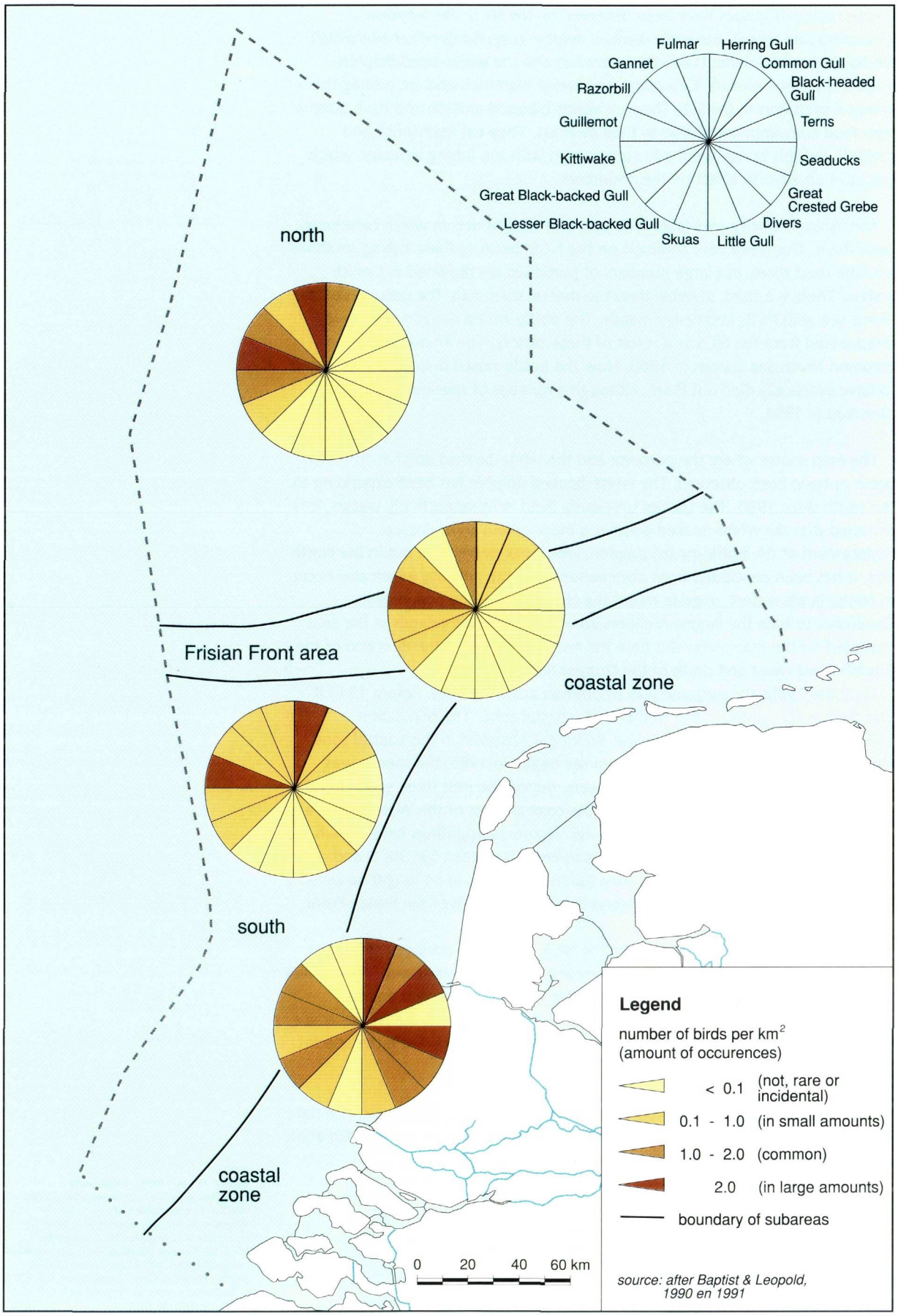
Seabird species in winter



Whales

Four cetacean species have been observed on the NCS: the porpoise (*Phocoena phocoena*), the white-beaked dolphin (*Lagenorhynchus albirostris*), the bottle-nosed dolphin (*Tursiops truncatus*) and the white-sided dolphin (*Lagenorhynchus acutus*). Cetaceans are marine mammals and are among the principal predators in the sea. They are warm-blooded animals and have quite a high food consumption relative to their biomass. They eat mainly fish and shellfish and this brings them into competition with the fishing industry, which can have an adverse effect on their numbers.

The fishing industry uses large fyke nets and vertical nets in which cetaceans can drown. This is not very common on the NCS, because these fishing methods are little used there, but large numbers of porpoises are drowned in Danish waters. There is a third, invisible threat to marine mammals: the pollution of the North Sea with PCBs and heavy metals. The bottle-nosed dolphin may have disappeared from the NCS as a result of these factors. The animal was still a common North Sea species in 1960. Now the bottle-nosed dolphin is considered to have practically died out there, although a number of specimens was observed in 1991.

The map shows where the porpoise and the white-beaked dolphin currently occur or have been observed. The white-beaked dolphin has been expanding to the south since 1960. The species previously lived in more northerly waters. It is assumed that the white-beaked dolphin is more or less an ecological replacement of the bottle-nosed dolphin, which has nearly died out in the North Sea. It has been concluded from observations that the animals, which also occur in Netherlands waters, migrate round the North Sea. In the period from December to June the largest numbers are seen in the Netherlands in the area indicated on the map. After this time the animals migrate in the direction of the English coast (west and north of the Dogger Bank).

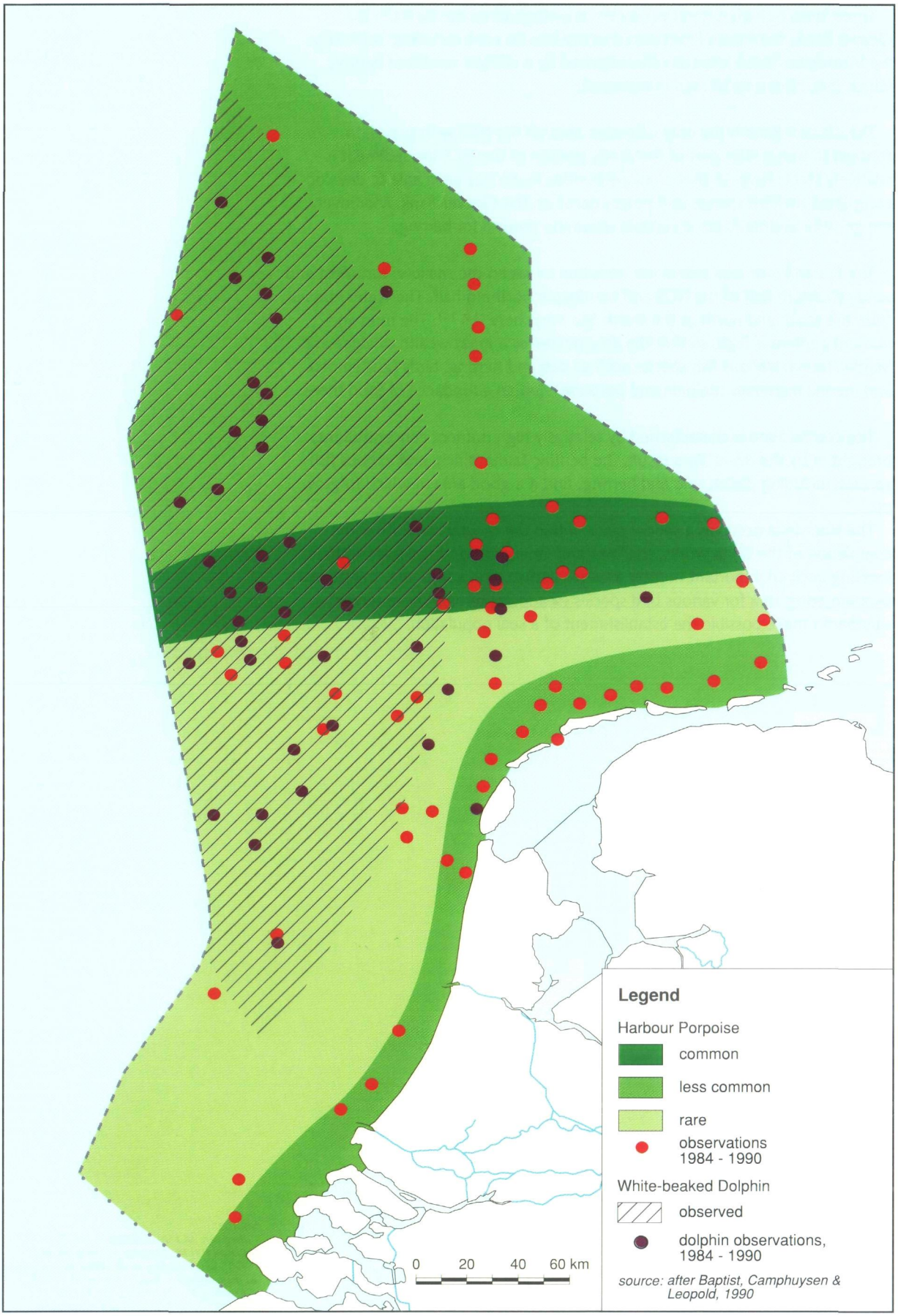
Until the 1960s the porpoise was a common animal species. Before 1940 it was frequently sighted in the Netherlands coastal zone. The population collapsed after 1960. The species was no longer observed in this coastal zone. When regular observations on the open sea began in 1985, the species was regularly encountered there. It also appears, during the past three years, to be returning to the coastal zone, including the coastal inlets of the Wadden Sea and the Zeeland channels, particularly in winter. Numerous sightings have shown that the porpoise now occurs off the Frisian Front (between 53° 30' N and 54° 10' N) throughout the year in such numbers that it can no longer be called a rare animal. The porpoise is also observed north and south of the Frisian Front.

