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Dutch involvement in fisheries research prior to and in early ICES

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The first General Secretary of ICES was P. P. C. Hoek, a well-known marine zoologist and a good organizer. As scientific adviser to the Dutch Council for Sea Fisheries, he stressed the need for proper scientific research before measures could be taken to prevent overfishing. For the foundation of ICES, concern about fish stocks (especially plaice) was just as important as relationships between hydrography and variations in the stocks of herring. ICES projects were a great impetus for marine science. At the new National Institute for Sea Research in Den Helder, fisheries, plankton, and seasonality of nutrients were studied. Later, the lack of permanent positions coupled with an interest in brackish inland waters contributed to a decline in research on the North Sea. After World War I, fisheries research suffered from fragmentation. In 1942, the various branches were reunited into the Netherlands Institute for Fisheries Research (RIVO), now in IJmuiden. The marine division of the Meteorological Institute (KNMI) remained active in North Sea hydrography, while the explosion in environmental research after World War II involved both governmental and other institutes in marine research relevant to ICES. A few research topics, initiated before 1910, but still of current interest (time series, nutrients, closed areas, and *Phaeocystis* blooms) are briefly considered.

Keywords: fisheries, history, Holland, Hoek, ICES, North Sea, nutrients, plankton.

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Fisheries in the southern North Sea before ICES was founded

In the late 19th century, Great Britain had by far the largest fleet of steam-powered fishing vessels (Figure 1). The Dutch fleet of sailing vessels landed more fish than the total German fleet. The introduction of the steam engine, both on fishing vessels and for the transportation of the catch to inland markets had greatly increased fishing (Lenz, 1992). The British Sea Fisheries Act of 1868 had removed all restrictive measures in line with a general liberal attitude. Two statements by T. H. Huxley, made in 1883 (Huxley, 1903) on the occasion of a fisheries exhibition in London, had echoes of long duration: "In relation to our present modes of fishing the most important sea fisheries, such as cod, herring and mackerel are inexhaustible" and "Those who impose an ill-founded law on fishermen deserve heavier punishment than those who break it." Nevertheless, exhaustion of plaice stocks in the southern North Sea was a real concern and the (British) National Sea Fisheries Protection Association, founded in 1882, decided voluntarily to quit trawling for two years around Helgoland (Figure 2), which was then British territory.

This Association regarded international cooperation as necessary and organized a two-day conference in July 1890 in London to which experts from six other countries were invited, including Professor Hensen from Kiel and Dr Hoek from The Netherlands. The conference was "unofficial" (Lenz, 1992) because official support from the Fisheries Section of the British Ministry for Trade was not obtained; however, the invitations to foreign experts were sent by the British Foreign Office (Went, 1972). Went described the conference as "abortive", concluding that organized fisheries research did not yet exist, while scattered individuals were hampered by a general lack of money for science.

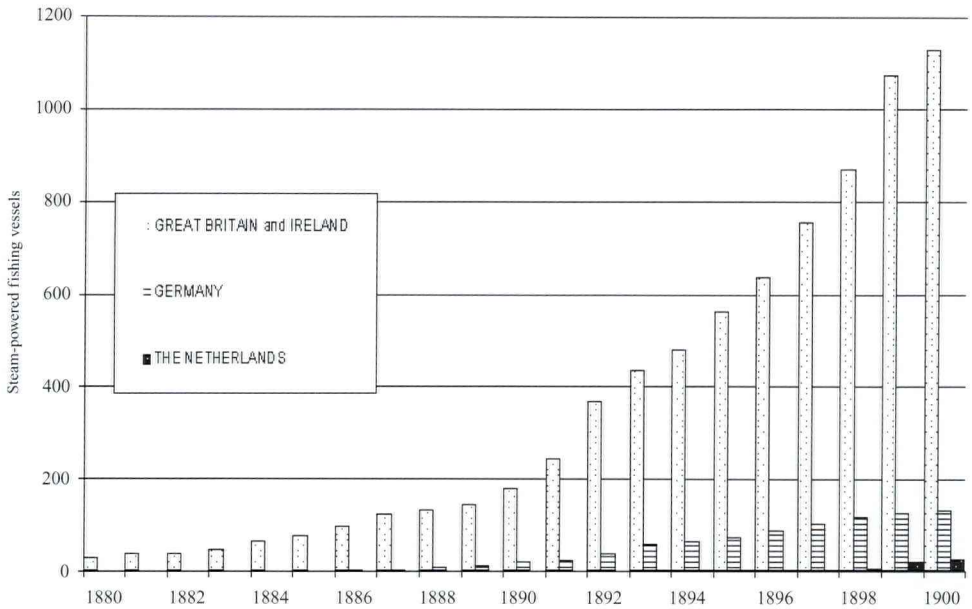

Figure 1. Comparison of British, German, and Dutch steam-powered fishing vessels, 1880–1900. Data collected by Bottemanne (1902) from Olsen's *Nautical Almanac* and from *Mittheilungen Deutscher Seefischerei Verein*.

