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Ecology of the Wadden Sea: Research in the past and challenges for the future

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ABSTRACT

This paper provides a brief overview of ecological research in the Wadden Sea during the last 50 years and its role in the conservation of the area. Conservation of the Wadden Sea would not have been possible without solid scientific information and a good interlink between science and conservation will also be crucial for the future management. Some suggestions for future research topics are made.

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1. Introduction

Wadden Sea research has its roots in the 19th century when all along the European coasts marine laboratories were established. In the Netherlands, the Zoological Station of the Dutch Zoological Society was the first marine field station (van Bennekom, 2001). This first station was movable and has served as a laboratory at various places along the Dutch coast. Its first season in 1876 was spent at Den Helder. The following years until 1885 the station was situated at Vlissingen, Terschelling, Tholen and Delfzijl to explore the Dutch coastline. After ten years the building was worn out and a permanent site had to be selected for a new building. Den Helder was chosen based on the experiences of the previous ten years; Den Helder provided access to both the North Sea and the Wadden Sea and it was the largest fishery harbour in the country. The investigations had an exploratory and inventory character whereby during the first decades the main aim was the taxonomic description, the physiology and the distribution of animal species.

In Germany the obvious place for a marine station at the North Sea coast, including the coast of the Wadden Sea, was at Helgoland because of its rich variety of marine species. This negatively affected the establishment of any marine station in the German Wadden Sea. However, Helgoland was British property which precluded the establishment of a German research station. This explains that in 1888 a movable marine zoological station ("Zoologisches Wanderstation") was founded. It was active in the estuaries of the Ems, Weser and Elbe (Werner, 1993). But when Helgoland was returned to Germany in 1890 the road was paved for the creation of the Biologische Anstalt Helgoland in 1892 (Werner, 1993). This major institute dominated the research scene and made establishment of Wadden Sea stations difficult.

The study of the rich oyster beds in the North-Frisian Wadden Sea was the subject of marine scientists (Möbius, Hagmeier) operating from temporary facilities. However, the continuing questions for advice on oyster culture finally resulted in the founding of a permanent Wadden Sea station at List (Sylt) in 1924. This has developed into the present Wattenmeer Station at List (AWI, 1999). In the second part of the 20th century, most marine laboratories developed from zoological stations into multidisciplinary marine institutes and hence also the research scope changed to ecological and multidisciplinary research projects. At the same time coastal zone systems experienced a strongly increasing anthropogenic threat ranging from land reclamation to serious pollution. In this respect the Wadden Sea was no exception and there was a growing awareness of the need to conserve the Wadden Sea. For this integrated scientific knowledge on different parts of the Wadden Sea ecosystem was needed.

In this paper, a short overview is provided of the milestones that were critical in the conservation of the Wadden Sea and the role of and need for ecological research with respect to that. The first part of the title of this paper is derived from a book (Wolff, 1983). This book comprises the first overview of the available knowledge with respect to the ecology of the Wadden Sea, which were the results of the activities of the Wadden Sea Working Group, a group of scientists concerned about the protection and conservation of the Wadden Sea.

2. The 1960s and 1970s: the growing awareness of the vulnerability and conservation value of the Wadden Sea

Around 1965 the future of the Dutch Wadden Sea looked bleak. Plans for reclamation of the entire Dutch Wadden Sea were published in the 1960s. Others advocated the reclamation of parts of the area such as the Ameland tidal flats. Harbour porpoises disappeared completely from the tidal channels around 1965; the cause was not

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identified (Verwey and Wolff, 1981). The harbour seal population showed a continuous decline; over-hunting was suspected to play a part, but it could not explain the entire decline (Reijnders et al., 1981). Coastal birds, such as spoonbill, herring gull, eider duck and sandwich tern, died in ever larger numbers in the 1960s until it could be ascribed to discharge of chlorinated hydrocarbons in the Rotterdam harbour (Koeman, 1971). The sandwich tern nearly became extinct in the Netherlands due to this pollution incident. Bird mortality due to small-scale oil pollution was well known in the Wadden Sea area, but the shipwreck of the Torrey Canyon in Cornwall, UK in 1967, resulting in the spillage of about 90,000 t of crude oil (Essink and Wolff, 1978), made people aware of what could happen in the Wadden Sea. Mercury was demonstrated to occur in marine mammals and birds living in the Wadden Sea and from Minimata, Japan, it was reported what devastating impact mercury pollution of seafood could have on humans. At the same time people were discovering the beauty and the conservation value of the Wadden Sea. This resulted in two initiatives: a school-boy Kees Wevers founded the Dutch Society for the Preservation of the Wadden Sea (Landelijke Vereniging tot Behoud van de Waddenzee) in 1965 and Dr. Jan Verwey and some colleagues established the scientific Wadden Sea Working Group which had its first public meeting also in 1965.

Dr. Jan Verwey had been appointed director of the Zoological Institute of the Netherlands Zoological Society in 1931. This institute at Den Helder developed into the Dutch national marine institute and in 1957 it was renamed Netherlands Institute for Sea Research (Dutch abbreviation: NIOZ). Verwey retired from his directorate in 1965. During Verwey's directorship the focus of the research of the institute was on the Wadden Sea. After his retirement Verwey became an influential advocate of protection of the Wadden Sea. This role was based on scientific arguments. By collecting and publishing data on the ecology of the Wadden Sea he attempted to influence decision makers, both to protect the Wadden Sea and to mitigate damaging influences of human actions. In 1965 Verwey was one of the principal contributors to a public meeting of the Dutch Liaison Committee for the Protection of Nature and Landscape (Contact-Commissie voor Natuur- en Landschapsbescherming) on the future of the Wadden Sea. Later that year Verwey took the initiative to found the Wadden Sea Working Group, originally a group of Dutch scientists who wanted better protection of the Wadden Sea. In 1970 the Working Group met in Bremerhaven, Germany, and established contacts with German and Danish scientists (Harmsen, 1972). At that occasion the Working Group counted about 20 members. A second international meeting was organised in Oosterbeek, The Netherlands in 1973; at that occasion the overall Working Group was subdivided into small-scale working groups for 11 subdisciplines (e.g., Hydrography, Primary Production).

In 1975 Dr. Jan Verwey stood down from the chair of the Working Group and was succeeded by Dr. Jenne J. Zijlstra, a new director of NIOZ. In that same year the Netherlands Zoological Society supported the Wadden Sea Working Group via the Veth Foundation for Support of Wadden Sea Research. Dr. H.J. Veth worked in the period 1876–1888 at the Zoological Station. In his last will he bequeathed a considerable sum of money to the Society. However, although this money was sufficient to buy stamps and rent meeting rooms, it was insufficient for employing people. This changed when Dr. Jan W. Woldendorp, treasurer of the Foundation, was able to attract HFL. 1,000,000 from a national lottery ("Aktie Natuur"). This enabled the start of the Co-ordination Group for Research and Management of the Wadden Sea area (COBW — Coördinatie Groep Onderzoek en Beheer Waddengebied) on 1 November 1975.

3. The 1980s: the scientific legacy of the Wadden Sea Working Group

The COBW was a joint venture of Netherlands Institute for Sea Research (NIOZ), Research Institute for Nature Management (RIN), Wadden Sea Working Group, and Veth Foundation for Support of Wadden Sea Research. NIOZ provided the housing, RIN paid the co-ordinator, the Wadden Sea Working Group had the scientific lead and the Veth Foundation provided the money.

NIOZ had an interest in the COBW because the NIOZ-scientists were swamped with requests for advice, short-term and long-term, on the management of the North Sea and the Wadden Sea. They wanted to curtail this flood and demanded that COBW (= RIN) should take up this task.

RIN was a government-funded institute for research into nature conservation problems. Its director Prof. Dr. Donald J. Kuenen had been a member of two government committees set up to solve major nature conservation problems in Dutch coastal waters: 1) the closure of the Oosterschelde estuary and 2) the future of the Wadden Sea. In both cases the staff of his institute, experienced in terrestrial and freshwater ecology, had been unable to support him at expert level. Moreover, Don Kuenen had the opinion that applied research on conservation problems was the task of RIN. He believed that the COBW project could be the start of a RIN Department of Estuarine Ecology. To this end RIN recruited Dr. Wim J. Wolff as a leader of the COBW project and as a future head of department; he started at Texel on 1 November 1975.

The Wadden Sea Working Group was organised into small sub-groups of varying size: from 2 to 20 members. Usually a senior member was elected chairman. In the COBW period the Working Group counted about 125 scientists. The money of the Veth Foundation was used to employ three young scientists to support each sub-working group. They acted as secretary to the chairmen and were employed to analyse and report data sets from former research projects. Kees S. Dijkema and Cor J. Smit started their work on 1 January 1976, and Dr. Norbert Dankers on 1 April 1976. In 1980–81 Dr. Peter J.H. Reijnders (RIN) assisted with the report on marine mammals.

The COBW project resulted in 11 reports, published by the publisher A.A. Balkema in Rotterdam, describing the geomorphology, the hydrography, the ecology and protection of the Wadden Sea (Table 1). They covered the entire area between Den Helder and Esbjerg and provided an account of the scientific research in the

Table 1
Reports of the COBW project, published by A.A. Balkema Press, Rotterdam.

Report	Editors	Year of publication	Title
1	Dijkema, K.S., Reineck, H.E., Wolff, W.J.	1980	Geomorphology of the Wadden Sea area. 135 pp.
2	Postma, H.	1982	Hydrography of the Wadden Sea: movements and properties of water and particulate matter. 75 pp.
3	Wolff, W.J.	1979	Flora and vegetation of the Wadden Sea. 206 pp.
4	Dankers, N., Kühl H.& Wolff, W.J.	1981	Invertebrates of the Wadden Sea. 221 pp.
5	Dankers, N., Wolff, W.J. & Zijlstra, J.J.	1978	Fishes and fisheries of the Wadden Sea. 157 pp.
6	Smit, C.J. & Wolff, W.J.	1980	Birds of the Wadden Sea. 308 pp.
7	Reijnders, P.J.H. & Wolff, W.J.	1982	Marine mammals of the Wadden Sea. 64 pp.
8	Essink, K. & Wolff, W.J.	1978	Pollution of the Wadden Sea area. 61 pp.
9	Dijkema, K.S., Wolff W.J.	1983	Flora and vegetation of the Wadden Sea islands and mainland coastal areas. 320 pp. + appendices
10	Smit, C.J., den Hollander, J., van Wingerden W.K.R.E., Wolff W.J.	1981	Terrestrial and freshwater fauna of the Wadden Sea area. 275 pp.
11	Mörzer Bruijns, M.F., Wolff, W.J.	1983	Nature conservation, management and physical planning in the Wadden Sea area. 120 pp.

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