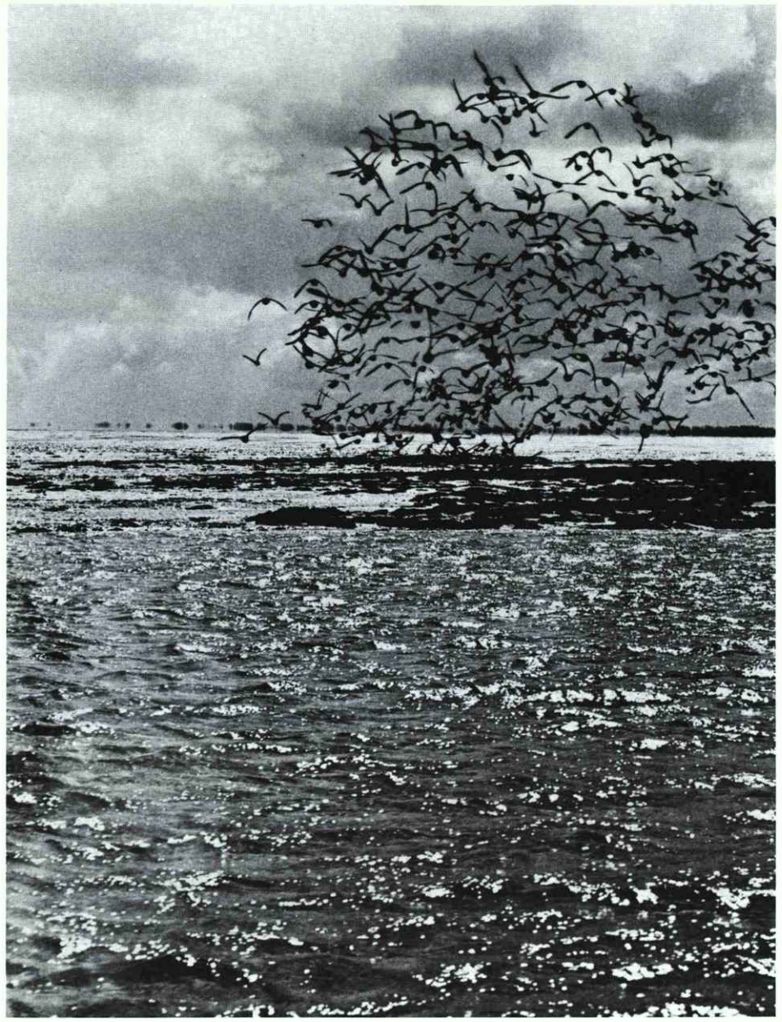
The "landscape", with its relatively unspoilt natural resources, shaped and maintained by the tidal action of the sea, is subject to an increasing pressure of destructive forces generated by man. It is true that chances of a complete or large scale partial reclamation seem at present remote. This is partly because the threat of floods has been greatly reduced by an effective defence system against the sea and partly because land reclamation in the remaining area has become less profitable.

However, it seems doubtful, whether land reclamation, of which small projects are still being carried out or planned, presents the main factor endangering the area. New dangers have evolved as for instance the development of harbour facilities and industrial sites with their accompanying pollution, military exercise areas, engineering works connected with oil and gas exploitation, sand extraction and, last but not least, recreation. All these relatively new human activities, which can be observed everywhere in the wide expanses of the Waddensea, tend to degrade the area in a less conspicious, but in the long run probably equally effective way as large-scale reclamation projects.

It is a good however to note that an increasing number of people in the countries bordering the Waddensea have become aware of the value of the area as a sanctuary for nature in addition to its attractive landscape. Among others this changing attitude has already resulted in reserving parts as nature conservancy areas. Most of these are situated on the islands or the coast, leaving the large area below high-water mark with its forces responsible for maintaining the system unprotected. Only in the most northern-part of the German Waddensea, is the founding of a sanctuary which will include the whole area, in preparation.

Tidal flat at low tide with characteristic faecal mounds of the lugworm (Arenicola marina).

What is actually needed is an extension of this idea to the whole or at least the major part of Europe's largest wetland, which can only be considered as one coherent system, if only by the water, which feeds and maintains the area, but also transports for instance pollutants from one end to the other. There are signs that this goal — an international Waddensea sanctuary — will be reached one day. In the meantime those who recognize the immense value of the Waddensea — scientists and others — are co-operating in the three countries to make an inventory of its treasures, to plan its conservation and management and



A cloud of godwits over the Waddensea at high tide.

to evaluate the effect of existing or planned human disturbances in the area.

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THE RHINE
and its Wetlands – past, present and future

Prof. Dr. Wilhelm SCHÄFER

Natur-Museum and Forschungs-Institut Senckenberg, Senckenberg-Anlage 25 6 - Frankfurt A/M

The Rhine, one of Europe's largest rivers, rises in the Alps and flows into the North Sea. It has a total length of 1,236 km. and its source is above 2,300 m. On its way to the sea, steep gradients (mostly narrow eroded valleys with little sedimentation) alternate with less steep sections, broad alluvial meadows and heavy sedimentation (Fig. 1).

The Alpine, High, Upper and Middle Rhine are steep-gradient sections.

Lake Constance and its delta, the Upper Rhine and the Lower Rhine with the Rhine Delta are the major sedimentary areas with low gradients ; alluvial meadows are varied and extensive, wetlands in natural conditions cover large expanses.

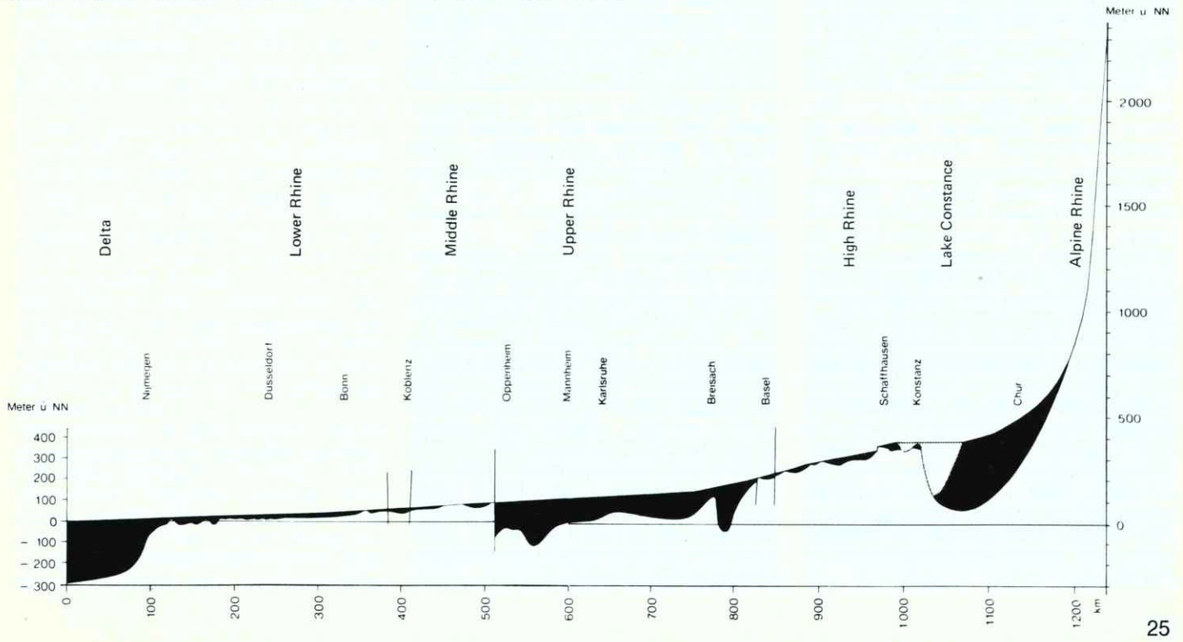
It is with these wetland areas that we are concerned here :

1. Sedimentation and landscape in natural conditions : sedimentation always reflects a levelling gradient (and the stream's reduced tractive force). The more sediment is deposited by the river, the higher it lays its own bed. When in flood (3 times a year), the river overflows its banks, forming an extensive highwater bed on the alluvial meadows. Branching and meandering are the result. Wherever the river bed is high and overflowing is frequent, there is a high groundwater level in the adjoining meadowland. Luxuriant vegetation is the result, as was originally the case in the delta zone on Lake Constance, in the Upper Rhine plain, on the Lower Rhine and in the Rhine Delta.

2. Human action : Johann Gottlieb Tulla started improving the Rhine as early as 1818. He closed off gullies and straightened out meanders, shortening the river and raising its speed of flow. In so doing, he turned lateral erosion into vertical erosion.

The river began to cut into the soil, lowering the bed by 7 m. in the southern Upper Rhine in the courses of 100 years. Tulla's efforts led to less frequent flooding, less gully formation, but also a fall in the water table, causing meadows and wetlands to dry up. Where there had once been swamp and softwood tree cover were grassland, fields and orchards, later on dry zones. Subsequently the Rhine was made navigable by engineering works. Boats came up past Mannheim and Karlsruhe to Strasbourg, then on to Basle. Settlements and ports grew up along the river, together with facto-

Fig. 1
Longitudinal section of the Rhine. Sedimentation areas are shown in black. Where high sedimentation coincides with gentle gradient, there is pronouced wetland formation (after Quitzow 1974).



Flooded river foreland along the Rhine near Wageningen, the Netherlands.

ries. Thus with more and bigger boats, a faster-flowing river, the generation of electricity, the start of widespread destruction of riverside meadowland and wetlands became inevitable.

3. Dangerous side-effects : once vertical erosion had started it could no longer be stopped. Hence increasing falls in the water table (8-10 m.) turned the land into dry heath. Yet the Rhine canal was nonetheless built alongside the river after the First World War, with dams, locks and power stations. Now improvements are continuing downstream beyond Strasbourg, channelling the river between 12 m. high embankments. The wetlands that originally flanked the Rhine are now separated from it by embankments and — unless artificially irrigated — will dry out.

The consequences : the water table in the southern Upper Rhine area is falling by up to 12 m. and further north by up to 5 m.; the drinking water supply is endangered in the expanding densely populated areas ; the groundwater is polluted by impurities filtering through the banks from the river ; meadow vegetation is disappearing, especially the healthy softwood and hardwood trees, causing climatic deterioration through scant vegetation (fields are now irrigated artificially !). The meadowland itself is being swallowed up by roads and motorways, embankments, refuse dumps, building, industrial plants, and spoiled by cooling water that raises the temperature of the Rhine.

4. What is to be done ? The Rhine is fed 80 % by surface water and groundwater from the nearby uplands. It is important, therefore, to keep the feeder water in the Rhine plains as long and as clean as possible (by topping up the groundwater, developing healthy biocenoses, cultivating luxuriant plant growth, developing a damp climate without strong contrasts). However, if in these same areas towns and industry continue to grow and traffic on and along the river increases, the mass of sewage will also continue to grow. Consequently — and this is the task of the eco-technologists — waste water must be cleaned by means of treatment plants and drained off from the Rhine area as quickly as possible, whilst clean water must be kept there as long as possible.

This is not possible with one gully system. Two are needed.

When the Rhine was straightened out in the 19th century, a great many meandering loops were cut off. Many are still there. Their ditch-like hollows — now carrying very little water, many silted up, some with their gravel layer removed, other blocked with building waste and refuse — are just the gully system we now need. They must be cleared, in some cases deepened, and filled by draining off water when the Rhine is in flood (three times a year). Sluices at inflow and outflow points, can be used to adjust the water level. Individual gullies should be interconnected to form a network.

5. What will this achieve ?

a) The constantly full gullies will block the flow of groundwater running in the direction of the river and raise the water table. There will be water in the wells again, artificial irrigation can stop, cracked, dried-out earth will disappear, wind erosion will diminish.

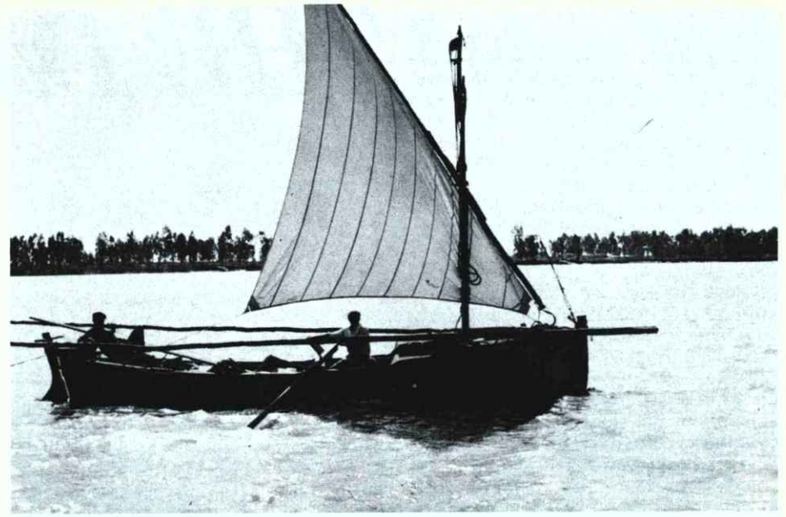
b) The rise in the water table in the meadowland will restore natural plant life (especially woodland).

c) Water tapped from the Rhine in flood will benefit the meadowland's groundwater, strengthen its vegetation, and foster biological interchange between the river and the old channels.

d) The restored vegetation (trees, reeds) will improve the microclimate by levelling out contrasts.

6. Ecological processes cannot be divided up ; they work only as unbroken sequences in an environment as a whole. The meadowland of the Upper and Lower Rhine is sedimentologically, hydrologically and ecologically such an environmental entity. The objective of overall regeneration of the Rhine can be achieved only through biological restoration of all its meadowland and old channels. This lends the task an organisational, political aspect in addition to its sedimentological, biological and technical side. This is a problem that does not respect frontiers. International co-operation is required in the interests of ecological unity.

THE GUADALQUIVIR



Luis Blas ARITIO
Doctor of Biology
Director of the Institute for Hunting Photography and Natural Sciences
Castello, Madrid

Two of the rivers that make up the hydrological network of the Iberian peninsula, have been included in category A of the MAR list because of the special features of their outlets. They are the Delta of the Ebro, in the province of Tarragona, and the "Marismas" of the Guadalquivir, in the Andalusian provinces of Helva and Seville. Both these wetlands are of extreme interest, but it is the second which has acquired the greater importance, both because of its size and strategic situation, and also because a part of this flooded area has been scheduled as a National Park.

The Guadalquivir is 560 km. in length, and rises in the glen of Aguafria, at an altitude of 1,400 metres, in the Cazorla sierra. At the moment a national game reserve, the sierra is one of the wildest and most picturesque wooded areas in the Iberian peninsula. The principal game species found there are the red deer *(Cervus elaphus)* the Spanish ibex, one of the three mountain goat sub-species *(Capra pyrenaica hispanica),* the moufflon *(Ovis musimon)* fallow deer *(Dama dama),* roe deer *(Capreolus capreolus)* and wild boar *(Sus scrofa),* together with numerous birds of prey, which are protected throughout the national territory.

This include golden eagles *(Aquila chrysaetos),* Bonelli's eagles *(Hicialas fasciatus),* peregrine falcons *(Falcus peregrinus),* Egyptian vultures *(Neophron percnopterus),* griffon vultures *(Gyps fulvus).* Also to be found are fourlegged predators such as red foxes *(Vulpes vulpes),* pine martens *(Martes martes),* common otters *(Lutra lutra),* badgers *(Melos melos),* wild cats *(Felis sylvestris),* small-spotted genets *(Genetta genetta)* and weasels *(Mustela nivalis).* As well as roburs and oaks there are Bordeaux pines, Italian pines, holm oaks, besides mastic trees, caprifigs and arbutuses. The place where the ancient Guadalquivir rises could not be more wild and splendid than this sierra, eroded by snow, rain and wind, one of the areas of most outstanding natural beauty in the whole of Spain.

Where it flows through the mountains, the river is narrow, with frequent waterfalls, such as the Utrero, with a fall of over 100 metres. On leaving the Cazorla sierra, it flows into a vast tectonic area, known as the Betic depression, limited to the North by Sierra Morena and to the south by the Subbetic range. Before reaching the historic city of Cordoba, the chief centre of Arabic culture in Spain, the river hollows out a broad valley, which as landscape could be described as a region of gentle inclines, where olive trees predominate. Between the town of Los Califas and Seville, the old port of departure for the Indies, the river twines its way along the valley, forming extremely fertile broad alluvial plains, which are today employed mainly for irrigation.

Shortly after leaving Seville, the valley becomes swampy and marshy, edged with gently-rising woodland, finally widening into a broad estuary at Sanlucar de Barrameda. The Guadalquivir may be said to rise in a natural landscape that is unspoiled and picturesque, while its delta is one of the most splendid sites in the continent of Europe. The National Park of Doñana, situated at the mouth of the Los Tartesos river, is one of the bird sanctuaries to which the eyes of the whole scientific world are today turned.

It is almost impossible to attempt to describe Doñana in a book, so that it would be somewhat absurd to try to do so in a few lines. It is worth listing the main features, however, which make it a region of inestimable ecological interest. Setting aside its importance as a place where migratory birds halt, hibernate and breed, we will first mention the biotopes which are particularly characteristic. It provides an unending succession of marshes, dunes, corrals, lagunes, pinegroves, - spinneys remarkable for the helianthemum and marsh cork-trees with their worldfamous "bird-cages", where bitterns and spoonbills fill these ancestral forests with life and colour, forming a natural area whose beauty is unequalled throughout Spain.

These biotopes provide shelter for complex biocenoses in which the different classes of vertebrates, principally birds, are represented in strength. The wealth of its fauna includes the Spanish lynx *(Lynx pardellus),* Egyptian mongoose *(Herpestes ichneumon),* the imperial eagle *(Aquila heliaca aldalberti),* spoonbill *(Platalea leucorodia),* purple gallinule *(Porphiroo Porphirio),* azure-winged magpie *(Cyanopica cyanus),* the greater flamingo *(Phoenicopterus ruber),* to name but a few. The Guadalquivir is afforded protec-

tion at its source and when it finally empties itself into the sea. The Cazorla national game reserve, where a capable body of guardians watches over the different species, both fur and feather, protects the first few kilometres of its course, while the Doñana national park affords 39,225 hectares the maximum official protection status. However, the Doñana faces a number of menaces which might imperil its future. The principal one is the draining of the marshes, so as to convert the flooded lands into agricultural zones. This would mean a substantial change in the marsh ecosystem, with all its unpredictable consequences. The second is the increase in tourist centres in the region, especially the sea coast, which little by little would gain a stronghold on this much-favoured district. Although voices have been raised from all sides in consternation and brought the matter to the notice of the public, the country's chief conservation authority, the Instituto Nacional para la Conservación de la Naturaleza (ICONA) has taken the matter in hand by establishing contacts with the IUCN, WWF and other national and international organizations with a view to taking, as a matter of urgency, the appropriate measures to safeguard the national park, whatever the cost.
The historic and ancient Guadalquivir is one of those rivers to enjoy the blessing of Nature : it rises in one of Spain's most unspoiled regions, and its delta is in one of the most important national parks of the whole continent. We are all concerned in the protection of its landscape and biotopes, which it is to be hoped future generations will be able to enjoy as well.

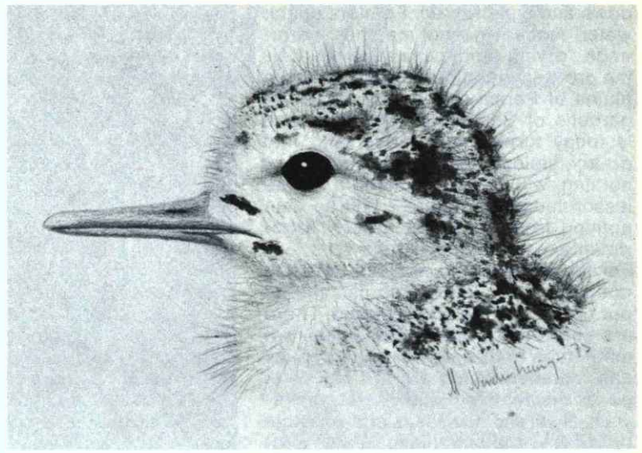
THE DANUBE

Dr. Maria PASPALEVA

The Danube — Donau, Dunàrea or Dunav — is one of the great rivers of Europe, the second longest and the only one that flows through eight countries. The 366,867,000-odd Europeans in our continent are introduced to it — and learn to love it — mainly through their geography text-books. We Rumanians say that anyone who has drunk the water of the Danube will always come back...
The Ancients called it Istros. To the Romans it was Ister from its sources to the *Iron Gates* and Danubius from there to its delta. Long before Greek historians and geographers — Herodotus and Strabo — described it, ships were sailing up and down its waters. The Phoenicians, the Egyptians, the Romans and the Byzantines also knew of this immense water way whose banks jealously guard the memory of ancient cities buried in the loess, more than 20 on the Bulgarian shore.
The Danube is Europe's second longest river, after the Volga ; every second it empties 6,300 cubic metres of water and 2,140 kilos of alluvial deposits into the Black Sea. The water is supplied by more than 120 tributaries in 12 different countries. It has an area of 805,300 square kilometres. Three capitals, nine cities with over 100,000 inhabitants and hundreds of townships and villages perched on its banks rely on it for their drinking water, food and energy supplies, since the waters of the Danube are used for farming, fishing, hydro-electric power stations and shipping. Sadly, it is also a dumping ground for waste from industrial areas and household refuse. As a result, the sources of the Danube, the "Blue Danube" of the Viennese and the Bulgarians' "White Danube" are gradually turning into a mud-coloured stream of flowing slime whose oily waters ooze into the Sulina Sound amid concrete and retaining walls. Here and there, the reeds still succeed in making the water of lakes and canals transparent once more and often the fish do still survive the effect of pesticides and other poisonous chemicals. In the same way, birds still find quiet, deserted nooks to build their nests in. All the same, anyone who has known this great river in any other way than from the tourists' landing stage, anyone who has set foot on its islets, sailed under the arching willow trees and learnt to love its green banks and the sunny stretches of reeds, realises that the true Danube, the old Danube, rich, wild and generous, is becoming increasingly a thing of the past.
There are more and more changes, sometimes scarcely perceptible with slow, unexpected results, sometimes sudden and with disastrous consequences, destroying in a few years what nature had taken centuries to build up. Damage and decay are on the increase and following a geometric progression : a marsh that used to be a little paradise on earth, full of pulsating life, is drained ; elsewhere a dam keeps fish out of their age-old spawning grounds ; further on a pump is pouring gallons of pesticide-saturated water into the river ; on the other bank, a reed-cutting machine is destroying the floating roots, depriving the water of its natural filter ; lastly, the river's biological balance is increasingly being jeopardised by intensive fishing or the farming of fish that are foreign to it.
It would take too long to list everything that man can invent and "produce" to exploit the riches of nature — even at the cost of destroying them — particularly if he is not curbed by any laws, regulations or international conventions.
It is high time to realise that the Danube and its delta are dying. Where are the sturgeons which used to be found as high up as the Iron Gates ? Where are the 400 1b catfish still recalled by old men who fished on the banks of the Danube ? What has become of the imperial eagles, the white-tailed eagles and the ospreys which used to watch over the river ? Practically everywhere any bird qualified as piscivorous — fish farmers apply this name to anything from a pelican to a white-winged black tern — anything flying over their breeding grounds is hunted down and slaughtered. Farmers attack water meadows and marshes : drainage, drying and cultivation — it is the process that turned the once fertile plains of Persia into desert, filled the gardens of Semiramis with sand and is today turning still fertile land into dreary, lifeless wastes. Has man learnt nothing, will he learn nothing from the lesson taught by nature ? Will he gain nothing from his predecessors' experiments, so often disastrous ?
For the Danube and its delta time has not yet run out. Everything can still be put right, repaired and restored. There are still are some forgotten islets, some hidden nooks, some unspoilt lakes and marshes which are the last refuge of the teeming wild life of yesteryear. Now and then it is still possible to glimpse the white-tailed eagle's lonely nest or a hidden colony of cormorants or herons. There are still pelicans and rush-beds in the delta, enormous catfish and pike can still be found there sometimes and the sturgeon has not died out. This great river is not yet as polluted as the Rhine.
But it is high time to take action if we wish to preserve the Danube as it still is today.

Above and below: the Danube delta.

THE ORNITHOLOGICAL IMPORTANCE OF DANISH WETLANDS AND THEIR DISTRIBUTION AND CLASSIFICATION



Lorenz FERDINAND, Doctor
and Poul HALD-MORTENSEN, M. Sc

The mainland of Denmark is composed of fertile soils with many fresh water lakes and brakish lagoons ; in its characteristic shallow coastal waters are to be found about 500 islands of varying sizes bringing the coastal length to a total of 7,400 km.
In spite of a high degree of cultivation (approximately 85 per cent of the country is arable land) and drainage, a rich birdlife abounds in and around the numerous lakes and bogs ; but in an international context, it is the coastal wetlands which offer the best conditions for many breeding, resting, moulting and wintering species of birds, especially the sheltered coasts with tidal flats, salt marshes, brackish lagoons and swamps, where the highest densities of birds can be found throughout the year.
Approximately 1,400 km² of the coastal waters are less than 2 metres deep and there are also very large areas of shallow offshore marine water, at some distance from the coast. These localities are important feeding areas for impressive numbers of wintering sea ducks and other diving birds.
The basic physical structure of the Danish wetland areas was created during the last glaciation, but they have since undergone considerable changes due to both natural and human influences. In particular, large waterlogged areas and lakes have been drained off and certain areas with shallow coastal waters have been reclaimed and separated from the sea by dykes. Many of those former wetland areas in Denmark have been converted into arable land as has been the fate of so many other characteristic ecosystems in this highly cultivated country. However, not all these efforts have been entirely successful, especially in the case of land reclamations with the result that the areas concerned now represent some of the most valuable Danish wetland localities — as for instance Vejlerne, the famous scientific nature reserve in Jutland and the important Saltbaekvig area on Zealand.
The importance of Danish coastal wetlands as breeding localities is best illustrated by the fact that high proportions of the European breeding populations of certain species are to be found in these regions, such as Shelduck, *Tadorna tadorna,* Red-breasted Merganser, *Mergus serrator,* Avocet, *Recurvirostra avocetta,* Sandwich Tern *Sterna sandvicensis,* and Little Tern, *Sterna albifrons.*

Wetland studies

Intensive studies carried out on Danish bird fauna over the last 15 years have been particularly fruitful due to the running of several parallel projects. These have been organized and coordinated by the Danish Ornithological Society and the national Game Biological Station, although much of the work has been done by participating amateur ornithologists.
The following projects are considered the most important :
1. From about 1965 data on the most important localities for breeding and resting birds in Denmark have been systematically compiled. These data are recorded in the Locality Register of the Danish Ornithological Society, and have resulted in several publications (Ferdinand 1967, 1971, and 1976).
2. Since the beginning of the 1960's the Danish Game Biology Station has collected and published data on the distribution and number of waterfowl. All the most important localities can now be considered as well known (Joensen 1968, 1974, Fog 1971).
3. During the years 1971-1974 an "atlas scheme" was undertaken in Denmark, in which all the different types of bird species occurring in 5×5 km. squares were recorded. It was arranged as a joint project between the Danish Ornithological Society and the Zoological Museum, Copenhagen. The results will be published by Dybbro in 1976.
4. Counts of all species of waders throughout the country have been carried out in co-ordination with I.W.R.B. (International Waterfowl Research Bureau) since 1973. This work has been done by a working group under the Danish Ornithological Society.

The location and classification of Danish wetlands

Of all the localities recorded in the Local Register of the Danish Ornithological Society about 750 have been considered worth selecting for more detailed description. Of these about three quarters are wetlands. Table 1 shows the distribution of birds in the different localities. Fig. 1 shows the number of species and individuals of waders on coastal localities, based on data given in Table 2 on the classification of localities for resting and migrating birds. These data illustrate the importance of the Danish coastal areas to waterfowl and also provide a very useful tool for present and future conservation work.
Outside the breeding season several hundred thousands of waterfowl on the Northwest European "fly-way"

Table 1: Classification of the Danish breeding bird localities according to the system introduced by Ferdinand (1971).

	Code	Forest localities (S localities)	Code	Heaths and heath-bogs (H localities)	Code	Bogs and lakes (M localities)	Code	Meadows, coastal marshes and shores (E localities)	Code	Sea-bird colonies (bird-islands) (F localities)
1. Exceptionally good breeding areas (of European importance)	SI	Over 15 pairs : Sparrow Hawk, Goshawk, Kestrel, Common and Honey Buzzard, Peregrine, Osprey, Cormorant	HI	Over 15 pairs : Black Grouse, Wood Sandpiper, Teal, Curlew, Short-eared Owl, Golden Plover, Crane	MI	Over 200 pairs : Waders and Ducks, Rails, Coot, Grebes 2000 pairs : Black-headed Gulls Locality for : Spoonbill, Bittern, Little Gull, Red-crested Pochard	EI	Over 200 pairs : Waders and Ducks, Gull-billed Tern	FI	Over 2000 pairs : Gulls, Terns and Ducks, Guillemot, Razorbill, Gull-billed Tern
2. Very good breeding areas (of national importance)	SII	Over 6 pairs in continuous forest-area of Sparrow Hawk, Kestrel, Common and Honey Buzzard, Goosander, Barred Warbler, Goshawk, Hobby Raven	HII	Over 3 pairs : Teal Over 2 pairs : Black Grouse Over 5 pairs : Curlew Over 2 pairs : Wood Sandpiper, Short-eared Owl	MII	60-200 pairs : Waders and Ducks, Rails, Coot, Grebes Over 5 pairs : Grey Lag Goose Over 300 pairs : Black-headed Gull Locality for : Marsh Harrier, Montagu's Harrier, Black-necked Grebe, Pochard and Tufted Duck, Gadwell, Spotted Crake, Black Tern	EII	60-200 pairs : Waders and Ducks Localities for : Blacktailed Godwit, Ruff, Kentish Plover, Pintail, Short-eared Owl	FII	500-2000 pairs : Gulls, Terns and Ducks Over 5 pairs : Grey Lag Goose, Colony of Mute Swan Over 10 pairs : Eider Duck Locality for : Sandwich Tern Lesser, Black-backed Gull, Great Black-backed Gull, Black Guillemot, Kittiwake
3. Good breeding areas (of regional importance)	SIII	Good forests for passerines: Nightjar, Oriole, Green Sandpiper, Woodcock, Stock Dove, Wryneck	HIII	Curlew, Teal, Wood Sandpiper	MIII	30-60 pairs : Waders, Ducks and Rails, Coot, Grebes Over 3 pairs : Red-necked Grebe Over 3 pairs : Black-headed Gull Locality for : Teal, Shoveler, Garganey, Grey Lag Goose, Common Snipe, Water Rail, Great Reed Warbler	EIII	30-60 pairs : Waders and Ducks Locality for : Dunlin, Avocet, Little Tern	FIII	100-500 pairs : Gulls, Terns and Ducks Locality for : Arctic Tern, Common Tern, Little Tern, Eider Duck, Rock Pipit

Table 2: Classification of the Danish localities for resting and migrating birds (cf. Ferdinand 1971).

	Code	Resting localities for Geese (TG localities)	Code	Resting localities for Ducks and Swans (TA localities)	Code	Resting localities for Waders (TV localities)	Code	Localities with concentrated diunal passage (TL localities)	Code	Localities for migrating and resting birds of prey (TR localities)
1. Exceptionally good localities (of European importance)	TGI	Regular occurrance of at least 600 Geese outside breeding season	TAI	Regular occurrance of at least 5000 Coot, Cormorant, Grebes and Ducks (mixed flocks) Regular occurance of at least 200 Whooper and Bewicks Swans or over 100 Mute Swans	TVI	Regular occurrance of at least 5000 Waders (except Golden Plover)	TLI	Very important locality for migrating birds	TRI	Locality with large passage of or with many resting birds of prey Regular of occurrance of White-tailed Eagle
2. Very good localities (of national importance)	TGII	Regular occurrance of 200-600 Geese outside breeding season	TAII	Regular occurrance of 600-1000 Coot, Ducks, Cormorant and Grebes Regular occurance of Whooper and Bewicks Swans Over 200 Mute Swans outside breeding areas	TVII	Regular occurrance of 600-5000 Waders (except Golden Plover)	TLII	Important locality for migrating birds	TRII	Locality with passage of or with resting birds of prey in some scale
3. Good localities (of regional importance)	TGIII	Regular occurrance of 0-200 Geese outside breeding season	TAIII	Regular occurrance of 200-600 Ducks, Coot, Cormorant and Grebes	TVIII	Regular occurrance of 200-600 Waders (except Lapwing and Golden Plover)	TLIII	Less important locality for migrating birds	TRIII	Locality with passage of or with resting birds of prey in a small scale

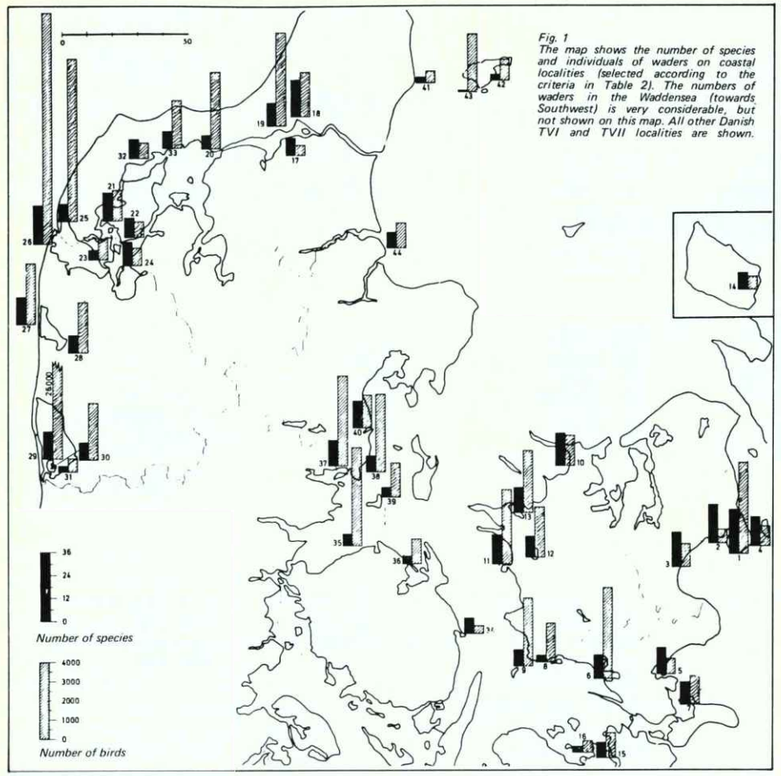


Fig. 1
The map shows the number of species and individuals of waders on coastal localities (selected according to the criteria in Table 2). The numbers of waders in the Waddensea (towards Southwest) is very considerable, but not shown on this map. All other Danish TVI and TVII localities are shown.

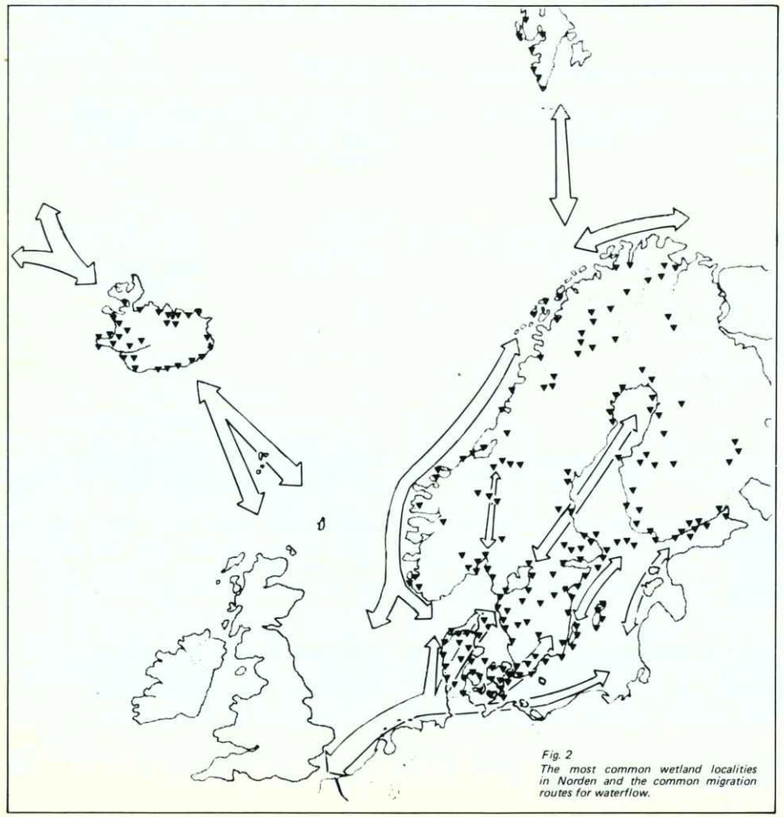


Fig. 2
The most common wetland localities in Norden and the common migration routes for waterflow.

pass over Denmark, which provides very important resting areas to many of these migrating species. Those particularly concerned are the dappling duks, Bewick's Swan, Brent Goose, Pinkfooted Goose, Grey Lag Goose, etc. On the map in figure 2 this central position of Denmark is particularly well illustrated.

During the winter the Danish wetlands are important for many species of diving ducks and the swans. In some species a very high proportion (sometimes more than $^1/_2$) of the total fly-way population spend the winter in Denmark. This applies to for instance Mute Swan, Song Swan, Tufted Duck, Scaup, and Red-breasted Merganser.

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Mag. Dr. Stefan PLANK
Ludwig Boltzmann Institut
für Umweltwissenschaften
und Naturschutz
Heinrichstrasse 5/III
A - 8010 GRAZ

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Service des Réserves
naturelles domaniales et
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de la Nature
auprès de l'Administration
des Eaux et Forêts
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B - 1050 BRUXELLES

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NICOSIA

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Monuments and Sites
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DK - 1602 COPENHAGEN V

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Centre de documentation du S.I.R.A.E.
Ministère de la qualité de la vie
« Environnement »
14, bd du Général-Leclerc
F - 92521 NEUILLY-SUR-SEINE

FEDERAL REPUBLIC OF GERMANY
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Zu Händen von
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Heerstrasse 110

GREECE
Société hellénique pour la
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69, rue Anagnostopolou
ATHÈNES 135

ICELAND
Mr. Arni REYNISSON
Iceland Conservation Council
Laugavegur 13
REYKJAVIK

IRELAND
Mr. E. O'CONNOR
Department of Lands
Forest & Wildlife Service
22, Upper Merrion Street
IRL - DUBLIN 2

ITALY
Ministero dell'Agricoltura
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Signora Dott. E. MAMMONE
5, via Caducci
I - 00100 ROMA

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de la Conservation de la Nature
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A l'attention de M. F. Ch. MULLER
L - LUXEMBOURG-VILLE

MALTA
Director of Agriculture
Department of Agriculture and Fisheries
14, Scots Street
VALLETTA

THE NETHERLANDS
Mr. J. J. ZWEERES
Voorlichtingscentrum
voor Natuurbescherming
Plantage Middenlaan 41
NL - AMSTERDAM

NORWAY
The Royal Ministry of Environment
Myntgaten 2
Oslo-Dep.
N - OSLO 1

SWEDEN
Mr. S. LUNDSTRÖM
National Swedish Environment
Protection Board
Smidesvägen 5
Fack
S - 171 20 SOLNA 1

SWITZERLAND
Ligue suisse
pour la protection de la nature
A l'attention du Dr. Jürg ROHNER
Wartenbergstrasse 22
CH - 4052 BASEL

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and Natural Resources
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YENISEHIR-ANKARA

UNITED KINGDOM
Miss Shirley PENNY
Librarian
The Nature Conservancy Council
19, Belgrave Square
GB - LONDON SW1X 8PY