But newspapers in Germany praised Hensen for "having saved German fisheries", while Dutch newspapers applauded the role of Hoek. The German position was difficult (Lenz, 1992): they wanted more international regulation of North Sea fisheries, but not to such an extent that growth of German fisheries would be impeded. Hoek stated that he would not agree to any resolution unless it was also agreed that more statistical data were needed to give proposed measures a scientific basis. Hoek's statement was supported by the conference.

Hoek's position in The Netherlands

Dr Paulus P. C. Hoek (1851–1914; Figure 3) was the central person in fisheries as well as in marine biology at the end of the 19th century in The Netherlands (de Groot, 1988). In 1888, he was appointed scientific adviser to the Governmental Council for Sea Fisheries, established in 1857 to advise in all matters concerning sea fisheries. Ship owners, representatives from government, and university professors participated in this Council. Hoek had a good reputation as a zoologist, working on the *Cirripedia* of the "Challenger", "Belgica", and "Siboga" expeditions. He also played a major role in the establishment of a transportable marine biological station operated from 1876 to 1889 by the Dutch Zoological Association (NDV) (Dral, 1998). A three-year project on the oyster and oyster culture was one of the results (Hoek, 1883/4). In 1890, a permanent Zoological Station (Figure 4) was established in Den Helder, considered the most suitable place along the Dutch coast. It was a main fishing port with great diversity in its marine environment.

The Station was built and owned by the NDV, while the government rented rooms in the building for the work of its Scientific Adviser on fisheries. Hoek was also (unpaid) Director of the Station, and members of the NDV agreed to give attention to fisheries, "economic biology" as Hoek called it. This agreement was not without debate; some naturalists argued that it was all right for them to advise government and fishermen, but they did not want to serve fisheries. Hoek's arguments that it was the only way to put marine research on a more secure financial basis were decisive. He apparently adhered to the view of Louis Pasteur (cited by Paul, 1985, p. 39): "Applied science does not exist, but there are applications of science." Applied science with commercial interest was impossible at the zoological station in Naples. For many marine biological stations in northwest Europe, fisheries research became an important task after about 1890, more than in southern European countries such as France and Italy (Kofoid, 1910).

In a report to the Dutch government, Hoek (1894) summarized his thoughts about the minimum marketable fish sizes, the control measures, and the possible

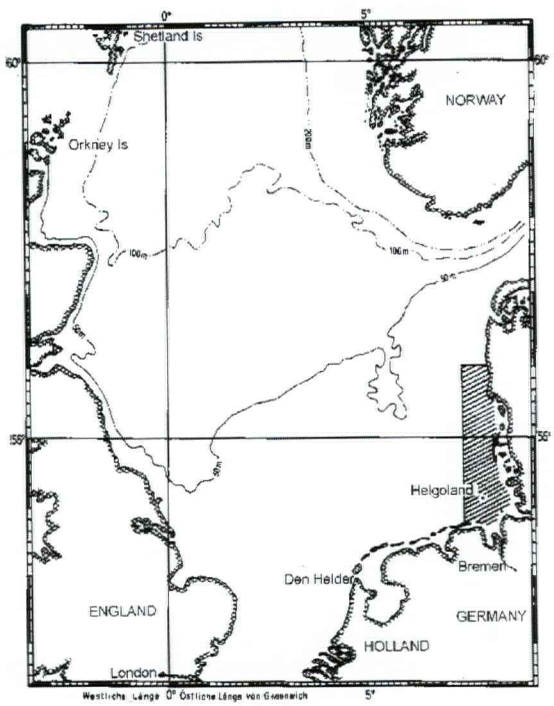

Figure 2. The area where the British proposed to quit trawling (from Lenz, 1992).

extension of territorial jurisdiction. He referred to Huxley's statement about "ill-founded laws". This report was translated into German and discussed by Ehrenbaum (1895), who also quoted "those golden words", not mentioning that they were from Huxley.

Foundation of ICES

Semi-official contacts between Dutch and German authorities were resumed at a meeting in 1897 in Dortmund, Germany, where plans took shape for another international conference to be jointly organized by the German and Dutch governments. This initiative was superseded by that of the Swedish King Oscar II, who invited experts from many countries to Stockholm in 1898. Fisheries problems in Scandinavia were dominated by the periodic disappearance of fish stocks, causing famine in parts of Norway and Sweden. Possible relationships with hydrography were a prime research target of Scandinavian physical oceanographers led by Pettersson and others, e.g., Hjort, who had a government post in fisheries management. It is often said that the Scandinavians founded ICES, and they certainly played a major role. To extend the programme over the entire North Sea, joining forces with the Germans and the Dutch, was needed, which also meant attention to possible overfishing. This is most apparent from the people in 1902 elected to the ICES Bureau in Copenhagen. The first President, Herwig, was trained as a lawyer and was Chair of the German Association of Fishermen. The Swedish physical oceanographer Pettersson (the "Father of ICES", Svansson, in press) was Vice-President and Hoek was General Secretary. They assumed some of their responsibilities long before ICES was formally founded; already in April 1901, Herwig wrote Hoek that other nations supported his candidacy.

The British, who dominated North Sea fisheries, had a "wait-and-see" attitude towards ICES. They agreed to take part, but after three years they would evaluate if they would continue. The Central Bureau in

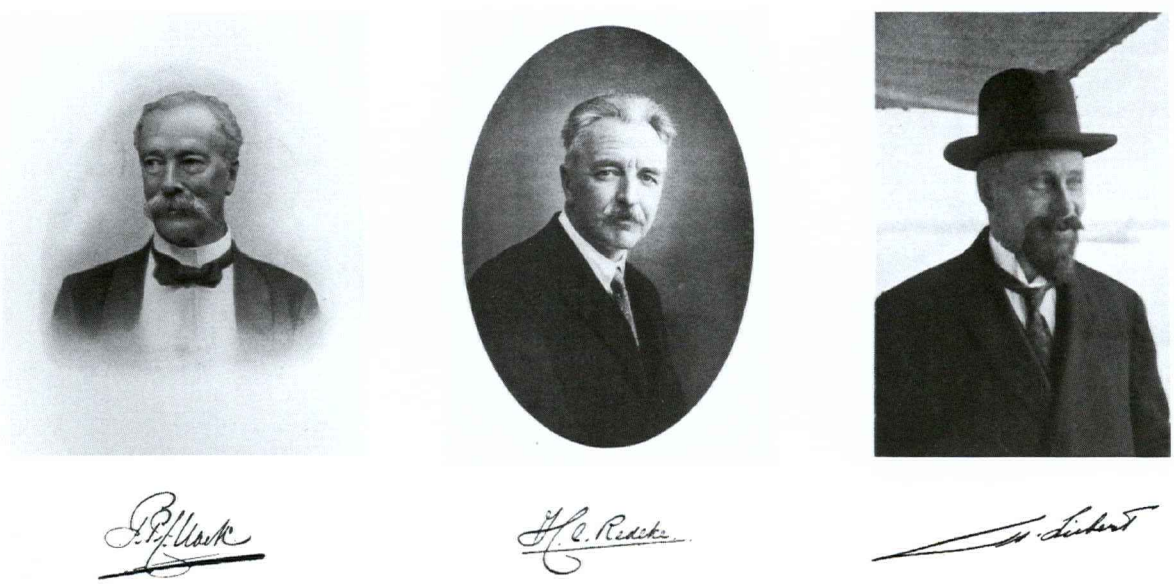

Figure 3. From left to right: P. P. C. Hoek, H. C. Redeke, and F. Liebert.

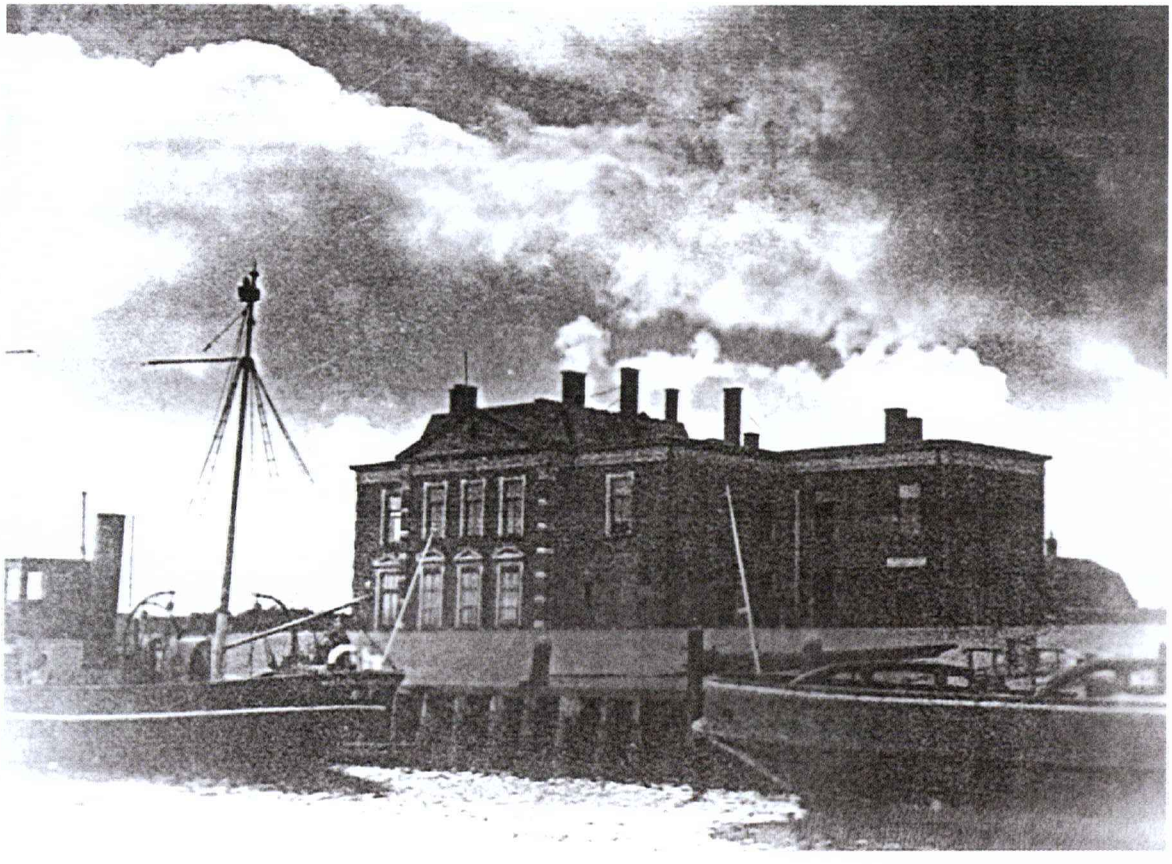

Figure 4. The Zoological Station of the Dutch Zoological Association in Den Helder which also housed the National Institute for Sea Research.

Copenhagen and the Central Laboratory in Oslo each had a British assistant, Kyle and Fox, respectively.

The aims of ICES were twofold: the study of migration and fluctuation of cod and herring in the northern North Sea on the one hand and overfishing, especially of flatfish in the southern North Sea, on the other hand. In 1902, Nansen, Director of the new ICES Laboratory in Kristiania (now Oslo), wrote to the Norwegian Prime Minister: "The really important part of the Central Institution, namely the laboratory would be sited in Norway, while the Bureau has been reduced to a communication office with some office people, but with no expertise...." (Went, 1972, p. 16, who adds a sic here). Went described the many political barriers before and after the foundation of ICES. Hoek's diplomatic and linguistic abilities contributed to the steering of ICES through its first years.

In 1905, a survey of the work during the first two years was edited by the Bureau (Herwig *et al.*, 1905); it contained a comprehensive report on fisheries statistics by Hoek, Kyle, and contributions from all countries. Hoek's "meticulousness, which sometimes could be almost pedantic" (Henking, 1914) caused conflicts with his first assistant, Martin Knudsen, who from the start had wanted a more independent position at the Bureau (J. Smed and A. Svansson, personal communications, 2000). In 1907, the Dutch government wanted Hoek to direct scientific work on Dutch fisheries. He indeed returned to Holland, but upon request remained General Secretary of ICES until 1908.

Contribution of Dutch scientists to the early work of ICES

The commitments by governments to the initial five-year projects of ICES were instrumental in providing financial means to study fisheries and hydrography from quarterly cruises on a large station grid with standardized methods. This grid was already established in 1898 at the Stockholm Conference (Smed, 1983). Later, small modifications were added, such as stations in the English Channel.

In The Netherlands, the National Institute for Sea Research was established and housed in the Zoological

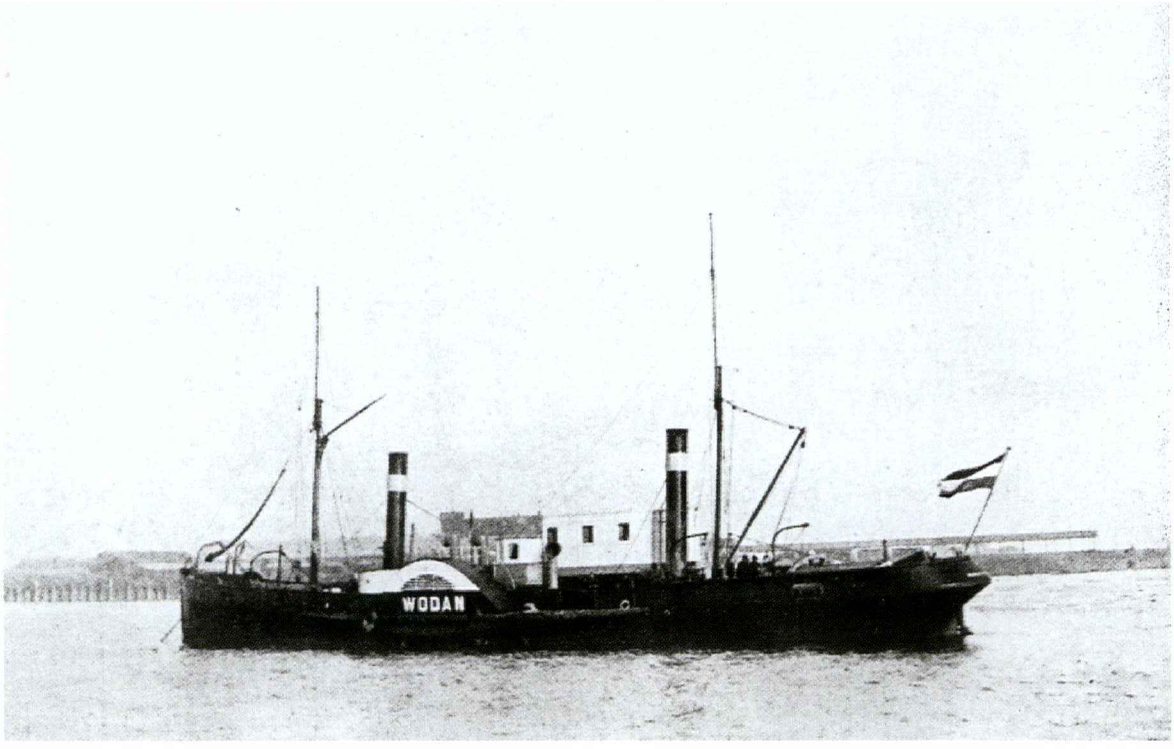

Figure 5. The RV "Wodan" hired to occupy, in 1902–1907, the Dutch stations agreed in the ICES programme on seasonal observations.

Station in Den Helder with H. C. Redeke (Figure 3), Hoek's son-in-law, as Director (he had been Hoek's assistant since 1897). New staff were appointed, mainly biologists, but also a chemist, W. E. Ringer. A paddle tugboat, the "Wodan" (Figure 5) was rented for 70 days per year and equipped with a laboratory to carry out the seasonal cruises. Results on temperature and salinity were included in the Bulletins edited by Knudsen (1902–1907).

For the navigation of the "Wodan", and for technical assistance in the observations at sea, naval officers were temporarily placed at the Institute. The standard station grid in the North Sea (Figure 6) was extended for special purposes, such as for pinpointing the distribution of plaice eggs.