Because of their rare occurrence on the NCS, the other species of cetaceans are not shown on the map, although they are occasionally observed. This applies to the white-sided dolphin and, recently, also to the bottle-nosed dolphin. Outside the NCS, the pilot whale (*Globicephala melaena*) and the Minke whale (*Balaenoptera acutorostrata*) have been occasionally sighted. The latter species is increasing in the areas bordering the NCS.

The map is based on observations made from ships and from the air. The data have been derived from the NIOZ (M.F. Leopold), the Club of Marine Migration Observers (C.J. Camphuysen) and from DGW (H.J.M. Baptist).

Source:
Baptist, H.J.M. (1991). Voorkomen zeezoogdieren op het NCP. V&W/RWS/DGW, GWAO-notitie (unpublished).
Bergman, M.J.N., Lindeboom, H.J., Peet, G., Nelissen, P.H.M., Nijkamp, H., Leopold, M.F. (1991). Beschermde gebieden Noordzee, noodzaak en mogelijkheden. NIOZ/LNV-report 1991-3.
Baptist, H.J.M. (DGW), Camphuijsen, C.J. (Club van Zeetrekwaarnemers), Leopold, M.F. (NIOZ) (1990): unpublished data.

Whales


Legend
Harbour Porpoise
common
less common
rare
observations 1984 - 1990
White-beaked Dolphin
observed
dolphin observations, 1984 - 1990
source: after Baptist, Camphuysen & Leopold, 1990
0
20
40
60 km

Areas of high natural value

Three areas of high natural value can be distinguished on the NCS: the Cleaver Bank, the Frisian Front area and the coastal zone including, especially, the Voordelta. These areas are characterised by a relative wealth of benthic fauna, fish, birds and/or marine mammals.

The Cleaver Bank is the only extensive area on the NCS with gravel. In contrast to the greater part of the sandy portion of the NCS the sediment is relatively stable here, so that a unique benthic fauna has been able to develop. Long-lived shellfish species and polyps occur on the Cleaver Bank. Moreover, the gravelly bottom forms a suitable spawning ground for herring.

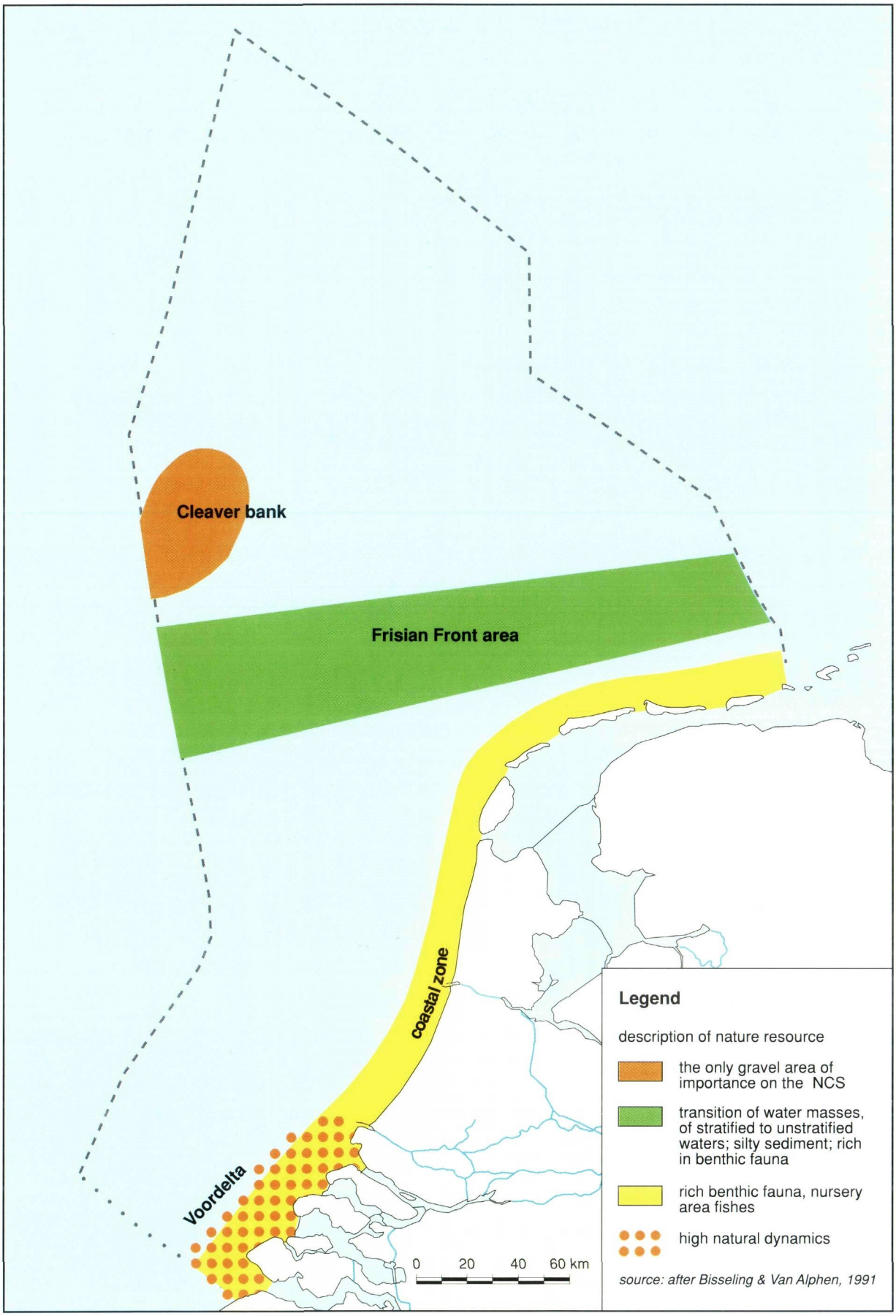
The Frisian Front area marks the transition between the shallow, turbulent and sandy southern half of the NCS and the deeper northern half. The water masses from the south and north of the North Sea meet here [13, 14]. The mud and nutrient content is high, so that the area possesses a great wealth of algae and benthic fauna. Various fish species such as dab and herring, birds (guillemots) and marine mammals (dolphin and porpoise) find an abundance of food there.

The coastal zone is characterised by relatively high nutrient concentrations, brought in by the rivers. As a result, the benthic fauna is rich, and various fish species, including plaice, sole and herring, find it a good area in which to grow up.

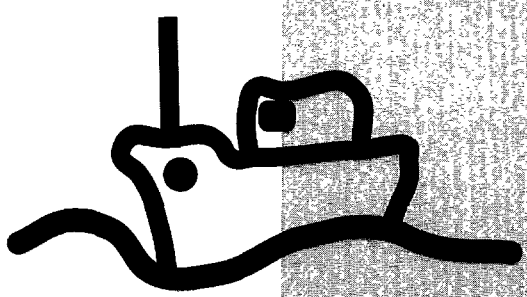
The Voordelta occupies a special place within the coastal zone. After the completion of the Delta works, shallows and emergent sandbanks arose there, creating both an important nursery area for flatfish, and a foraging, transit and overwintering area for various bird species (seaducks, terns). The emergent sandbanks make possible the establishment of a seal population.

Source:
Bergman, M.J.N., Lindeboom, H.J., Peet, G., Nelissen, P.H.M., Nijkamp, H., Leopold, M.F. (1991). Beschermde gebieden Noordzee, noodzaak en mogelijkheden. NIOZ/LNV-report 1991-3.
Bisseling, C. (LNV/NMF), van Alphen, J.S.L.J. (V&W/RWS/DNZ) (1991): oral information.

Areas of high natural value



Use of space



The use of maritime space on the NCS in 1975

The map shows only the uses which occupy space on the sea surface. Pipelines, cables and military aircraft exercise areas are not shown.

The 1975 map shows a relatively comprehensive use of space on the North Sea. Some uses occupy space permanently or for a long period. This applies particularly to the placing of offshore installations. Other uses occupy space in a manner that varies in time and place: shipping, for example.

- Shipping
  Ships do not occupy much space in themselves, but the special "traffic lanes" which have been marked out for shipping do occupy a lot of space. This applies particularly to the traffic separation schemes and deep water routes. These were still modest in extent in 1975. The intensity of shipping traffic was then not as high as now and there was still insufficient knowledge of the traffic flows off the Netherlands coast. Moreover, it did not appear from practice that ships had too little room for manoeuvre. The development of offshore industry on the North Sea changed this situation [55]. The main function of the deep water routes in 1975 was to mark where there was sufficiently deep water for deep-draught ships.

- Dumping
  A striking feature is the reservation of space for discharging industrial waste immediately off the coasts of Zeeland and Holland. There was still little knowledge in 1975 about the environmental effects of that kind of discharging in the coastal zone. Nor was there sufficient understanding of the importance of the coastal zone for the functioning of the North Sea ecosystem.

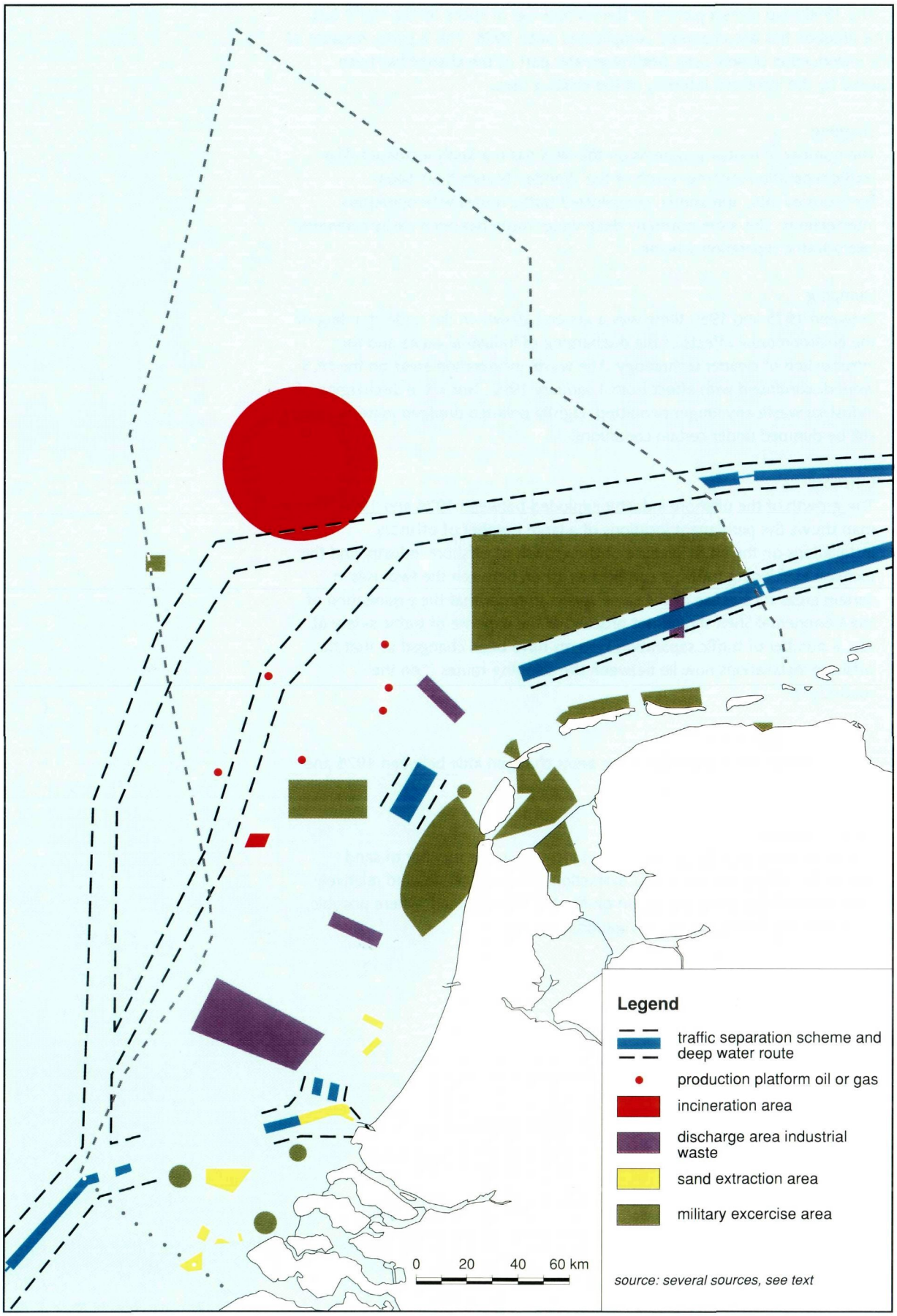
- Offshore
  The 1975 map clearly shows that the exploitation of the oil and gas reserves was still in its infancy. Six offshore installations with their safety zones occupied relatively little permanent space. Moreover, these installations occupied sites where their presence did not yet produce any conflicts with other uses. That this would later change is shown by the 1990 map.

- Military exercise areas
  Two kinds of military exercise areas are distinguished on the map: the exercise areas situated at sea (notably off the Zeeland coast and on the edge of the NCS) and the exercise areas which extend from the land out over the sea (e.g. the areas on the North Sea side of the Wadden Islands and on the coast of Noord-Holland).

- Sand extraction
  The map shows that the sand extraction areas are situated relatively close to the coast. This is an important condition to enable sand to be extracted profitably. Sand extraction on the NCS is combined, where possible, with the maintenance of the navigation channels.

Source:
Hydrographic Office (1975) Bericht aan zeevarenden. Hydrographic Service of the Royal Netherlands Navy, BAZ no 1
Ministry of V&W, RWS, North Sea Directorate (V&W/RWS/DNZ): unpublished data.
see also the sources of map 58, 69, 76.

The use of maritime space on the NCS in 1975



The use of maritime space on the NCS in 1990

The 1990 map gives a picture of the present use of space on the North Sea. The situation has become more complicated since 1975. This is partly because of the introduction of new uses, but the greater part of the change has been caused by the increased intensity of the existing uses.

- Shipping
  The number of routeing systems on the NCS has markedly increased. The traffic separation schemes north of the Wadden Islands have been transformed into, apparently, complicated traffic routes with numerous intersections. The more northerly deep water route has been partly converted into a traffic separation scheme.

- Dumping
  Between 1975 and 1990 there was a general growth in the understanding of the environmental effects of the discharging of industrial waste and the introduction of cleaner technology. The waste incineration areas on the NCS were discontinued with effect from 1 January 1992. Nor is the discharging of industrial waste any longer permitted. Lightly polluted dredged materials may still be dumped under certain conditions.

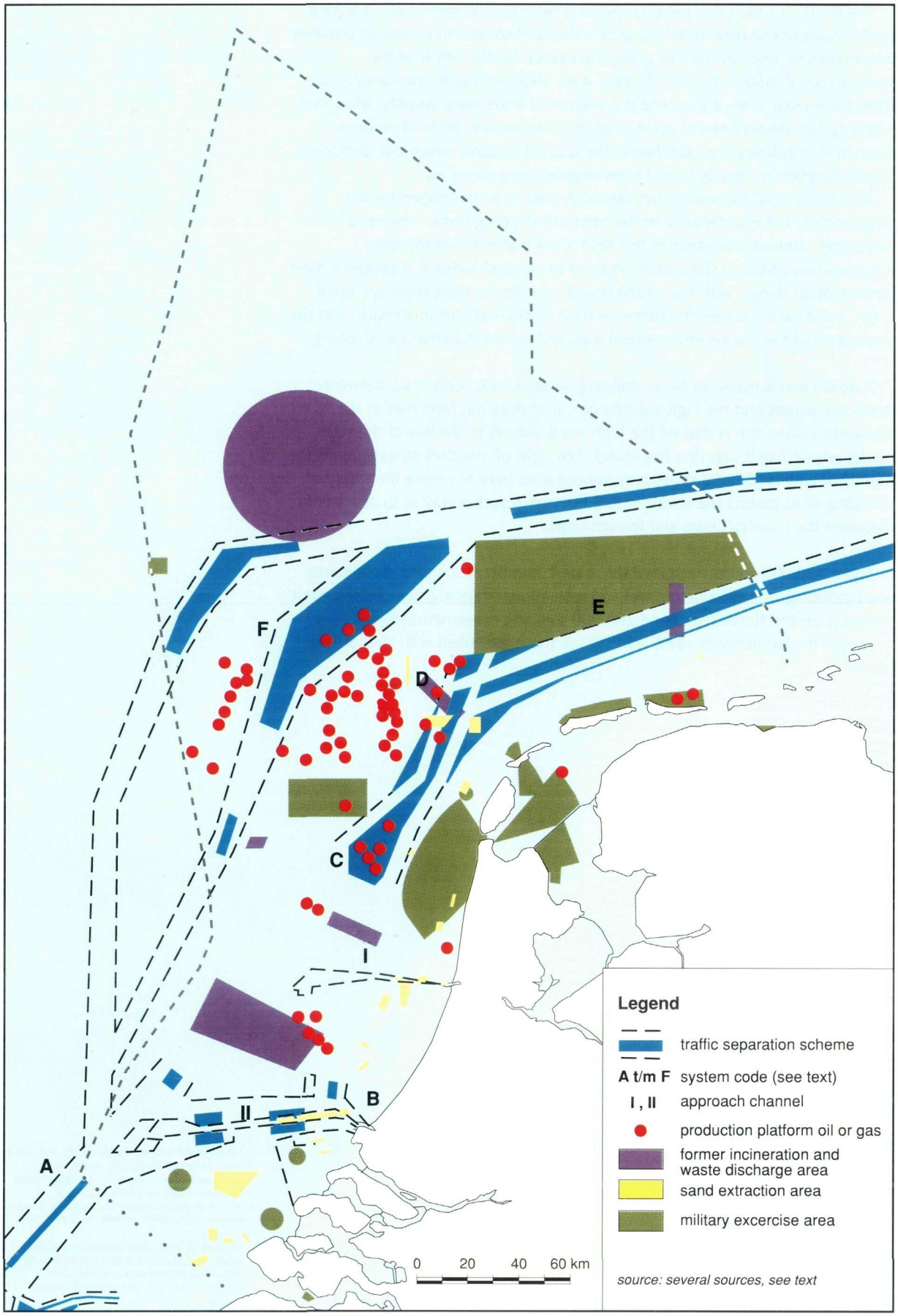
- Offshore
  The growth of the offshore industry exploded between 1975 and 1990. The map shows the permanent locations of a large number of offshore installations on the NCS. Because of the growth of offshore industry and the increase in shipping traffic, a conflict has arisen between the two uses in certain areas for the use of the same space. In order that the exploitation of the Continental Shelf should not proceed at the expense of traffic safety at sea, a number of traffic separation systems have been changed so that the offshore installations now lie between the shipping routes ("on the roadside").

- Military exercise areas
  The locations of the military exercise areas changed little between 1975 and 1990.

- Sand extraction
  The map shows that there has been an increase in the number of sand extraction areas since 1975. The extraction areas are still situated relatively close to the coast. Sand extraction on the NCS is combined, where possible, with the maintenance of the navigation channels.

Source:
see also the sources of map 58, 69, 72, 77, 76.

The use of maritime space on the NCS in 1990



Shipping lanes and traffic intensity

The North Sea has been used by shipping from time immemorial. Changing trade routes linked constantly changing centres of social and economic activities. Merchant shipping has been of great importance for the whole of the Netherlands since the country's Golden Age. Ships constantly increased in size after the industrial revolution and the volume of trade grew steadily. Merchant shipping has always been of great economic importance. 80% of modern Netherlands industry is established in the seaport regions, which also perform a transit function for goods to and from neighbouring countries.

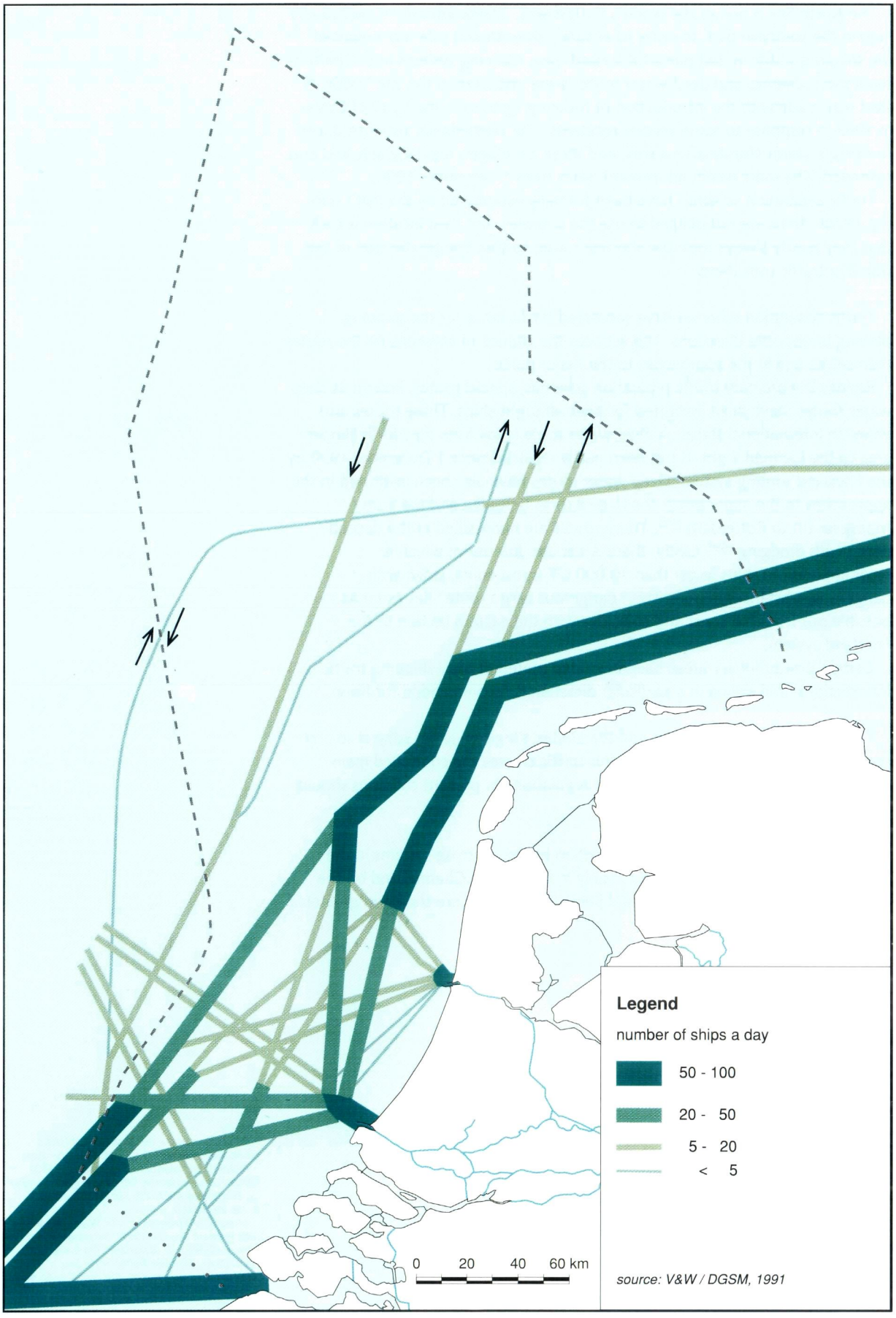
An international framework has obviously had to be developed for the organisation and maintenance of the safety of shipping traffic. The most important international organ in this field is the International Maritime Organisation (IMO), a specialised organ of the United Nations. It concerns itself, among other things, with the establishment of rules for equipment on board ships, routeing measures, the harmonisation of international procedures and the protection of the marine environment against the harmful effects of shipping.

A distinction is made, as far as shipping jurisdiction is concerned, between territorial waters and the high sea (the part that does not form part of the territorial waters (4)). A ship on the high sea is subject to the law of the state under whose flag it sails (the flag state). The right of innocent passage applies in territorial waters. Coastal states may impose rules here to ensure the safety of shipping or to protect the environment, but not in such a way as to discriminate between the country's own and foreign ships.

Some 420,000 course-restricted (or route-committed) shipping movements (not including fishing vessels, naval and recreational shipping) may be recorded annually on the North Sea. Some 260,000 shipping movements (60%), take place off the Netherlands coast. 154,000 of these are linked with Netherlands ports.

Source:
Ministry of Transport, Public Works and Water Management (V&W) (1987). Beleidsnota Scheepvaartverkeer Noordzee" Op koers" (free translation: Maritime Traffic North Sea: Netherlands policy report "On course"). Second Chamber, 1986-1987, 17 408, no. 25-26. SDU, The Hague.
Ministry of V&W, Directorate-General for Shipping and Maritime Affairs (V&W/DGSM) (1991): unpublished data over 1981-1987, collected according to the VONOVI-method (publication expected in spring 1992).

Shipping lanes and traffic intensity



Traffic separation schemes and deep water routes in the North Sea

The North Sea is one of the world's busiest seas. Traffic intensity is particularly high in the southern part. In order to ensure a smooth and safe movement of the shipping traffic in that part of the North Sea, routeing systems in the form of separation schemes and deep water routes were instituted in the late 1960s. A start was made with the introduction of routeing systems in the Strait of Dover in 1967 in response to some serious accidents. The Netherlands also introduced routeing systems shortly afterwards, and these have been regularly adjusted and extended. The most recent adjustment dates from 1 December 1990.

Traffic separation schemes have been formally established by the IMO since the 1970s. Ships are not obliged to use the schemes, but their location is such that they nearly always form the shortest route, so that the greater part of the shipping traffic uses them.

Traffic separation schemes have separated traffic lanes for the shipping moving in opposite directions. This reduces the chance of collisions on the routes themselves and in the approaches to the major ports.

Besides the ordinary traffic separation schemes, special routes, known as deep water routes, have been instituted for deep-draught ships. These routes also enjoy an international status. A deep water route leads from the North Hinder area to the German Bight. It has been partly replaced since 1 December 1990 by the Friesland routing system. Deep water routes have also been instituted in the approaches to the major ports: the IJ-geul (I) to IJmuiden and the Euro-Maasgeul (II) to Rotterdam (58). These routes are maintained at the desired depth with dredging (59). Lastly, there is a route, the use of which is recommended to ships larger than 10,000 GT (gross tons), laden with dangerous substances in bulk. This "dangerous cargo route" lies as far as possible out from the coast and coincides with the eastern section of the Friesland system.

Certain precautionary areas have been designated at busy shipping traffic intersections, and sailing in a particular direction is recommended for these.

Traffic between the continent and the United Kingdom is not subject to any specific routeing regulations. Where this traffic crosses the controlled main traffic flow, it is very important that the regulations to prevent collisions should be strictly observed.

The map gives an overview of the location of the routeing systems in the North Sea. These are concentrated mainly in the English Channel and on the Netherlands sector of the Continental Shelf. The systems are shown in greater detail on the next map.

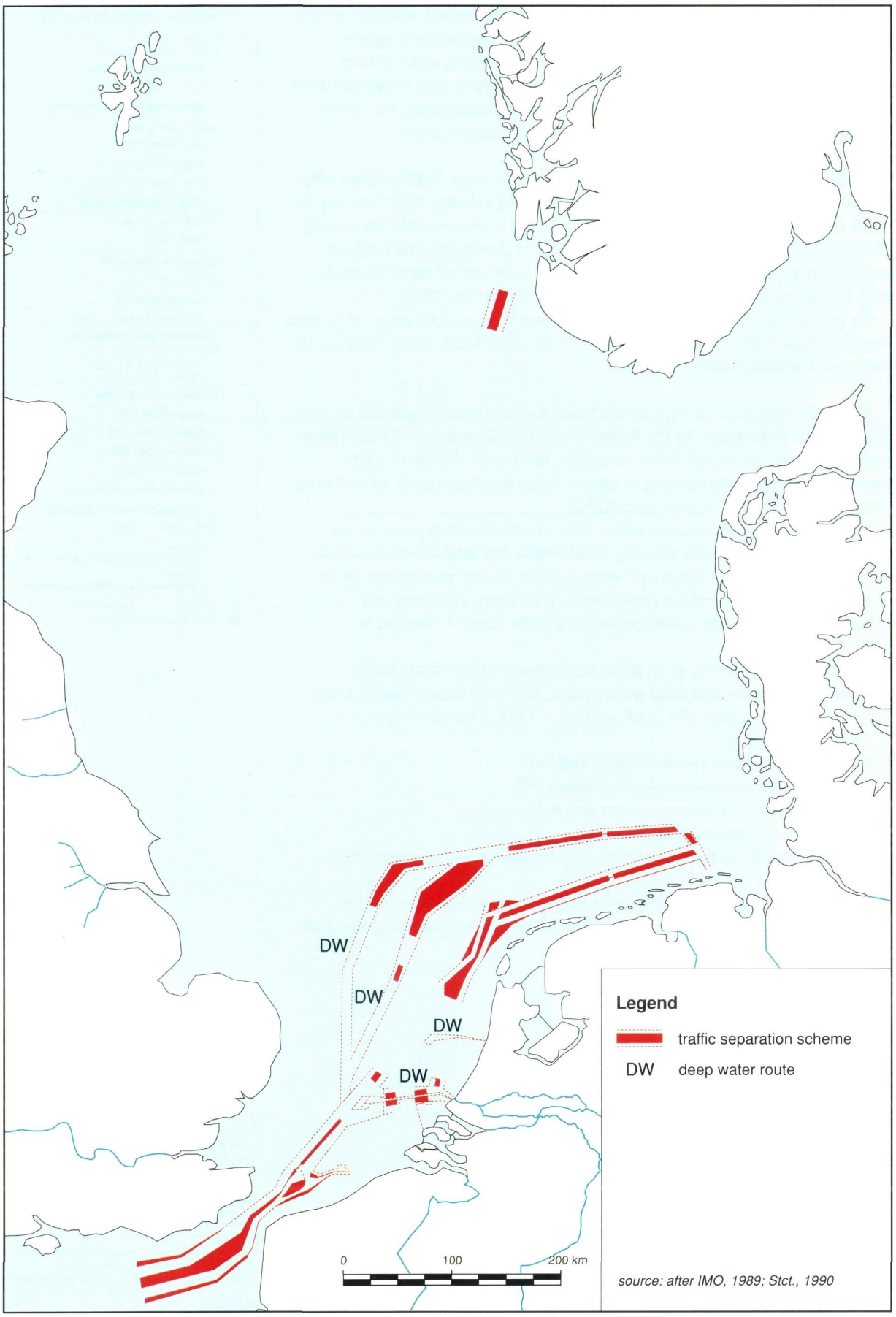
Source:

Publication of the establishment of traffic separation schemes, 1990, Stct. 1990, no. 233.

International Maritime Organization (IMO) (1989). Ships' routeing. 5th edition IMO, London (as adapted by the North Sea Directorate of Rijkswaterstaat).

Ministry of Transport, Public Works and Water Management (V&W) (1987). Beleidsnota Scheepvaartverkeer Noordzee" Op koers" (free translation: Maritime Traffic North Sea: Netherlands policy report "On course"). Second Chamber, 1986-1987, 17 408, no. 25-26. SDU, The Hague.

Traffic separation schemes and deep water routes in the North Sea



Traffic separation schemes and deep water routes on the NCS

Traffic separation schemes and other routeing measures are necessary on the North Sea not only to ensure the safety of shipping, but also to integrate shipping traffic with other uses. The integration of shipping with offshore minerals extraction is mainly regulated in the Mining Act which designates areas where no minerals extraction may take place (closed areas) and areas where conditions can be placed on minerals extraction (restriction areas).

A medium-term arrangement has been established since 1985 in zones where spatial use gives rise to conflicts between competing interests. Changes may be made to the shipping routes every 5 years to assist minerals extraction. During the intervening years the shipping routes are kept clear of mineral extraction activities involving fixed installations. The most recent adjustment was made with the institution of the Friesland system on 1 December 1990.

No formal shipping routes with IMO status are in zones established as defence exercise areas. Fishing and recreational craft are regarded as traffic components and must therefore observe the rules.

The traffic behaviour of ships on the North Sea is primarily regulated by the International Regulations for the Prevention of Collisions at Sea (1972). These regulations concern priority rules, navigation behaviour, the use of traffic separation schemes, the carrying of signals, lights and day-signals, as well as all other matters relating to good seamanship.

As part of its obligations as a coastal state, the Netherlands provides the following services to enable shipping to sail within the established standards:

- the issuing of nautical charts and various other nautical publications by the Hydrographic Service of the Netherlands Royal Navy. Additions and corrections to these are issued periodically in the form of "Notices to Mariners";
- the marking of channels as an aid to navigation and to indicate traffic separation schemes and deep water routes. The IMO recommended a new system of sea buoyage (the IALA system) in 1981; it consists in part of lightships and buoys;
- the use of orientation systems (Decca system);
- the issuing of hydro-meteorological reports [10];
- guiding shipping (by means of radar and radio links);
- the pilotage of seagoing-ships.

The Coastguard has the task of ensuring compliance with the regulations.

The map shows the routeing systems on the Netherlands sector of the Continental Shelf in detail. The explanation of the codes is illustrated alongside.

Explanation codes on map 58

A	North Hinder routeing system - North Hinder South TSS * - North Hinder North TSS - North Hinder Precautionary Area
B	Maas Routeing system - Maas North TSS - Maas West Inner TSS - Maas West Outer TSS - Maas Precautionary Area
C	Texel Routeing system - Texel TSS
D	Vlieland Routeing system - Vlieland TSS - Vlieland North TSS - Vlieland Precautionary Area
E	Terschelling and in the German Bight Routeing system - Terschelling and in the German Bight TSS
F	Friesland Routeing system - Brown Ridge TSS - Friesland West TSS - Friesland East TSS - Botney Ground TSS - Friesland Precautionary Area - Four deepwater routes (in)between North Hinder and above routeing measures
I	- IJ - geul deepwater route leading to IJmuiden
II	- Eurogeul deepwater route leading to Europoort

* TSS (Traffic Separation Scheme)

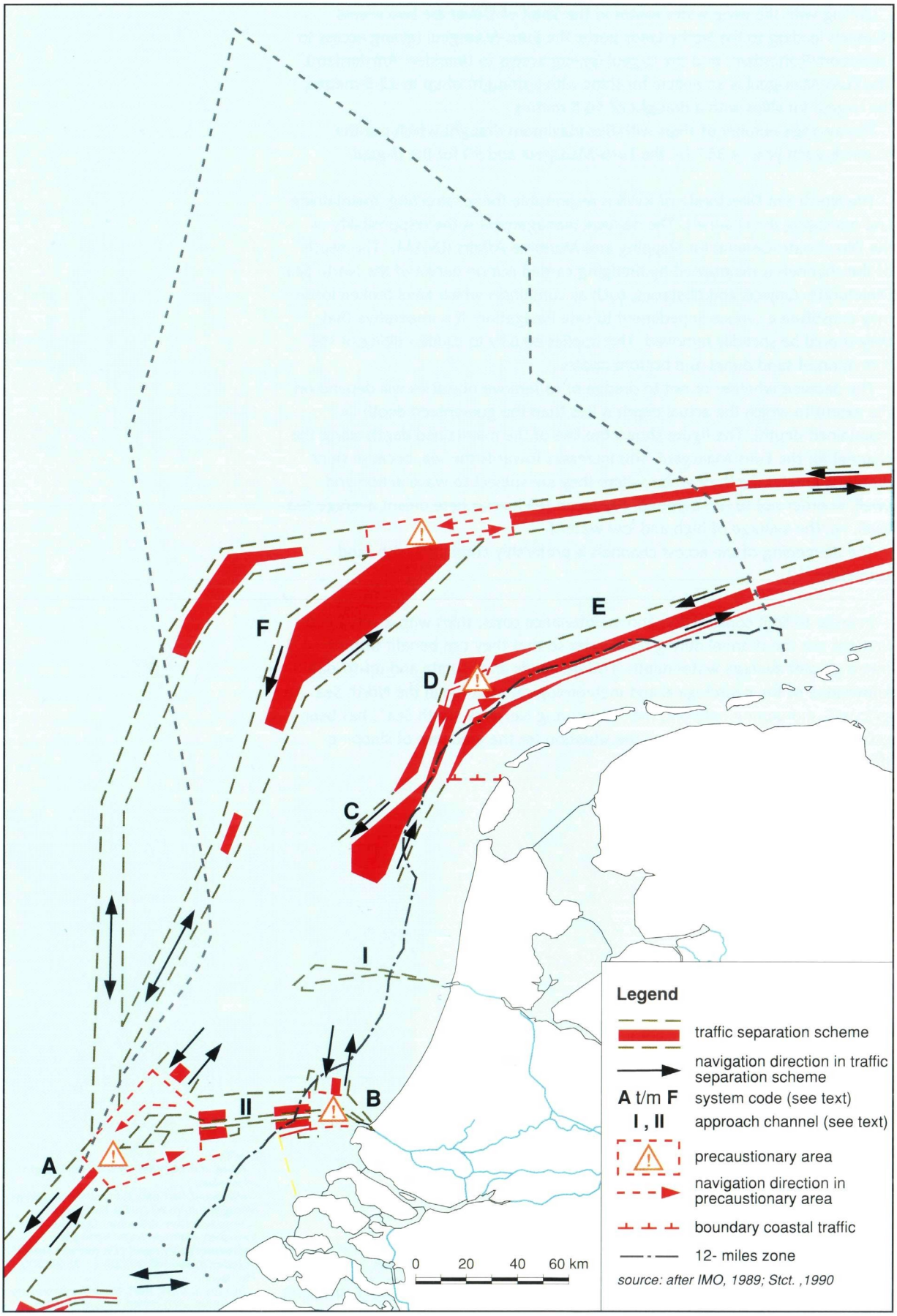
Source:

Publication of the establishment of traffic separation schemes, 1990, Stct. 1990, no. 233

International Maritime Organization (IMO) (1989). Ships' routeing. 5th edition IMO, London (as adapted by the North Sea Directorate of Rijkswaterstaat).

Ministry of Transport, Public Works and Water Management (V&W) (1987). Beleidsnota Scheepvaartverkeer Noordzee" Op koers" (free translation: Maritime Traffic North Sea: Netherlands policy report "On course"). Second Chamber, 1986-1987, 17 408, no. 25-26. SDU, The Hague.

Traffic separation schemes and deep water routes on the NCS



Harbour approach routes and navigation channels

Linking with the deep water routes in the Strait of Dover are two access channels leading to the Netherlands ports: the Euro-Maasgeul (giving access to Europoort/Rotterdam) and the IJ-geul (giving access to IJmuiden/Amsterdam). The Euro-Maasgeul is accessible for ships with a draught of up to 22.5 metres, the IJ-geul for ships with a draught of 16.5 metres.

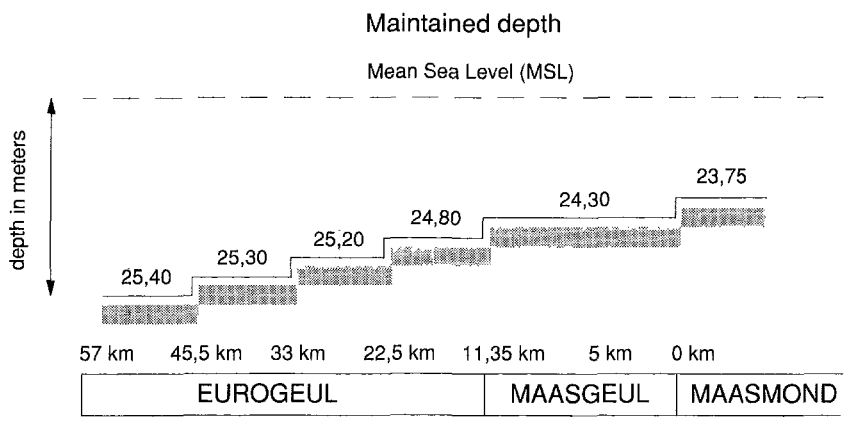
The average number of ships with this maximum draught which use the channels each year, is 357 for the Euro-Maasgeul and 90 for the IJ-geul.

The North Sea Directorate of RWS is responsible for constructing, maintaining and managing the channels. The nautical management is the responsibility of the Directorate-General for Shipping and Maritime Affairs (DGSM). The depth of the channels is maintained by dredging carried out on behalf of the North Sea Directorate. Objects and obstacles, such as containers which have broken loose, may constitute a serious impediment to safe navigation. It is imperative that they should be speedily removed. This applies equally to sudden silting or the formation of sand dunes and bottom ripples.

The decision whether or not to dredge or to remove obstacles will depend on the extent to which the actual depth is less than the guaranteed depth (= maintained depth). The figure shows the line of the maintained depth along the channel for the Euro-Maasgeul. This increases towards the sea, because ships require a greater depth of water where they are subject to wave action and swell, in order not to run aground. (By mean sea level is here meant average sea level, i.e. the average of high and low water.)

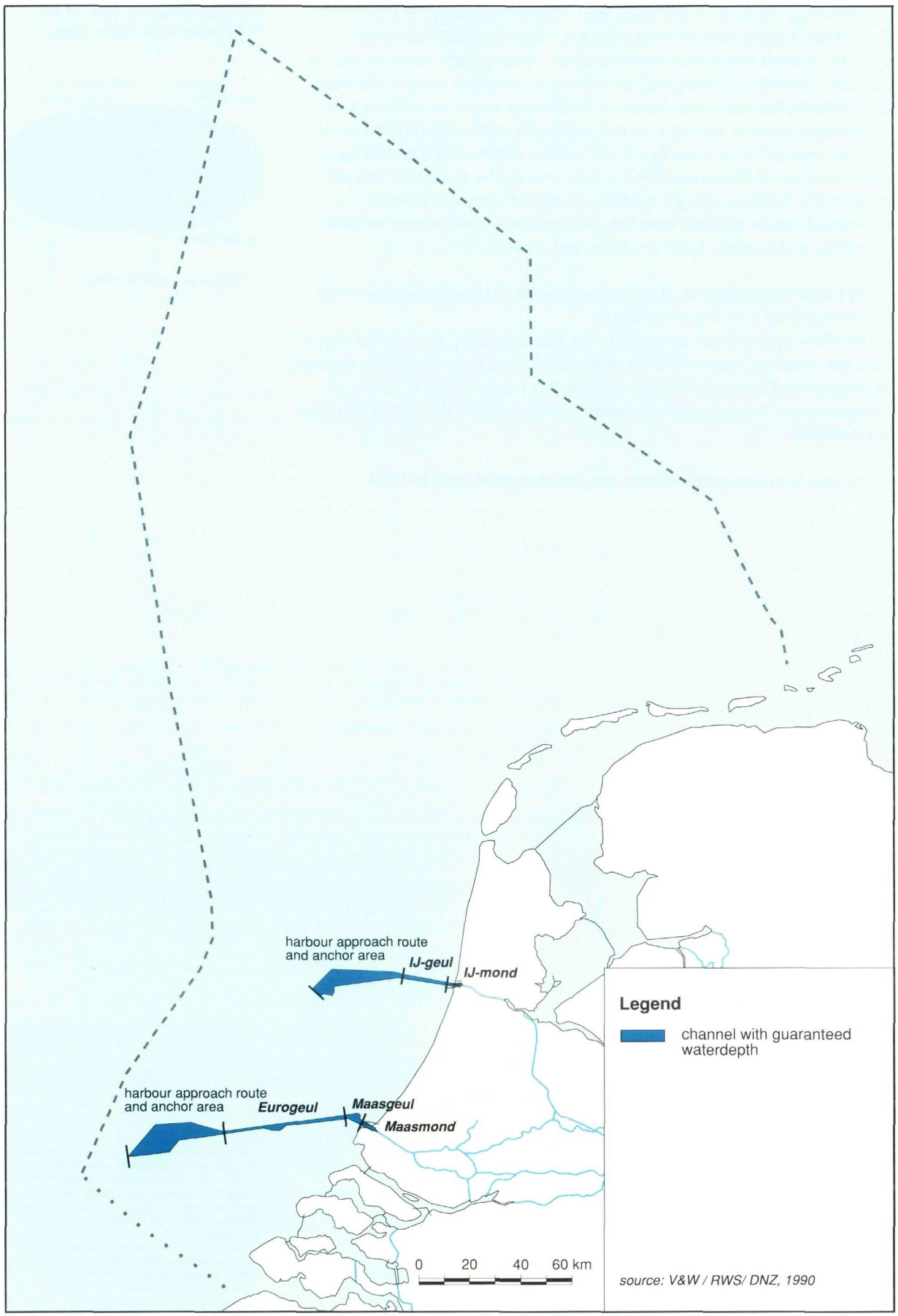
The deepening of the access channels is preferably combined with sand extraction (72).

In order to limit construction and maintenance costs, ships with a very deep draught use the channel during high water so that they can benefit from the 1.5 metre greater average water depth. This demands an accurate and up-to-date knowledge of the hydrological and meteorological situation in the North Sea. An extensive monitoring network, the "Measuring Network North Sea", has been established to provide reports on the situation for the guidance of shipping (hydro-meteorological reports) (10).



Source:
Pollen, R.A.W. (V&W/DGSM) (1991): oral information.
Ministry of Transport, Public Works and Water Management (V&W) (1987). Beleidsnota Scheepvaartverkeer Noordzee" Op koers" (free translation: Maritime Traffic North Sea: Netherlands policy report "On course"). Second Chamber, 1986-1987, 17 408, no. 25-26. SDU, The Hague.
Ministry of V&W, RWS, North Sea Directorate (V&W/RWS/DNZ) (1990). unpublished data.

Harbour approach routes and navigation channels



Traffic density: total shipping

Commercial shipping on the North Sea has been studied by the Directorate-General for Shipping and Maritime Affairs (DGSM) since 1975 using the VONOVI method (North Sea Traffic Research Visual Identification). As part of the study a database is being built up of observations from aircraft. The North Sea off the Netherlands coast has been divided into a number of flying zones.

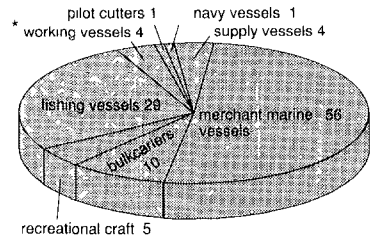
The name, position, course, type and nationality of the ships present in the zone are recorded from a low height. All further information is looked up in Lloyd's Register of Shipping under the ship's name. The assembled data are stored in the database. Using a specially developed computer program, information can be obtained from the database about such matters as route intensities, route widths, route structures and densities (56).

The traffic composition of all the shipping on the Netherlands sector of the Continental Shelf is shown in the figure.

The following trends are occurring in the shipping traffic: the total number of ships has remained more or less the same. Small ships have been partly replaced by larger ones. Conventional cargo shipping has been reduced in favour of container ships. The ferry traffic between Scandinavia and the United Kingdom has increased.

The map has been compiled from data for the period 1982 to 1987.

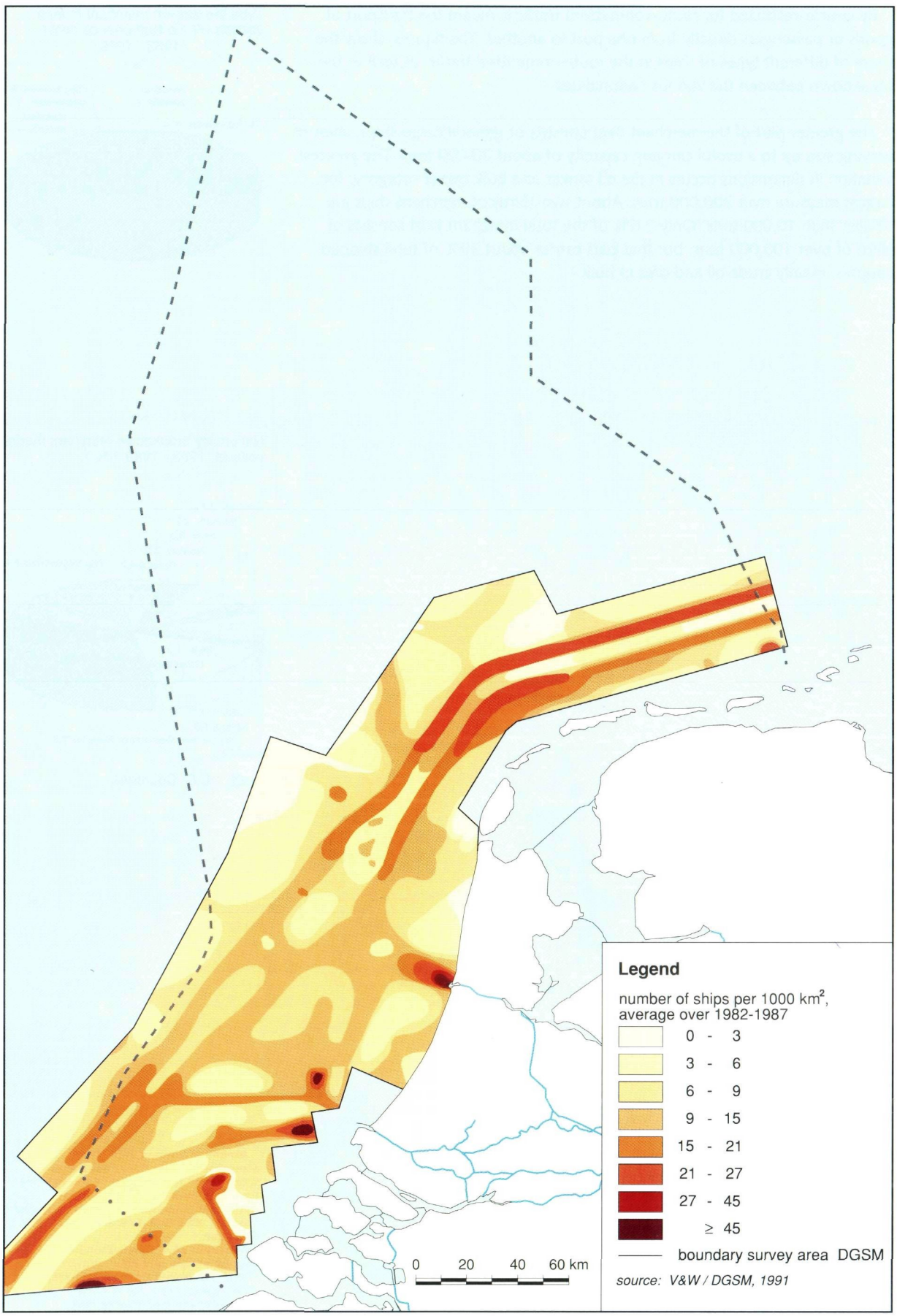
Traffic breakdown all ships off the Netherlands coast, 1983 - 1986
(%)



* tugs , barges , cranevessels etc

Source:
Ministry of Transport, Public Works and Water Management (V&W) (1987). Beleidsnota Scheepvaartverkeer Noordzee" Op koers" (free translation: Maritime Traffic North Sea: Netherlands policy report "On course") Second Chamber, 1986-1987, 17 408, no. 25-26. SDU, The Hague
Ministry of V&W, Directorate-General for Shipping and Maritime Affairs (V&W/DGSM) (1991): unpublished data over 1981-1987, collected according to the VONOVI-method (publication expected in spring 1992).

Traffic density: total shipping

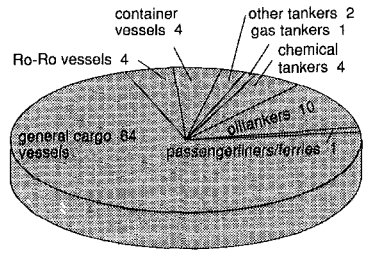


Traffic density: course-restricted traffic

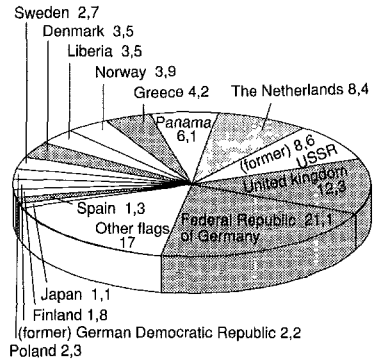
By course-restricted (or route-committed) traffic is meant the transport of goods or passengers directly from one port to another. The figures show the share of different types of ships in the route-committed traffic, as well as the breakdown between the various nationalities.

The greater part of the merchant fleet consists of general cargo ships; ships of varying size up to a useful carrying capacity of about 20,000 tons. The greatest variation in dimensions occurs in the oil tanker and bulk carrier category; the largest measure over 300,000 tons. About two-thirds of merchant ships are smaller than 10,000 tons. Only 2.6% of the total merchant fleet consists of ships of over 100,000 tons, but that part carries about 30% of total shipped cargoes, mainly crude oil and ores in bulk.

Type breakdown merchant marine vessels off the Netherlands coast, 1983 - 1986 (%)



Nationality breakdown merchant marine vessels, 1983 - 1989 (%)



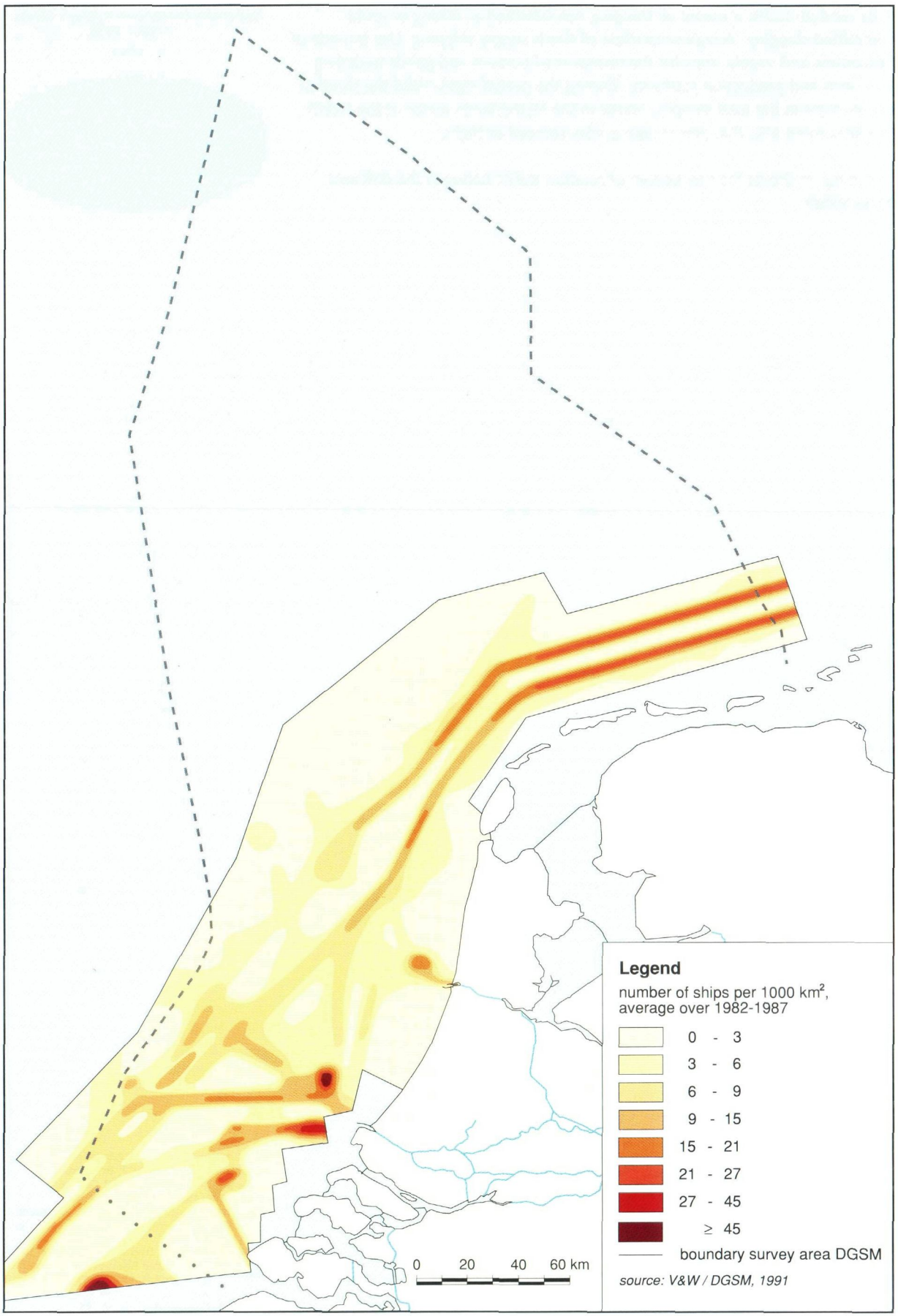
E.C. Countries

Source:

Ministry of Transport, Public Works and Water Management (V&W) (1987). Beleidsnota Scheepvaartverkeer Noordzee" Op koers" (free translation: Maritime Traffic North Sea: Netherlands policy report "On course"). