

Chapter 2

The Wadden Sea Wetlands: A Multi-jurisdictional Challenge

Introduction

This is a story of a very large coastal wetland complex bordering the North Sea plus three countries in Europe. Intertwined with a multi-jurisdictional management issues is the role of several NGOs most notably the Society for the Preservation of the Wadden Sea. This case study will present the wetland resource, the various threats to the resource, a three-country institutional context, and finally the role and history of the NGOs involved.

The Wadden Sea covers an area of 8,000 km², half of which is tideland and an additional 1,000 km² made up of the Wadden Islands. More than half (60%) of the tideland found between Europe and North Africa to the mangrove coasts is situated in the Wadden Sea. The sea is bounded by three countries: the Netherlands, Germany, and Denmark and sits between Den Helder in the Netherlands and Esbjerg in Denmark (see Fig. 2.1).

Historical Overview

Humans have interacted with the Wadden Sea since its origin 7,500 years ago. Exploitation, habitat alteration, and pollution have strongly increased since the Middle Ages, affecting abundance and distribution of many marine mammals, birds, fish invertebrates, and plants. Large whales and some large birds disappeared more than 500 years ago. Most small whales, seals, birds, large fish, and oysters were severely reduced by the late nineteenth and early twentieth centuries, leading to the collapse of several traditional fisheries (Lotze 2005).

Since 1600 the surface area of the Dutch Wadden Sea has decreased by successive reclamation of salt marshes. In 1933 the Zuiderzee (3,200 km²) was closed off from the Wadden Sea causing an increase in tidal range and current velocities in the remaining parts. In 1969 the Lauwerzee (91 km²) was closed off and turned into a freshwater lake. Dredging in harbors and shipping routes as well as extraction of sand and shells became common practice and contributed to turbidity of the Wadden Sea. Discharge of nitrogen and phosphorus into the western Wadden Sea increased manifold since 1950 causing an increase in

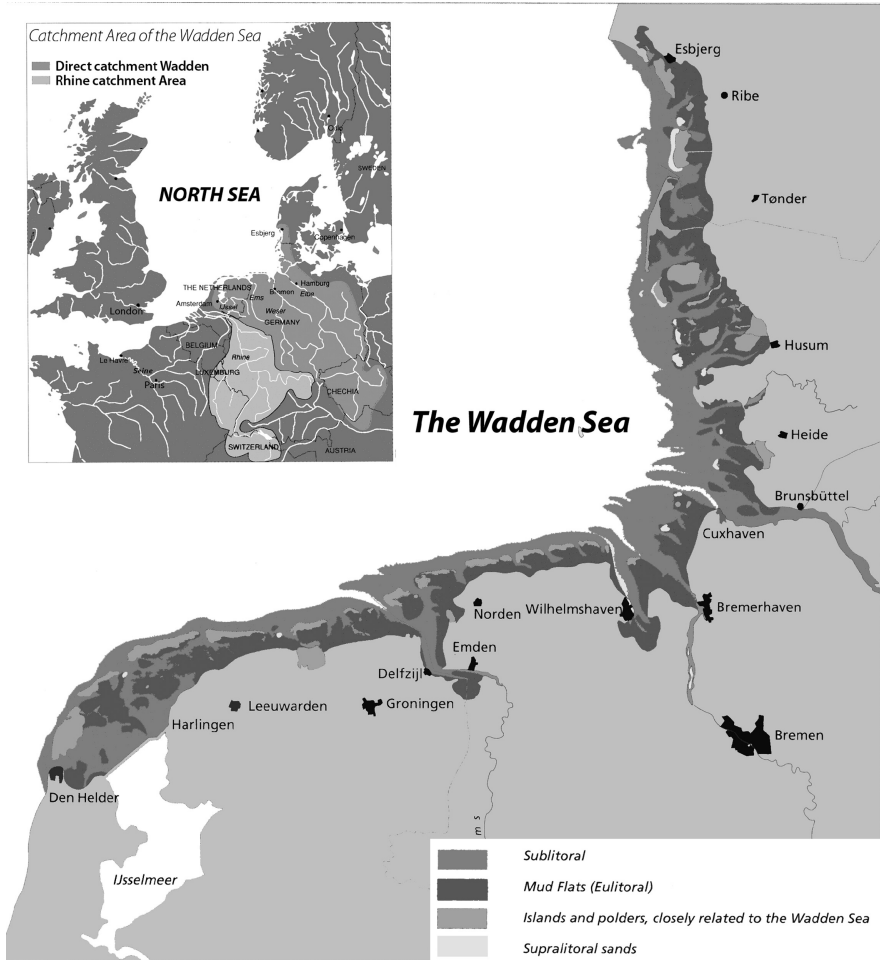


Fig. 2.1 (a) Catchment area of the Wadden Sea and The Wadden Sea: Sublittoral, mudflats, islands, and supralittoral areas redrawn by Samuel Gordon. Sources: Adapted from Common Wadden Sea Secretariat, Undated. *The Wadden Sea: A Shared Nature Area*, p. 3, and WWF, 1991. *The Common Future of the Wadden Sea*, p. 57

phytoplankton production, duration of phytoplankton blooms, and intertidal macrozoobenthic biomass (de Jonge et al. 1993, Swennen 1989).

Fisheries changed drastically since the 1930s. Fishing in the Zuiderzee herring came to an end shortly after closing off the Zuiderzee. The anchovy fishery ceased in 1960 and that of the flounder in 1983 (de Jonge 1993). Under-sized brown shrimps were fished until 1971 and selective shrimp trawls and sorting devices with flushing seawater were introduced to reduce mortality among young flatfish and shrimp. Oysters became extinct in the 1960s due to over-exploitation of natural beds. Production of mussels increased more than



Fig. 2.1b and c Aerial photo of part of the Danish Wadden. Source: Common Wadden Sea Secretariat, Undated. *The Wadden Sea: A Shared Nature Area*, p. 1

10 times between 1950 and 1961 due to “culturing”, and catches of cockles increased slowly between 1955 and 1984. Whelks were fished until 1970 (de Jonge et al. 1993).

The most important changes in the biotic system of the Wadden Sea (de Jonge et al. 1993) were increased production of microalgae and intertidal macrozoobenthos which can be attributed to increased nutrient loads. Eutrophication provided ample food supply for mussels, which were harvested mainly by man and eider duck, and may have caused increased growth rates in juvenile plaice. Increased turbidity may have impaired life conditions for adult dab and assisted in recovery of substantial eelgrass beds after their disappearance in the 1930s (de Jonge et al. 1993, Swennen 1989).

Increased turbidity in the Wadden Sea is probably caused by the closing of the Zuiderzee in 1931 by a significant increase of dredge spoil disposal near Hoek van Holland between 1970 and 1983 and by more than a 10-fold increase in mussel culturing since 1950 (de Jonge et al. 1993). Stocks of several bird species breeding in the Wadden Sea area suffered great losses in the early 1960s due to pesticides. Most of the populations have recovered.

The Wadden Sea Physical Environment

One of the key characteristics of the area is the great tidal variation from 1.36 m in Den Helde in the Netherlands to 3.43 m in Husum in Germany. This variation in conditions is instrumental to the exceptional diversity and wealth of flora and fauna. The coastal landscapes and dunes rank among Europe's most beautiful places. On the islands, more than 900 different plant species, 300 moss species, 350 species of lichen, and 650 species of fungi occur.

There is also an abundance of birds and the area plays a vital part in the survival of about 50 different species, originating from the larger part of the northern hemisphere: from northeastern Canada, Greenland, and Spitzbergen up to central Siberia. Estimates have shown that there are 9.3 million herbivorous water birds utilizing the area for foraging and migratory rest stop. Species that can be seen include barnacle geese, osprey, spoonbills, sheldrake, avocet, sandwich terns, sandpipers, bar-tailed godwits, and oyster catchers (Smit 1989). One of the current issues is the conflict between commercial shellfish fishing and shellfish-dependent birds (Kees 2001, Verhulst et al. 2004, van Eerden et al. 2005, Goss-Custard et al. 2004, van Berkel and Revier 1991).

Then there are the fish. Estimates indicate that the Wadden Sea has an average fish density of one fish per square meter, which means billions of fish. The catch taken in the North Sea is considerable. Eighty percent of all plaice and 50% of all sole caught in the North Sea grew up in the Wadden Sea, representing annual turnover of many hundreds of millions in dollars (de Jonge et al. 1993, Swennen 1989).

At the incoming tide large shoals of fish, mainly flat fish, like plaice, flounder, dab and sole, spread over the inundated sandbars to look for food. They mainly feed on the smaller shellfish, worms, shrimps, and crabs. The fish in the Wadden Sea can be classified into several groups: sedentary fish such as eelpout, butterfish, and scorpion fish spend their lives in the Wadden Sea. Migrants, including flounder, garfish, and gray mullet, visit the mud flats only in a certain period, mostly in the summer. Several species of fish find themselves as occasional visitors to the North Sea (de Jonge et al. 2006, Swennen 1989).

The fisheries in the Wadden Sea concentrate on mussels, cockles, and shrimps. Mussels are cultivated in the western part of the Wadden Sea. A management problem is that mussel and cockle fishing seriously disturbs wildlife in the area (Goss-Custard et al. 2004, Verhulst et al. 2004). Natural mussel beds have vanished with the removal of the mussel seed. The cockle fishers cause

disturbance of benthic species on the bottom. As a result 25% of the flats in the Wadden Sea have been closed for mussel and cockle fisheries, while effects of shrimp fishing are still being investigated. Fishing licenses have been limited and there is some minor fishing activity for eel, sole, gray mullet, and smelt.

In terms of biodiversity of the Wadden Sea we have a few definitive studies. Wolff (2000) examined various causes of expiration of marine and estuarine species within the Wadden Sea and their relative importance. He obtained data from geological, archeological, historical, and biological publications. According to Wolff (2000) at least 10 species of algae, 10 invertebrates, 13 fish, 5 birds, and 4 marine mammals became extinct during the past 2,000 years. Habitat destruction played a part in 26 cases, over-exploitation in at least 17 cases, and pollution in at least three cases. According to Fog et al. (1996) eight species of amphibians and four species of reptiles are threatened in at least one subregion of the Wadden Sea. Of these, seven species of amphibians and all four species of reptiles are threatened for the entire area and are therefore placed on the International IUCN Red list.

The only mammal left in the Dutch coastal waters is the seal (see Fig. 2.2). Its reason for staying in the Wadden Sea is also the abundant food stocks, the peace, and the space still to be found there. In summer the females have their young on the high exposed sand bars. They also use these sand bars as places to rest. In the 1950s there were still about 2,500 seals in the Dutch Wadden Sea, but their number rapidly declined as a result of hunting and human disturbance, and later water pollution. After reaching a low of 350 animals in 1975, their number increased to about 1,000 in 1988. In that same year, a virus disease attached to the colony and in combination with water pollution decimated the animals to 350 in 1989. The seal has become an indicator of environmental quality and its numbers have increased to almost 1,200 in 1994.

In 1962 the Netherlands prohibited seal hunting. Germany and Denmark followed the lead in 1973 and 1976, respectively. The places where seals used to



Fig. 2.2 Seals on an offshore shoal. Source: Common Wadden Sea Secretariat, Undated. *The Wadden Sea: A Shared Nature Area*, p. 3

rest are under additional protection. The Netherlands has two resorts for seals: one on the island of Texel, in the research center of EcoMare, and the other a village of Pieterburen. Germany has one in Norden and one in Fridrichskoog, and Denmark one in Esbjerg.

The major landscape features heading back from the waters edge are salt marshes, islands, dunes, and embankments around dike edges (see Fig. 2.3). Much of the original marsh was destroyed by reclamation, but new salt marsh has also been created due to natural siltation and accretion processes. The salt marshes are extremely productive or fertile and are valuable as pastures for farmers at the seaside. These same farmers have been trying to stimulate the formation of salt marshes and these methods vary from country to country. In 1930 the Netherlands took over the Schleswig–Holstein method, which implies the stimulation of silt deposit by ditches and osier dams. When the deposit had become high enough a dike was constructed and so a new plodder had been created. Now and again a newly “reclaimed” salt marsh was protected against further influence of the sea by a low dike. A similar salt marsh is called a “summer Plodder”. In the 1960s the reclamation of the Dutch Wadden area was stopped. Only maintenance of reclamation works is kept up. There is also experimentation with different species such as *Juncus* and *Phragmites* for brackish marsh creation (Bakker et al. 1993, Huiskes 1988) (Fig. 2.4).



Fig. 2.3 Typical estuarine pattern. Source: Common Wadden Sea Secretariat, Undated. *The Wadden Sea: A Shared Nature Area*, p. 7

The long chain of islands and high sandbars, approximately 50 in number, characterizes the European Wadden area. Most of these islands were formed after the last ice age from the beach ridges along the coast. Windblown sand made these ridges higher and the spreading vegetation settled the newly



Fig. 2.4 Coastal dunes. Source: Common Wadden Sea Secretariat, Undated. *The Wadden Sea: A Shared Nature Area*, p. 12

developed dunes. Not all islands developed in this way. The Halligen in the Schleswig–Holstein area are remains of an extensive area of salt marshes. The Danish Wadden Islands were also formed on sandbars; the wide beaches are the result of the enormous transport of sand in this part of the Wadden Sea.

Dunes are not only formed by the wind piling up loose sand, but the sand may also be blown away again, unless plants hold it. Sometimes the sea washes away large parts of the dunes during a gale. In the Netherlands, this is a real problem on the island of Texel. When the dunes protect the land from the sea, much effort is being made to keep them as they are.

Marram is planted and reed mats are put up to prevent the dunes from eroding. Longitudinal dikes are also built across the beach to ward off the current. This was done on Vlieland. So the beach holds its initial width and the waves can only wash dunes during extremely heavy storms. On Texel the beach is raised with new layers of sand to protect the dunes. The west sides of most of the islands of Lower Saxony have been “embedded in concrete” by heavy dikes. In the Netherlands, by contrast, it is possible to keep the coastal strip more dynamic. The key is that dune land variation in lime, lime limited, wet and dry creates the variation and diversity in vegetation. Dunes also function as fresh water collection devices.

For centuries embankment of land outside the dikes was common practice in the Wadden area. Creeks were cut off in order to improve the protection of the hinterland. It also made more soil available for farming and cattle breeding and more recently for industrial and military activities. The land outside the dikes, however, is also of great importance for wildlife as it provides many bird species with grounds to feed, rest, and breed. In recent years the motives for embankment of new land outside the dikes came under great pressure, because there is

increasing demand for farmland, and embankments demand great financial sacrifices.

Due to the efforts of conservationist's organizations like the Wadden Society the general public became aware of the natural values of the land outside the dikes. In the course of time this had a political effect in conjunction of large-scale plans for embankments along the coastline of North Holland (Balgzand), Friesland (North Friesland outside the dikes), Groningen (North Groningen and the Dollart), and Germany (Dollart, Tummlauer Bucht).

Specific Wetland Resource Management Issues and Threats

The following sections outline the major events affecting the Wadden Sea wetlands for the Dutch Wadden including the Lauwersmeer and Ens-Dollart area, the German Wadden including Lower Saxon, Elbe, and Schleswig–Holstein areas, and the Danish Wadden including Skallinger, Varde A, Romo and Fano, and Esbjerg. Major source material for this section is from Wadden Society (1994) and WWF (1991).

The Dutch Wadden

The western and eastern parts of the Dutch Wadden area show great differences. The Wadden Sea between Den Helder, Vlieland, and Harlingen is much deeper than the eastern part. Therefore the surface of the sandbars being uncovered in the eastern Wadden is larger. At low tide the ferries heading for Ameland and Schiermonnikoog sail in gullies between the emerging sand bars.

Because of the peace, space and the beautiful landscape in the islands are ideal holiday resorts. The problems involved with recreation on the Wadden Islands are numerous. Vulnerable dune land had to be closed to the public. The flow of tourists created the need for all kinds of additional facilities, including housing, water supply, waste removal, and transport. The Wadden Society is of the opinion that recreation should not expand, but should be stabilized at the present level. Fortunately this same view is held by most of the people on the Wadden Islands.

The first inhabitants of the Wadden area could only maintain themselves by building their houses on man-made mounds. By the beginning of the second century the first dikes were built when the connecting roads between the mounds and the walls of the salt marshes were leveled. The monasteries in the area have always played an important part in dike construction. In the Frisian Wadden the Portuguese landlord Caspar di Robles took the initiative to improve dike maintenance during the Eighty Year's War. The delta project drawn up after the tragic Zeeland flood in 1953 also included raising the dikes in the Wadden area.

In the course of this century recreation on the Wadden Islands, where many landscapes are combined (beach, dune land, salt marsh, woodland, and plodder), has developed into an important means of existence. This led to drastic changes. Several farmers decided to close their farms and become “recreational farmers”. Water sports have also expanded enormously in the Wadden Sea. During high season the islands harbor so many tourists that the total number of inhabitants is increased 10-fold. On the one hand, recreation affects nature and landscape, on the other hand it has focused the attention on the Wadden area with favorable effect on conservation and protection. In recent years there is a tendency to expand the season in order to reduce the flow of tourists during the high season.

The Wadden Sea is very attractive for water sportsmen. The number of yachts is still increasing, and several Wadden Islands decided to enlarge their marinas and the effects are not all positive. Careless water sportsman can seriously disturb natural areas at critical times. Seals are very vulnerable in summer when their young are born. This also applies for breeding, roosting, and foraging birds. Since 1981 the number of areas coming under the Nature Conservation Act has largely been extended. Some parts may not be entered by boat or otherwise and sometimes entering is only allowed for nature study or research.

Lauwersmeer

In 1969 the Lauwersmeer was separated from the Wadden Sea by a dike with the intention of improving the drainage of the provinces of Groningen and Friesland. This dike has been provided with a lock and a drainage sluice. The result was the Lauwersmeer, a hinterland consisting of land and water. The Lauwersmeer area is important for all kinds of migratory birds, such as geese. There are many kinds of recreational facilities, especially for water sports. The military exercise ground that has been established there does not fit in with areas so near the Wadden Sea and near recreational activity.

In 1965 a plan was launched to connect the island of Ameland with the mainland by means of two dams. This plan was the impetus to set up the Dutch Society for the Preservation of the Wadden Sea. The Wadden Society succeeded in preventing the plan from being realized. However, reclamation of an area of 4,000 ha along the Frisian coast, the so-called Noord-Friesland Buitendijks (North Friesland outside the dikes), was still being pursued. But in the last instance the Wadden Society also blocked this plan. Conservationists do not support future plans for reclamation of parts of the Dutch Wadden area. In the German Wadden, however, such plans are still an issue.

The Dutch Wadden area is also used for military purposes. Especially the western part is extremely popular with the Ministry of Defense. Military activities take place near the city of Den Helder and the island of Texel and

on and around the island of Vlieland. In addition there is a route for low-flying military aircraft over the eastern part, and the Lauwersmeer has an exercise ground and shooting range. The German Wadden area is also disturbed by military activities affecting human and wildlife activities.

Currents transport great quantities of polluted water from the European rivers (Rhine, Scheldt, Meuse, Elbe, and Ems) into the Wadden Sea. The atmosphere, the IJsselmeer, dumping in the North Sea, and discharges from the Wadden Sea itself all add to the pollution. Agriculture and shipping oil (oil spills) are also to be blamed for the pollution of the Wadden Sea. The polluting substances penetrate into the food chain via plankton. As a result seals are weakened, become infertile, and are susceptible to virus diseases. The number of fish diseases in the North Sea and Wadden Sea still increases. Man is also part of the food chain and recently found susceptible to the long-term subtle affects of toxics. Fortunately the flow of polluting substances from the large rivers is decreasing lately.

The bottom of the Wadden Sea holds natural gas in some locations. Oil companies are constantly searching for these gas fields. On the island of Ameland and the western part of the Wadden Sea exploitation has already started. But there are more sites where the presence of natural gas has been established. Exploitation of natural gas disturbs the ambient environment, seriously affects the landscape for a long time, and leads to settlement. As a result, vulnerable dune land and marshes are submerged, and the areas appropriate for foraging birds decrease in size. The Wadden Society resisted the new plans the oil concerns made to put new drilling rigs in the Wadden Sea from 1994. Exploitation of natural gas is not accepted within the context of the Wadden Sea as a nature reserve.

Ems–Dollart Area|the Netherlands and Germany

The Dollart is a deep bay in the Ems estuary between the Netherlands and Germany. Its natural value is very high. It is a sheltered area, and so the smallest particles of silt can settle down in the Dollart. The soft layer of silt, which is formed in this way, is very attractive for certain birds like the avocet. The Dollart is a brackish tideland. The water becomes brackish because the sea saltwater blends with the freshwater of the rivers Ems and Westerwoldse A. These conditions create unique vegetation: the Dollart area is famous for its high bushes of sea asters.

Many chemical industries are concentrated in the Ems–Dollart area, near the cities of Delfzijl and Emden. As a result chemicals continuously affect soil, water, and air. The German plans to establish a large-scale industrial harbor in this area were not realized, but the area is under pressure from new plans and proposed ventures. In the 1970s the digging of a channel outside the dikes through the Dollart did not happen. A large part of the Dollart is a national

nature reserve and is administered by the Stichting Groningen Landschap (Foundation of the Groningen Landscape) and the Vereniging tot Behoud van Natuurmonumenten (Society for the Preservation of Nature Reserves).

Lower Saxony – Germany

The Wadden area of Lower Saxony extends between the estuaries of the Rivers Ems and Elbe. Between the Ems estuary and the Jadebusen lies the East Frisian Wadden area, which closely resembles the Dutch Wadden. More to the east, between the Jadebusen and the Elbe, the Wadden has developed in a slightly different way under the influence of currents and estuaries. Seven inhabited and two uninhabited islands and sandbars bound the East Frisian Wadden area. Between the Jadebusen and the Weser estuary lie the Wadden of the Hohe Weg. Between the rivers Weser and Elbe are the Wurster Watt, the Wadden area of Knechtsand, and the Neuwerker Watt.

During the last 200 years the coast of lower Saxony showed drastic changes. Several estuaries were formed such as the Dollart, Leybucht, and Jadebusen. Many of them were embanked in the course of the centuries. The Jadebusen did not change any more after it was formed. Afterward it partly silted up, and during this process high moor peat was deposited. In the eleventh century a dike ran from the city of Wilhelmshaven to the present Jadebusen, along the peninsula of Butjadingen on the river Weser. The dike was swept away by storm tides taking the settlements with them. Only part of the peat moor has survived in the nature reserve called Das Schwimmende Moor (the Floating Moor).

Germany was the first to discover the recreational value of the Wadden area, far before the Netherlands did. The island of Ameland had its first “bathing establishment” in 1850, while the German island of Norderney had known recreation for 300 years already. In the nineteenth century the islands were considered resorts where one could restore one’s health. High-rise blocks and promenades have affected the original character of Norderney and the island of Borkum nearby. The other islands of Lower Saxony, especially Spiekeroog and Baltrum, have retained their own character.

The Elbe – Germany

This swiftly flowing river has always influenced the Wadden area at the mouth of the River Elbe. The sand coming in from the west is checked by the Elbe; so a high slack water was formed at Neuwerk and Scharhorn. Horse and wagon can easily reach Neuwerk. The new man-made island of Nigehorn near Scharhorn has been created for the birds. The Elbe is responsible for the flow of great quantities of polluted water to the Wadden Sea. This water comes from the industries in and around Hamburg.

Schleswig-Holstein – Germany

This part of the Wadden is quite different from those in Lower Saxony and the Netherlands. The islands were formed in a different way and were called “Halligen”. They are partly remains of the salt marshes that were washed away by a fierce storm tide in 1634. In the course of time these islands grew at the side of the mainland, while parts of them at the seaside were washed away. The salt marshes were already inhabited before 1634. On the Halligen are mounds, called Warften, on which one or more farmhouses were built. Some Halligen are connected to the mainland by means of a dam. After the storm tide of 1962 most Halligen have been provided with summer dikes. A unique feature of this Wadden area is the “Wanderdunen” on Sylt, a bare dune land. This conservation area is subject to continuous erosion. Along the coast of Schleswig-Holstein active reclamation is still common practice.

In the last 50 years tens of thousands of hectares of biologically valuable ground outside the dikes were lost. In the Schleswig-Holstein Wadden a new dike was constructed in the Nordstrander Bucht, which resulted in the loss of 90 km² of the Wadden area. Elsewhere an area of 570 ha is threatened by embankment.

The Wadden area of Schleswig-Holstein is a very popular recreation area, especially the island of Sylt with its ample facilities. High-rise blocks dominate the capital of Westerland. Sylt is connected with the mainland by a dam. The train running across the dam takes hundreds of thousands of tourists with their cars to the island yearly. The islands of Pellworm and Amrum also attract many tourists. On most of the Halligen recreation is still a small-scale affair.

Some years ago Lower Saxony, Hamburg, and Schleswig-Holstein have designated “their” Wadden areas as National Parks. Unlike the Netherlands, the federal governments disposed of legal tools enabling them to take drastic protective measures. Germany has taken advantage of this possibility by creating special zones. In some of these zones, nature has absolute priority over all human activities. In other zones some activities are permitted. And there are buffer zones and zones where nature has no priority at all. The criteria for zoning are different in both federal states concerned. Unlike the Netherlands, Germany has not coordinated the administration of these zones.

The German Wadden area is exposed to several threats. Recreation is much more intensive than in the Netherlands, also because many islands are easily accessible by dams. Large-scale embankment projects were carried out in the Leybucht and the Norstander Bucht. Oil exploration takes place near the bird island of Trishen. Military activities are still expanded in the area. Large industrial centers are established near Emden, Bremerhaven, Wilhelmshaven, and Cruxhaven, involving contamination risks for soil, water, and air. A large nuclear power plant is situated near Esenshamm in the Weser area, as is the case at Bokdorf on the Elbe. Hamburg harbors many metallurgical and chemical

concerns. The Rivers Weser and Elbe are permanent sources of pollution for the Wadden Sea. But Germany is also beginning to realize the importance of protecting nature reserves such as the Wadden Sea.

The Danish Wadden

Two fixed points determine the shape of the Danish Wadden; the Horns Rev nears the coast of Blavandshuk (the most western point of Denmark) and the Rote Kliff on Sylt. The Danish Wadden is very dynamic. The coastline changes visibly every year as a result of the enormous quantities of sand supplied by the sea. So the exceptionally wide beach was created on the islands of Romo, Mando, and Fano. Except for the inhabited islands of Romo, Mando, and Fano, the Danish Wadden area comprises the uninhabited islets of Jordsand and Langli, the peninsula of Skallingen, and a few large sandbars. The coastline of the Danish Wadden is also greatly determined by dikes.

Skallingen

The Danish Ministry for the Environment bought Skallingen as a conservation area in 1976. This peninsula, which has a length of 13 km, came into being as a result of the transport of sand that formed a whole with the beach ridges. It consists of a row of dunes at the backside of which is an extensive salt marsh bordering the Ho Bugt and transacted by many channels. The salt marsh measures about 700 ha. Human activities have also marked the landscape of Skallingen. The erosion of the dunes is partly blamed on recreation, and intensive grazing causes the harm done to the salt marsh. Besides, many dikes of dry sand have been put up and ditches dug. The south point suffers from serious erosion.

Varde A

It is quite exceptional, especially in the Wadden Sea, that man allows rivers to flow freely into the sea without taking precautionary measures in his effort to check its stream by dikes and locks. The Varde A is such an exception. That is why such an unusual landscape has been created in and near its estuary. The extraordinary variety of its vegetation is a result that the freshwater river blends with seawater. At extremely high water levels and stormy weather the saltwater can penetrate a few kilometers into the riverbed. These “annoying” inundations have been resisted everywhere else but they provide beautiful landscape in the Varde A area.

Romo and Fano

Romo has a very wide beach, which at some places reaches a width of 4 km. Primary dune formation takes place on this beach. The old dunes on a large part of the island are overgrown with heather. At the side of the mud flats is a small strip of salt marsh. Since 1947 Romo is connected with the mainland by a dam, which divides the Danish Wadden area into two parts. As a result the island is under great pressure by recreation. The structure of Fano slightly resembles that of Romo. The beach is not as wide but the dunes and the strip of salt marsh are similar. Parts of the dunes are covered with woods. Fano has also reached the limits of its recreational possibilities.

Esbjerg

Due to the relatively low population density the Danish Wadden area is less disturbed than the Dutch and German parts. Esbjerg is the only large town in this neighborhood. The fish processing industries in this large fishing harbor are mainly responsible for the discharge of large quantities of wastewater. Moreover, the sewers of the city discharge into the Wadden Sea and the rubbish dump is situated near the beach. This is why organic matter mainly pollutes this part of the Wadden Sea. The coastal area north of Esbjerg along the Ho Bugt has a steep coast.

Protection and Management To Date

Major source material for the following section includes work by Bachest (1991), Dettmann and Enemark (2004), Hergreen (1991), and de Jong and Siderius (1995). Nienhuys (1990), Revier (1995), Swennen (1989), Waddensea Secretariat (1997), Walters (1990), van Zutphen (1989), van der Zwiep (1990), and van der Zwiep and Backes (1994). The Netherlands, Germany, and Denmark have all taken measures to protect the (remaining) ecological, cultural, and scenic values of the Wadden area or parts of it. Key or important steps were taken in the mid-1960s. At this time there was relentless pressure for more economic exploitation of the area, including recreation. At the same time there was pressure for extensive reclamation and embankments, which were engineered beyond protection goals.

In those days, nature conservation was almost exclusively concerned with the protection of rare species of birds, and numerous sanctuaries were designated for this purpose. The protection of the area in Denmark goes back to the 1930s at which time one can find the first implementation of preservation regulations, as laid down in accordance with the Nature Conservation Act of 1917 (Swennen 1989).

From this early time of habitat and species preservation, the situation changed when the general public became increasingly aware of the ecological

and scenic values at stake, and of activities which threatened these same values with fast decline or total destruction. The usual response was regulations (laws), which purport to restrict certain uses of the Wadden Sea areas. However, there was further decline of the area due to loopholes in the regulations, insufficient attention to particular values of the area, and lack of clear quality requirements. Finally a set of regulations was issued in the three states that truly did not reflect the ecological relations and connections characteristic of the area. Furthermore, these regulations were the result of numerous political compromises. Many of the regulations shared no connection to one another, and were issued by competing legislative bodies and competing authorities. There was no relation between the three countries bordering the Wadden Sea.

At the same time there were similar shared concerns. In the Netherlands and Germany there were people who argued in favor of valuation and description of the Wadden Sea as an ecological entity, recognizing protection as being of national significance. In the Netherlands, this led to proposals for a special Wadden act, and in Germany for a National Park Act for the Wadden area. Politicians were not ready for such institutional mechanisms and presented their own proposals. In Denmark, the most important Nature Conservation Act came into force as a result of the discussion about proposed dams in the 1960s. A final solution is yet to be found and regulations concerning the affected area have been and are still developing.

Before moving on to institutional mechanisms existing in each of the three countries, we should at least acknowledge three major NGOs that have focused public attention on the issues mentioned and in some cases forcing action. In 1965 the Dutch Society for the Preservation of the Wadden Sea was established. The Wadden Society goals include optimal conservation of the natural and historical-cultural values of the Wadden area. Several working groups in the Wadden Society engage in diverse issues such as water, military use, recreation, industrialization, and management. All legal means, which might lead to a favorable policy review, are applied such as

- consultation, objections, publicity, political pressure;
- information and advice;
- stimulating alternatives;
- mobilization of all environment-minded Dutchman.

The society has approximately 60,000 members, 300 of them active. The members receive the "Wadden Bulletin", a periodical with many activities about landscape and nature in the international Wadden area and interviews with people working and living in the area. Activities of the society are also given much attention.

In Germany, the Schutzstation Wattenmeer and the World Wildlife Fund (WWF) Wattenmeerstelle are active in Schleswig-Holstein. Not only do they engage in campaigns against embankment plans and nuclear plants but they also give information. Several islands have information centers, which also publish a newsletter (Informationsbrief).

In 1977 a Danish Wadden Group was established which at the time resisted reclamation plans and the increasing facilities for water sports. The Fishing Museum in Esbjerg has brought out quite a lot of publications on the Danish Wadden. These three groups have been the major NGO actors for preservation and ecosystem management of the Wadden Sea wetlands. The following sections will outline existing institutional protection measures for the three countries followed by international treaties and provisions.

The Netherlands

The Wadden policy in the Netherlands is based on the Physical Planning Act and the Nature Conservation Act. These two regulations support a complicated system that tries to make use compatible with protection. At the same time efforts have been made to solve the problem of coordinating competing powers of national, regional, and local authorities, and those of numerous other departments and institutions. The Nature Conservation Act grants the status of nature reserve by means of a designation with all concomitant legal consequences. The physical planning key decision (PKB), which is based on the Physical Planning Act, regulated the various forms of exploitation and coordination of administrative aspects.

The combining of the two regulations was necessary because the Nature Conservation Act cannot do justice to both the ecological and social functions of such a large area. On the other hand, the legal status of the PKB was too unstable and judicially weak to serve as a basis of integration for protection and use of the area.

In the Dutch system, these values are first described in the PKB. By doing so, the advantages of the physical planning law as the most favorable instrument to weigh all interests at issue, including the interests of nature, could be used. In this respect, use of a new instrument like the PKB based on the Physical Planning Act can be supported. It provides an opportunity to straighten out the rather complicated relations between ecological and social interests. By combining both instruments, the Dutch government made a lot of concessions to the Nature Conservation Act and the values and interests that the law is supposed to protect, and thus to the ecological values as well.

The policy established in this combination of regulations is based on conservation, protection, and recovery of the Wadden Area. Human use is not excluded. The PKB indicates what forms of use are meant, and how these are to be fitted to actual situations, for example, by granting permits under the Nature Conservation Act so as to cause as little damage as possible to the ecological value of the area. The PKB further indicates to which geographic area it applies. The area is limited to the actual marine part between the dikes on the mainland and the southern part of the islands, and some of the uninhabited parts of the islands.

The Dutch set of regulations shows severe shortcomings according to van der Zweip and Backes (1994). Although PKB allows the environment in the area

some preponderance, it is vague. The description of the interests that are considered acceptable and admissible is so noncommittal, and shows so many loopholes, that almost all activities can be allowed: industrialization, military activities, traffic and transport, recreation, fishing, etc. The only chance of restricting these is actually to be found in the roles for granting permits under the Nature Conservation Act or any other sector law at issue.

The boundaries of the nature reserve designated under the Nature Conservation Act do not correspond with those mentioned in the PKB. Since November 1993, the Nature Conservation Act had dealt with 90% of the area. That means that a more or less wide region the necessary junction between the PKB and the Nature Conservation Act can be laid. The protection of the other 10% of the Dutch Wadden Sea will remain incomplete. For this remaining part of the area, the rule applies that implementation of the PKB policy depends on weighing the pros and cons outlined in the sector law concerned. In other words, the PKB policy is dependent on the weighing described in sector laws. In those sector laws, the interests of nature can be omitted or sector interests can be predominant.

In the future, according to van der Zweip and Backes (1994) the link between the Nature Conservation Act and the PKB may become problematic. According to the new Nature Conservation Act, currently being discussed in the Dutch Parliament, the provinces will be largely qualified to implement this law. Furthermore the PKB is not legally binding in relation to lower administrative bodies. This would make the current legal instruments even more unclear and fragmentary (Fig. 2.5).



Fig. 2.5 Agricultural use of Wadden Sea marshes. Source: Common Wadden Sea Secretariat, Undated. *The Wadden Sea: A Shared Nature Area*, p. 8

Germany

In Germany, there are a lot of various instruments, which together form the judicial basis for the protection of the Wadden Sea. The legal system is rather complicated for several reasons. In the first place, because of the federal form of government, which means that the federal states (Lande) are the first to be responsible for nature conservation, while the federal government acts only as a coordinating body. All efforts to change this situation by a constitutional amendment failed in the early 1970s. The lack of unity among the authorities issuing regulations has been an important stumbling block in the development of the protection of the Wadden area in Germany.

This protection is mainly based on the Nature Conservation Acts and especially on the regulations for national parks. The Nature Conservation Act of the federation defines what this protection should comprise and the federal states have to work out the details of the regulation. As the German part of the Wadden area extends over four federal states (Lower Saxony, Bremen, Hamburg, and Schleswig-Holstein) the legal powers required for protection of the area as a total entity are dissipated. For example, as early as 1974 large parts of the area were already designated as “wetlands of international importance” under the Ramsar Convention. Other parts were not designated. The area of Schleswig-Holstein was designated as a national park in 1985, the area of Lower Saxony in 1986, and the Hamburg area in 1990. Bremen was left out. Through the City of Bremerton, the city-state of Bremen borders the Wadden area, is a party to the trilateral Wadden consultants at a governmental level, though it has no Wadden territory of its own, and therefore no specific Wadden regulations of its own.

The three existing regulations of the national parks are not only different from one another in a substantial way as to their form (laws in Hamburg and Schleswig-Holstein, a regulation/bylaw in Lower Saxony) but also in their territorial scope (with or without islands, salt marshes, forelands, and/or dikes). Furthermore, their degree of effectiveness is quite different. Nevertheless, the regulation of national parks in Germany were the only chance of realizing wider-ranging protection of the area than was possible under the already existing regulations for nature conservation, as these were haphazardly applied. It also offered the opportunity to create an administration infrastructure (national park administration) to manage the national parks as entities and to provide funds for their management.

These national park settlements embrace nature conservation aims, and formulate the acceptable and admissible social uses. All this is expressed in a set of local, periodic bans, orders, and exemptions. All regulations in the Lander are based on splitting up the area into zones, which apply different forms of protection. Roughly, the area is divided up into three zones: zone I in which the interests of nature are predominant and human use principle is excluded; zone II in which human use is not excluded but where important protection measures

are taken; and zone III which includes all remaining areas, above all recreation areas. A system of prohibitions applying to these zones has to guarantee that use is compatible with protection, i.e., that human activities do not harm the natural values.

Although protection of the Wadden area in Germany is mainly based on the Nature Conservation Acts, the Physical Planning Act also plays an important point. The systems, however, are not directly linked. The purposes established through town and country planning are necessary additions. The hierarchical structure of this instrument for planning is one of the reasons why certain uses, including environmental uses, can be weighed and established at an administrative level. Though these uses can only be roughly described, they have a highly standardized effect. In this way, various forms of exploitation have been defined by zoning. The pros and cons of relevant interferences (some indicated in the planned purpose) are meticulously weighed, both with respect to protection and to various other functions.

Lastly, sector law should be mentioned. On the basis of the constitutional distribution of legislative power, some activities are exclusively regulated by sector law (shipping on the Wadden Sea, for example). The nature conservation laws of the federal states and the regulations concerning the national park settlements adopted under them may not include any restrictions with regard to these activities. Restriction for the sake of nature protection can be enforced only under the sector law concerned. In actual practice, the authorities sometimes fail to do this, or if they do, the result is unsatisfactory. This can be considered a weak spot in the German legal system for the protection of the Wadden Sea.

Denmark

The Danish set of instruments for the protection of the Wadden Sea has been highly refined in recent years. This applies to the legal foundations supporting the protective measures as well. In 1992, the various nature protection laws were streamlined and integrated into the new Act on Nature Protection. The former designations under these nature protection laws were combined in 1985 to form one designation of large parts of the Wadden Sea as a nature preserve. However, the protection of the Danish Wadden Sea is not fully integrated into one regulation under the nature protection laws. In addition to the general conservation rule according to the Nature Protection Act that covers the whole region, there are special territorial laws applying to specific areas (for the reclaimed Margrethe Kog and the Tonder Marsh salt marshes).

Protection under the nature protection laws is complemented by protection on the basis of town and country planning. The Danish physical planning laws have also been drastically revised in recent years, especially with respect to the

integration of the various physical planning laws into the new 1992 Planning Act. Just as in Germany, Danish physical planning is hierarchical. The regional plans, which are drawn up by the two counties in the Wadden Sea region, are of special importance. After weighing all interests playing a part in the area concerned, the counties decide on the functions and the possibilities for development of the space concerned. The county and municipal councils will strive to implement the guidelines of the regional plan. Their planning and development activities may not contradict the regional plans. In most cases, the county or municipal councils operate at first instance; hence the physical plans have a significant practical importance.

International regulations have a large effect on the implementation of the above-mentioned regulations in Denmark, especially the Ramsar Convention and the EC Bird Directive, and in the future, the Habitat Directive. The Danish Wadden Sea was designated as a wetland of international importance under the Ramsar Convention in 1987, and earlier, in 1983, as a special protection zone in accordance with Section 4 of the Bird Directive. The provisions from international agreements and EC directives are in principle not directly binding in Denmark, but are first to be transformed into national law. Nevertheless, the Nature Complaint Board, in particular, uses the provisions from the Ramsar Convention and the EC Bird Directive for judicial review even without a clear national foundation. In real practice, those international agreements and regulations are therefore of utmost importance for the protection of the Wadden Sea, at least as far as the jurisdiction of the Nature Complaint Board is concerned.

Besides this, specific decisions such as conservation decisions, which are proposed by the nature conservancy boards in accordance with the rules laid down in the Nature Protection Act, are important. Such specific conservation decisions (e.g., regarding air traffic, marinas, water catchments, road projects, or management measures for special areas) are brought to the Nature Protection Board of Appeal. The power of this board as an administrative appeals board is based on such cases, which are viewed as administrative decisions based on the Nature Protection Act. These specific conservation decisions constitute another important environmental instrument for the protection of the Danish part of the Wadden Sea.

International Rules and Implementation

In 1982 the Danish, German, and Dutch governments agreed on a “Joint Declaration on the Protection of the Wadden Sea”. They declared they would “...consult each other in order to coordinate their activities and measures to implement the international legal instruments with regard to the comprehensive protection of the Wadden Sea region as a whole”. The legal instruments separately mentioned are as follows:

- The Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar February 2, 1972)
- The Convention on the Conservation of Migratory Species of Wild Animals (Bonn, June 23, 1979)
- The Convention on the Conservation of European Wildlife and Natural Habitats (Bern, September 19, 1979)
- The relevant EC Council Directives, especially the one issued on April 2, 1979, on the Protection of Wild Birds (79/409 EC); EC Bird Directive which is linked to
- Council Directive (92/43/EC) on the Conservation of Natural Habitats of Wild Fauna and Flora (May 21, 1992); EC Habitat Directive

Ramsar Convention

The Ramsar Convention aims at the protection and conservation of wetlands (as discussed in Chapter 1), which means protection of the whole biotype rather than only species. An area satisfying the criteria established by the convention can be presented on the list of wetlands. At present, almost the whole Wadden area has been designated as such and appears on the list.

Once an area has been designated, the contracting party is obliged under Section 3.1 to "...promote the conservation of wetlands included in the list". Under Section 4.1 there is also an obligation to promote the conservation of wetlands by establishing nature reserves whether or not these wetlands appear on the list. Denmark drew the conclusion that the convention does oblige the designation of areas satisfying the criteria, and consequently the protection of them by means of the national regulations (nature reserves). The Netherlands took the line that designation can only be realized and effective if the area is already protected under national regulations and inclusion on the List of Wetlands of International Importance only sets "the seal of protection". It is interesting, given this background that the Netherlands did not designate all parts of the Wadden area, which are already fully protected under national regulations. Though the whole PKB area is designated as a Ramsar area, not included are important parts of the islands, a strip of the North Sea, and parts of the mainland, which are also part of the Wadden Ecosystem. The German government has established new nature reserves or extended existing reserves on listed sites since for their inclusion on the list.

The Ramsar Convention has a strong influence on the protective measures for the Wadden area. In all these countries, the area, or large parts of it, is protected under national laws. This is also due to international supervision or observance of the convention through the permanent secretariat, periodic Conferences of the Contracting Parties, and access of NGOs to various events and processes. Through this public exposure, obligations though not directly binding, become morally binding. In Denmark, this is expressed by the fact that

the convention is used as a direct judicial criterion for assessment of human activities in the area. Public pressure made Germany observe the principle of compensation set down in Section 4.2 of the convention. The Dollarthafen project could only be carried out if 2,000 ha of nearby grassland was inundated by way of compensation for the loss of the listed wetland of the Ostfrisische Wattenmeer and the Dollart.

Yet there are differences both in the dimensions of the designated area and in the extent to which the various obligations of the convention are met. As a rule, the Dutch islands do not come under the designation. In Germany and Denmark, only parts of them do. Denmark has also included a belt of the North Sea in the designation; Germany and the Netherlands have not. The Netherlands does not recognize the principles of compensation set down in Section 4.2 of the convention, whereas Germany does. There are several interpretations of the concept of “wise use” (Section 3.1 of the convention). However at the Sixth Trilateral Government Wadden Sea Conference in 1991, the three countries agreed to fill these gaps.

World Heritage Commission

At the Sixth Trilateral Governmental Wadden Sea Conference in 1991, the three countries agreed on presenting a joint proposal that the international Wadden areas should be put on the World Heritage List of the Convention of Cultural and Natural Heritage. The convention concerning the Protection of World Cultural and Natural Heritage was adopted in 1972 in Paris and came into force in 1975. On the basis of the convention, area of “outstanding universal value” can be put forward for inclusion in the World Heritage List. If the area is put on the list, then the contracting parties are legally bound to conserve and protect it. The provisions concerned (in Sections 4 and 5) are more imperative than those of the Ramsar Convention. World Heritage List Convention offers financial and technical opportunities to support conservation and protection, but there is debate whether designation on the World Heritage List offers more effective protection.

Bonn Convention

The Bonn Convention especially aims at the protection of wild migratory animal species. The contracting parties bind themselves to conserve the habitats of the migratory species. The convention is a framework treaty on the basis of which regional agreements can be concluded. In 1988, the Netherlands, Germany, and Denmark concluded an agreement on the Conservation of Seals of the Wadden Sea. This agreement came into force on October 1, 1991, and is the first regional agreement under the Bonn Convention. So far the

agreement has had a favorable effect on scientific research, the monitoring of the seal population, the designation of special resting areas and public information. But as far as the protection of habitat of the seals against the threats of water pollution is concerned, neither the convention nor the Trilateral Seal Agreement has had any perceptible effect.

The convention can play an important part as an instrument for the coordination of the protection of migratory wild animals (especially birds) and their habitats on their long trek between north Siberia and Africa. The Wadden area has the important function of being the "intermediate station" for these birds. In this context, attention should be given to the paper prepared for the International Union for Conservation of Nature and Natural Resources (IUCN): *Elements of an agreement on the Conservation of Western Palearctic Migratory Species of Wild Animals*. This document states that "...the development of cooperative links with the governing bodies and secretariats established under the other international instruments dealing with certain Western Palearctic migratory species or their habitats is necessary". Furthermore, the document concludes that although none of the instruments (Ramsar, Bonn, Bern, EC Directives) covers the full range of all Western Palearctic species listed in the appendices of the Bonn Convention, they all deal with at least some of these species over the whole or part of their range. It is therefore essential that coordination mechanisms be established to avoid duplication of effort and ensure effective implementation of conservation and management measures.

EC Directives

Because of their binding effect, the most important international protective measures are those taken by the European Commission (EC). Among these measures are the Bird Directive and the new Habitat Directive, which have the most forward reaching consequences for the protection of the area. The Habitat Directive takes over and reinforces the function and the legal consequences of the Bird Directive as far as the designated areas under this directive are concerned, and also the provisions and obligations resulting from the Bern Convention. The Habitat Directive has been enforced in the national regulations of the three Wadden countries.

So far, the Bird Directive has inadequately been implemented with respect to the Wadden area, both as an obligation to designate protected areas and to the observance of the protective measures required. Both the Netherlands and Germany have been reproved for this several times by both the European Commission and the European Court of Justice.

One of these cases is the judgment made by the European Court of Justice in the Leybucht case regarding the structure of the new Habitat Directive. The judgment was that it is justified that the Habitat Directive be more strictly implemented and applied. The directive's implementation does not only involve designation of areas to be protected but also judicial consequences. The

provision in Section 63 prohibits, to a certain extent, permission being given to carry out projects and plans, which may be detrimental to the natural characteristics of designated areas. The granting of permission has been made dependent on environmental research and “imperative reasons for overriding public interest”. This provision imposes considerable restrictions on the various authorities in their scope of policy-making. There are many questions concerning further implementation of the Habitat Directive.

Section 3 explicitly states that the areas of the Bird Directive are automatically listed as Special Areas of Conservation. The Netherlands designated the area as area for bird protection (according to PKB boundaries). Germany also designated important parts of the area especially in Lower Saxony. Denmark designated this area as an area under Section 4 of the Bird Directive in 1983.

The Beginning of Cooperative Management of the Wadden Sea

Historically, the protection of the Wadden Sea was set according to a series of national initiatives in the late 1970s and during the 1980s starting with the establishment of the Wildlife and Nature Reserve in the Danish part in 1979/1982, the Wadden Sea Memorandum and Nature Reserve in the Dutch part in 1980/1981, and the three national parks in the German part from 1985 on. The Wadden Sea, from Esberg in Denmark in the north to Den Helder in the Netherlands in the west, is now covered by an almost unbroken stretch of nature reserves and national parks. Parallel talks between the three governments were initiated with the aim of achieving a comprehensive protection of the Wadden Sea as a shared ecosystem, which resulted in the first Trilateral Governmental Conference for the protection of the Wadden Sea in 1978. At the Third Governmental Conference in Copenhagen in 1982, the three governments formalized the cooperation by adopting the “Joint Declaration on the Protection of the Wadden Sea”. To extend and strengthen the cooperation, the Common Wadden Sea Secretariat was established in 1987, following a decision at the Fourth Governmental Conference in 1985 (Dettmann and Enemark 2004).

The area of the tri-national cooperation of the Netherlands, Germany, and Denmark is 13,500 km² large. The transition zone to the North Sea covers about 4,000 km², the islands about 1,000 km², the tidal area some 7,500 km², the salt marshes and summer plodders some 350 km². The four estuaries, the Varde A, the Elbe, the Weser, and the Ems, have a total surface area of 260 km². Also some areas on the mainland, which are important for birds, are part of the cooperation area and cover about 250 km².

Trilateral Wadden Sea Cooperation

During the years that followed the initial cooperation, the three governments were reluctant to engage in agreements, which contained elements of international legally binding arrangements. The breakthrough in the cooperation came

with the adoption of the Joint Declaration in 1982. The Ramsar Convention played an essential role in bridging the formal differences and expresses the political commitment to cooperate in the protection of the Wadden Sea (Dettmann and Enemark 2004). The three countries had ratified the Ramsar Convention and were legally committed to implement its provisions. If in accordance with Article 5, the Wadden Sea countries would consult on a coordinated implementation of the Ramsar Convention with respect to the Wadden Sea – this greatly contributed to comprehensive protection.

According to the Joint Declaration, the governments declared their intention to consult with each other in order to coordinate their activities and measures to implement a number of international legal instruments with regard to the comprehensive protection of the Wadden Sea region as a whole. The international legal instruments, as mentioned previously, are the Ramsar Convention on Wetlands, the Bonn Convention on the Conservation of migratory species, the Bern Convention on the conservation of European wildlife and natural habitats, and the relevant EC directives, in particular the EC-Bird Directive.

The Joint Declaration resolved a dilemma. It is a declaration of intent, stating the political commitment to work toward a common goal, but it includes a number of legally binding international instruments. It was the intention of the parties that counts, rather than the legal character of the instrument. The Joint Declaration served as a catalyst in the period after 1982, and in conjunction with the establishment of the common secretariat in 1987, the Trilateral Wadden Sea Cooperation was intensified and extended (Dettmann and Enemark 2004). The Trilateral Wadden Sea Plan, which was adopted at the Eighth Wadden Sea Environmental Ministers Conference in 1997, entails a comprehensive common policy and management of the Wadden Sea (see Waddensea Secretariat 1997)

The Trilateral Wadden Sea Plan – Key Elements

The Wadden Sea Plan entails policies, measures, projects, and actions, which have been agreed upon by three countries. The plan is a framework for the overall Wadden Sea management and will be revised at regular intervals. It is a statement on how the three countries envisage the future coordinated and integrated management of the Wadden Sea area as well as the projects and actions that must be carried out to achieve the targets.

The plan is a political agreement and will be implemented by the three countries in cooperation, and individually, by the various authorities on the basis of existing legislation and through the participation of interest groups. The implementation of the plan shall not interfere with legislation regarding marine navigation, management of marine navigation routes, harbor management, disaster control, sea rescue services, and other aspects of internal and external security (Waddensea Secretariat 1997).

The Wadden Sea Plan entails a number of critical decisions with regard to the delimitation of the common management area, the shared principles, and action to implement the targets.