A summary of the Dutch results is given in the "Volume Jubilaire" (ICES, 1927) by various authors. Seasonal changes in plankton and nutrients in the North Sea were studied as well. Ringer used the methods developed by Raben in Kiel to determine nitrate, ammonia, and silicate in seawater. Raben (1905) and Ringer (1906) published the first results on the seasonal cycle of these compounds coupled with phytoplankton. The results for nitrate + nitrite (Figure 6) seem quite reasonable regarding present knowledge. The concentration of silicic acid, 10–15 $mmol.m^{-3}$, seems too high, while good methods for phosphate were not available at that time. Raben found minima for nitrate + nitrite in August and minima for silicic acid in May in the Baltic Sea and in the North Sea. Ringer's results were too few to substantiate this. Plankton work by van Breemen (1905) showed that massive spring blooms of *Phaeocystis globosa* were found in the southern North Sea and in Dutch coastal waters, but not along the English coast.

After 1907, the Dutch quarterly cruises ended. In 1912, the Institute for Sea Research was renamed the Institute for Fisheries Research. Fisheries organizations doubted whether hydrographic research would result in more fish. The chemist F. Liebert (Figure 3), who had succeeded Ringer in 1908, turned his attention also to fish conservation, which was a clever move since this was of more direct importance to fisheries technology. He also studied denitrifying bacteria because of their supposed importance in the sea (Mills, 1989). In 1916, his department in Den Helder became independent as the National Institute of Hydrographic, Chemical, and Bacteriological Fisheries Research.

Fragmentation of Dutch fisheries research

The temporary assignments of the scientists hampered the continuity of the work. Many scientists wanted more security and found permanent jobs at museums or uni-

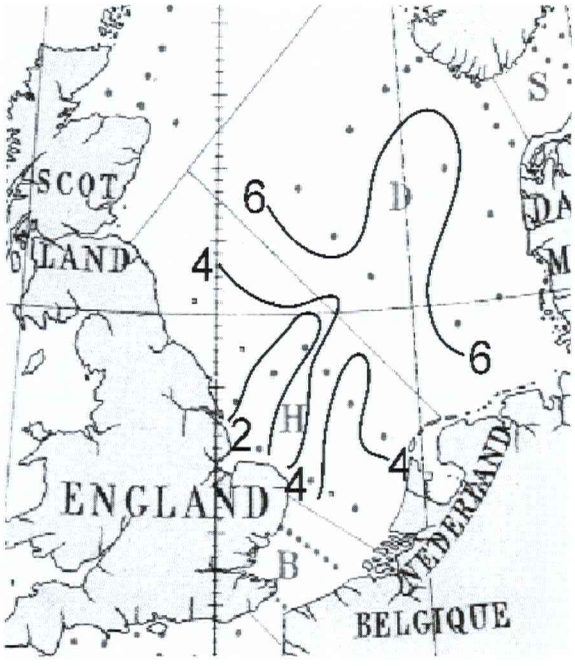

Figure 6. Distribution pattern of the nitrate + nitrite concentration mmol.m^{-3}) in November. German data (D) after Raben (1905); Dutch data (H) after Ringer (1906). The station grid is taken from Herwig *et al.* (1905) with addition of the extra Dutch stations.

versities. Hoek died in 1914 of heart disease. Redeke, who succeeded him as Director of the Fisheries Research Institute, concentrated more on inland waters. He did so for practical reasons, because research in the North Sea came to a virtual standstill during World War I, and for personal reasons, because he was appointed senior lecturer in Hydrobiology and Plankton Research at Amsterdam University in 1916. In 1920, he initiated studies of the hydrobiological changes caused by closure of the "Zuiderzee", after which the water in this region (now "IJsselmeer") changed from brackish to fresh.

Dutch fisheries research was further split during the 1920s into inland, coastal, and offshore sections. Together with the chemical department, there were now four small departments (each with 2–5 personnel) at four different places which, in the absence of a research vessel, contributed to very limited possibilities for research (de Groot, 1988). Payment of the Dutch national contribution to ICES and sending representatives to meetings was considered sufficient. At the end of the 1930s, plans emerged to reunite the various branches. This happened in 1942, under German occupation, when the Netherlands Institute of Fisheries Research (RIVO) with one Director (Havinga) was formally established. In 1949, a research vessel, the "Antoni van Leeuwenhoek" was commissioned, and in 1955, a new building in IJmuiden was opened (de Groot, 1988).

Involvement of the KNMI and other institutes

Since its establishment in 1854, the Royal Netherlands Meteorological Institute (KNMI) in De Bilt had included a marine department which collected meteorological and oceanographic data, primarily from the oceans. Already in 1853, the founder and first director of the department, the naval officer M. H. Jansen, proposed to collect water temperatures of the North Sea using the fishing fleet. The idea was to find the relationship between the occurrence of herring and the hydrographic conditions, and accordingly improve the catch (Jansen, 1853). This project started in 1856, but was discontinued in 1863, as it did not have the expected results. A later attempt (1876–1880) was similarly unsuccessful.

In line with the meteorological tradition, much emphasis was given to observations with standard equipment from regular shipping lines and fixed stations such as lightships. The first series of temperature observations from the "Noord Hinder" lightship already existed from 1859, while regular salinity observations from lightships started in 1905. A comparison of current meters was begun in 1904 (Wind *et al.*, 1912). The successive KNMI Directors-in-Chief, C. H. Wind and E. van Everdingen, were active in ICES meetings as Delegates and in the analysis of the observations (van Everdingen, 1928). In 1907, the "Nautical Affairs" Department at KNMI was renamed "Oceanography and Maritime Meteorology". Later, the directors of the Oceanography Department, starting with H. van Riel, became KNMI representatives. Before 1950, KNMI contributed to data handling and storage, as organized by the Service Hydrographique, and to rapid dissemination of data and data products rather than to hydrographic observations at sea.

After 1960, the Netherlands Institute for Sea Research (NIOZ), successor to the Zoological Station and transferred in 1969 from Den Helder to the nearby island of Texel, also became officially involved with ICES. After about 1975, the role of the National Institute for Coastal and Marine Management in The Hague increased.

Some reflections

Dutch fisheries

The motorized Dutch fishing fleet which grew substantially only after about 1920, currently plays a major role in beam trawling in the North Sea (Lindeboom and de Groot, 1998, Figure 3.1.2.). It is noteworthy that, a century after the first proposal to close areas in the North Sea for trawling, such proposals were made again, but this time for larger areas and to protect natural commu-

nities (Lindeboom, 1995). How these proposals will be received by the fisheries communities is predictable; however, the EU Commission on Fisheries Policy already focuses on how to reduce the effect of the heavy beam trawl on the marine habitat. The EU Impact Projects I by de Groot and Lindeboom and II by Lindeboom and de Groot demonstrated clearly that measures need to be taken. A comprehensive discussion of all the aspects related to the effects on non-target species and habitats by fishing can be found in Kaiser and de Groot (2000).

Hydrography

Understanding the North Sea hydrography depends on theoretical studies and modelling, but first of all requires information on the regional distribution of oceanographic parameters and long time-series. After about 1960, when Dutch research vessels became available again, there was a Dutch contribution to this type of research. Cooperation between KNMI, NIOZ, and RIVO, and institutes in neighbouring countries resulted in a better understanding of the hydrography of the southern North Sea (Otto *et al.*, 1990). However, the typical climatological KNMI approach, resulting in long time-series of temperature, salinity, and currents from lightships was of equal importance. The data collection in the archives of the Service Hydrographique, sampled by many nations, is of great value for the study of time-variability in the North Sea. Changes in the organization of marine research and in the observational techniques should not result in less interest in the continuation of oceanographic time-series.

Nutrients and their relationship with phytoplankton

Nutrient work was not a key priority of fisheries research. Improved chemical methods developed at the Marine Biological Laboratory in Plymouth established more firmly the seasonal cycle of nutrients related to phytoplankton in the English Channel (e.g., Cooper, 1933). In the late 1960s, emphasis at NIOZ shifted to the role of rivers in the increasing concentrations of phosphate and nitrate in the southern North Sea. Van Bennekom *et al.* (1975) concluded that the concentration of silicic acid limits the growth of diatoms in the spring. The spring diatom bloom does not consume all of the phosphate and nitrate; massive amounts of *Phaeocystis globosa* consume the rest. Again, modelling based on long time-series has improved the insight into the underlying processes in the cycle of nutrient elements (van Raaphorst and de Jonge, in press). Denitrification again became an important topic, now in the sediments and not in the water column (Lohse *et al.*, 1996).

Not only the concentrations, but also the ratios of minor and major nutrients influence phytoplankton species composition. The historical presence of the "nuisance algae" *Phaeocystis globosa* has been documented by Cadée and Hegeman (1991). Unusual ratios of nitrate to phosphate could play some part, but not the only role in the development of massive harmful algal blooms, such as that of *Chrysochromulina polylepis* in 1988.

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