Delimitation

The geographic range of the Wadden Sea Plan is the Trilateral Wadden Sea Cooperation Wadden Sea area, which is

- the area seaward of the main dike, or where the main dike is absent, the spring-high-tide-water line, and in the rivers, the brackish-water limit;
- an offshore zone 3 nautical miles from the baseline;
- the corresponding inland areas to the designated Ramsar and/or EC Bird Directive areas;
- the islands.

The trilateral conservation area is situated within the Wadden Sea, and consists of the following:

- In the Netherlands, the areas under the Wadden Sea Memorandum including the Dollard
- In Germany, the Wadden Sea national Parks and protection areas under the existing Nature Conservation Act seaward of the main dike and the brackish water limit including the Dollard
- In Denmark, the Wildlife and Nature Reserve Wadden Sea

It is recognized that within the Wadden Sea area, there are areas where human use has priority. The delimitation of the Wadden Sea area attempts to bridge the formal differences in jurisdiction between the three countries. The Wadden Sea area is a common management area and not a protection area, which allows for the implementation of trilateral agreements, measures, and actions by the application of a wide range of national instruments.

Shared Principles

The Guiding Principle of the Trilateral Wadden Sea Policy is “to achieve, as far as possible, a natural and sustainable ecosystem in which natural processes proceed in an undisturbed way”. The principal is directed toward the protection of the tidal area, salt marshes, beaches, and dunes.

In addition, seven management principles have been adopted which are fundamental to decisions concerning the protection and management within the Wadden Sea area (see Waddensea Secretariat 1997):

- The Principle of Careful Decision Making, i.e., to make decisions on the basis of the best available information
- The Principle of Avoidance, i.e., activities which are potentially damaging to the Wadden Sea should be avoided

- The Precautionary Principle, i.e., to take action to avoid activities which are assumed to have significant damaging impact on the environment, even where there is no sufficient scientific evidence to prove a causal link between activities and their impact
- The Principle of Translocation, i.e., to translocate activities which are harmful to the Wadden Sea environment to areas where they will cause less environmental impact
- The Principle of Compensation, i.e., that the harmful effect of activities which cannot be avoided, must be balanced by compensatory measures, in those parts of the Wadden Sea, where the principle has not yet been implemented, compensatory measures will be aimed for
- The Principle of Restoration, i.e., that, where possible, parts of the Wadden Sea should be restored if it can be demonstrated by reference studies that the actual situation is not optimal, and that the original state is likely to be re-established
- The Principles of Best Available Techniques and Best Environmental Practice, as defined by the Paris Commission

Unreasonable impairments of the interests of the local population and its traditional uses in the Wadden Sea area have to be avoided. Any user interests have to be weighed on a fair and equitable basis in light of the purpose of protection in general and in the particular case concerned.

Targets

The trilateral conservation policy and management is directed toward achieving the full scale of habitat types, which belong to a natural and dynamic Wadden Sea. Each of these habitats needs a certain quality (natural dynamics, absence of disturbance, absence of pollution), which can be reached by proper conservation and management. The quality of habitats shall be maintained or improved by working toward achieving targets, which have been agreed upon for six habitat types. Targets on the quality of water and sediment are valid for all habitats. Supplementary targets on birds and marine mammals have been adopted, as well as targets on landscape and cultural aspects (see Waddensea Secretariat 1997) (Table 2.1).

Policy and Management

The key element of the Wadden Sea Plan is the common policy and management (see Fig. 2.6 below). For each target category, trilateral policy, management, and proposals for trilateral projects and actions necessary for the implementation of the targets have been developed.

Table 2.1 Wadden Sea Plan targets**Targets on habitat and species***Salt marshes*

The habitat type for salt marsh includes all mainland and island salt marshes, including the pioneer zone. Also the brackish marshes in the estuaries are considered part of this habitat type.

The following targets apply to salt marshes:

- An increased area of natural salt marsh;
- An increased natural morphology and dynamics, including natural drainage patterns, of artificial salt marshes, under the condition that the present surface area is not reduced;
- An improved natural vegetation structure, including the pioneer zone, of artificial salt marshes.

Tidal areas

The tidal area covers all tidal flats and subtidal areas. The border to the North Sea side is determined by an artificial line between the tips of the islands. The borders of the estuaries are determined by the average 10% isohaline at high water in the winter situation.

The following targets are valid:

- A natural dynamic situation in the tidal area;
- An increased area of geomorphologically and biologically undisturbed tidal flats and subtidal areas;
- An increased area, and more natural distribution and development of natural mussel beds, *Sabellaria* reefs and *Zostera* fields;
- Viable stocks and natural reproduction capacity, including juvenile survival, of the common seal and gray seal;
- Favorable conditions for migrating and breeding birds;

= a favorable food availability;

= a natural breeding success;

= sufficiently large undisturbed roosting and molting areas;

= natural flight distances.

Estuaries

Estuaries include the estuaries of the rivers with a natural water exchange with the Wadden Sea. On the landward side, the mean-brackish-water line delimits estuaries. On the seaward side, the border is the average 10% isohaline at high water in the winter situation.

Estuaries will be protected and the riverbanks will remain, and as far as possible, be restored to a natural state.

Beaches and dunes

Beaches and dunes include beaches, primary dunes, beach plains, primary dune valleys, secondary dunes, and heath land behind the dunes.

The following targets apply

- Increased natural dynamics of beaches, primary dunes, beach planes, and primary dune valleys in connection with the offshore zone;
- An increased presence of a complete natural vegetation succession;
- Favorable conditions for migrating and breeding birds.

Offshore zone

The offshore zone ranges from the 3-sea-mile line to an artificial line connecting the outer tips of the islands. The border between the offshore zone and the beaches on the islands is determined by the average low-tide watermark.

Table 2.1 (continued)

The following targets apply to the offshore zone:

- An increased natural morphology, including the outer deltas between the islands;
- Favorable food availability for birds;
- Viable stocks and a natural reproduction capacity of the common seal, gray seal, and harbor porpoise.

Rural area

The rural area includes meadows and arable land on the islands and on the mainland where there is a strong ecological relationship with the Wadden Sea.

The following target applies

Favorable conditions for flora and fauna, especially migrating and breeding birds.

Targets on the quality of water and sediment

Nutrients

A Wadden Sea, which can be regarded as an eutrophication non-problem area.

Natural micropollutants

Background concentrations in water, sediment, and indicator species.

Man-made substances

Concentrations as resulting from zero discharges.

Source: Dettmann and Enemark (2004).

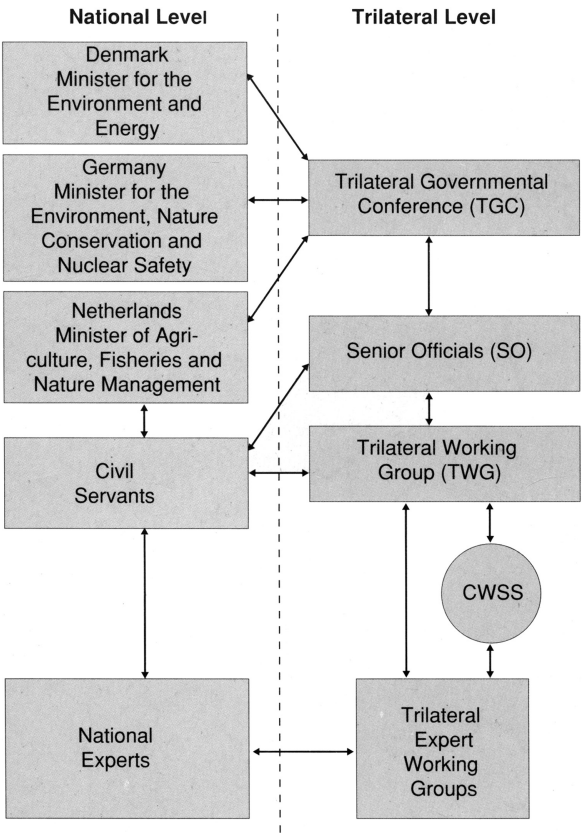


Fig. 2.6 Trilateral wetland governance. Source: Common Wadden Sea Secretariat, Undated. *The Wadden Sea: A Shared Nature Area*, p. 3

Summary and Missing Links

Given the different legal approaches to protection and management of the Wadden Sea wetland area by the three countries plus the different interpretations and implementation of international treaties such as the Ramsar Convention and EC Directives, we can see the linkage, coordination, and management integrative problems. They are myriad, but there have been substantial accomplishments as well. Before delving into the most critical future management issues, we should examine the role of the NGOs in Wadden Sea management.

The Role of the Wadden Sea NGOs

Events in all three Wadden Sea countries illustrate clearly the need to continue work on the development of better methods for the protection of the Wadden Sea. This was apparent in the early 1980s when environmental NGOs from all the Wadden Sea states started working together on the problem. With financial support of the World Wildlife Fund (WWF), they developed a program that involved the execution of two studies. The first of these focused on uniform, trilateral management objectives and criteria, and resulted in the managerial view contained in the report entitled "The Common Future of the Wadden Sea" (WWF 1991). This report played an important role in the formulation of the joint trilateral objectives and joint common principles for management of the Wadden Sea area that was laid down in the 1991 Esbjerg Ministerial Declaration (WWF 1991). WWF also set up coordination stations in Bremen and Husceu as well as coordination with up to 50 NGOs in the international Wadden Sea area.

This was the first time that such an approach had been taken and can be seen as something of a watershed in the trilateral sea cooperation. It was agreed that the Trilateral Wadden Sea policy would aim "to achieve, as far as possible, a natural and sustainable ecosystem in which natural processes proceed in an undisturbed way". In working toward this goal it was agreed that a number of common principles would be respected, among them the principle of careful decision making, the principle of precautionary action, and the principle of translocation.

Because the Wadden Sea is both a nature area and an area where people live, work, and spend their time, the Esberg Conference found it necessary to formulate a common strategy with regard to the variety of human activities affecting the area. In summary, they agreed to

- harmonize sea defense and salt marsh and dune protection;
- no new major developments of harbor and industrial facilities immediately adjacent to the Wadden Sea;
- increase efforts to eliminate pollution caused by shipping;
- cooperate in developing national criteria with regard to dredging operations;

- avoid exploration and exploitation of oil and gas until 1994;
- avoid (in principle) the construction of new pipelines;
- prohibit wind turbines in the Wadden Sea;
- limit the extraction of sand;
- limit the negative ecological impact of the mussel and cockle fishery;
- protect the recreational values of the Wadden Sea;
- reduce the disturbance to wildlife caused by hunting;
- limit the impact of civil air traffic on the Wadden Sea;
- reduce the impact of military activities;
- reduce the impact to the Wadden Sea of polycyclic aromatic hydrocarbons and organic compounds;
- express joint concern about climatic changes and sea level rise;
- develop plans for restoring parts of the Wadden Sea and for the reintroduction of species;
- develop a “Red List” of endangered marine and coastal species and biotopes in the Wadden Sea area;
- conserve seals;
- ensure adequate wardening;
- harmonize environmental impact assessments;
- cooperate in the field of public information;
- cooperate in international flora where the Wadden Sea was an issue (Ramsar Convention, World Heritage Convention, Flyway Cooperation, European Community, and North Sea Conferences).

Although the adoption in 1991 of the common principles and objectives was a significant step in the right direction, there were still major shortcomings in the trilateral cooperation. The principles and objectives were formulated in a way that allows individual countries considerable freedom for interpretation. Consequently, to some they can follow their own course while still complying in terms of the trilateral agreement.

Furthermore, the ministerial declarations are not legally binding. When a participating country does not comply with the adopted principles and objectives the other countries can only react at a political level and there are no significant sanctions. For these reasons and others previously covered in the review of existing management instruments, the NGOs sponsored a second study, which concerned the legal component of the managerial view. The intention was to study how the rules applied to the three countries could be harmonized. This study resulted in the publication entitled “Integrated System for Conservation of Marine Environments – Pilot Study: Wadden Sea” (Zweip and Backes 1994). Hans Revier, director of the Dutch Wadden Society, pointed out the need for such a study

- to document comparisons between the various national laws;
- to look at the principle of unity for ecosystem management and its implications;

- to develop a “level playing field” throughout the whole Wadden Area so as to avoid parties taking advantage of inconsistencies and undue development pressure for some areas;
- to insure NGO knowledge of each country’s administrative and legal structure similarities and differences.

The study itself focuses on the legal structure of the instruments, and where and why this structure is not functioning optimally. The study is divided into two parts: first, there is an analysis of national legal frameworks for the protection of the Wadden Sea, showing their strong and weak points and including recommendations for change and second, an attempt is made to further develop the umbrella of legal instruments covering all three Wadden states, i.e., the international and European laws for the protection of the Wadden Sea.

Of most interest are the possible routes, which could be taken to achieve a collective formulation of preconditions and criteria to affect unified ecosystem management of the whole Wadden Sea. One of these is part of EC law, the other of international law. In respect to the former, a special EC Wadden Directive could be established. The study prefers all parts of the area to be designated collectively and in a coordinated manner within the framework of the Habitat Directive, which would be much easier to accomplish.

As for international law, the study authors favor the establishment of a Trilateral Wadden Sea Treaty. If this were formulated in a sufficiently concrete fashion, then it would have a significant influence on national legal systems, and ensure that gaps in the various protective instruments would be filled.

Aside from the legal management structure needed for ecosystem management of the Wadden Sea there are still several outstanding physical–chemical problems that need attention. These are given below:

- Water quality targets especially for total discharge, nutrients, heavy metals, and organic micropollutants
- The need for fisheries management and biodiversity
- The need for an ecosystem management plan for the whole Wadden area
- Credible agreement on oil and gas exploration and production in the area
- Protection of special at-risk populations of seals and dolphins

The Role of Wetland Science in Monitoring, Modeling, and Future Impacts

There has been long-term monitoring of shorebirds on the Wadden Sea over 20 years (Smit 1989). Shorebird surveys in the Wadden Sea have not only revealed the extremely large importance of the area, especially for wading birds, but also show that different areas are exploited by shorebirds in different ways. They have also provided data on changes in bird numbers throughout the year but there still need to be improvements in how the counts are conducted.

In addition there has been 70 years of vegetation plot research in the Netherlands, including the Wadden Sea wetlands (Smits et al. 2002). The database provides insight into vegetation succession, fluctuations within plant communities over time, and the effects of changes of the environment on vegetation.

There have been calls for ecosystem models to quantify material flows to reveal imbalances, which then may indicate the direction of ecosystem change (Reise 1995). More specific models have been proposed for habitat suitability of restoration of *Zostera marina* shellfish beds (van Katwijk et al. 2000).

In terms of monitoring pollutants in the Wadden Sea, Van der Brink and Kater (2006) have used chemical measurements and bioassays to evaluate marine sediments for four groups, including heavy metals, PAHs, chlorinated aromatic compounds, and tin compounds. Measurements were taken at 16 locations in the Wadden Sea, the Netherlands. Principal component analysis indicated that the response to the Microtox Solid Phase bioassay had a positive significant relationship with the levels of PAHs and organic compounds in the marine sediment. These compounds may still be stressors for aquatic invertebrates in the Wadden Sea (Van der Brink and Kater 2006).

Besides pollutants in wetland sediment the other major concern with the health of wetland communities is the relative contribution of sediment and nutrients for maintaining or even building coastal marsh. According to Bakker et al. (1993) the area of salt marsh along the Netherlands Wadden Sea coast no longer increases. Recent erosion rates coincide with a rise in MHT level in the last 25 years. Despite the decrease in area, sedimentation continues, especially in the lower salt marsh, which acts as a sink for nitrogen. Assimilation and mineralization of nitrogen are in balance in most communities along the gradient from lower to higher salt marsh, whereas the above ground production and mean content of plants decreases. Sedimentation on main land marshes can compensate for the expected sea level rise, but this is not the case for island salt marshes. The stability of remaining coastal flats with a rising sea level scenario is also of concern to Danish Wadden Sea scientists as well (Christiansen and Aagaard 2004).

This brings us to the effect of future climate change on the Wadden Sea wetlands vegetation, fish, and wildlife. According to Brouns (1992) one of the main concerns is the rise of sea level and that the sedimentation rates will be insufficient to maintain salt marshes on the barrier islands as stated above. The marshes on the mainland coast will be impoverished, as high and low marshes are not expected to coexist in the same locations. As sediment supply to the Wadden Sea is sufficient to compensate for sea level rise, the estuarine character of the Wadden Sea, with sand and mud flats, is expected to remain largely unchanged (Brouns 1992).

The resultant impacts to wetland-dependent species have been studied for climatic change on Western Palearctic migratory birds by Meekes (1992). He concludes that many migratory bird species will be influenced by climate

change, leading to adaptation in the bird's annual cycle. The biggest problems may arise for those birds, which depend on wetlands, because many of these wetlands may desiccate (Meekes 1992).

Summary

So in essence, the role of Wadden Sea NGOs evolved from early protection of species to campaigns against specific development proposals and management activities, to international diplomacy and influence of policy determined at the Trilateral Government Wadden Sea Conferences. The strategy for the 1991, 1994, and 1997 meetings is that of the agenda setters; preparation of major policy documents designed to have maximum impact on policy decision makers. NGOs concerned with the Wadden Sea continue their monitoring role, especially with the international conventions such as Ramsar, Bonn Convention, and EC Bird/Habitat Directives. Above all the Wadden Sea NGOs do an incredible job with education through use of newsletters and other media to keep members and concerned citizens informed. The role of wetland science is also critical in monitoring and reporting on the health and direction of change of ecosystems habitat and specific species as reported above in the previous section

Acronyms

EC: European Commission

IUCN: International Union for the Conservation of Nature

PKB: Physical Planning Act

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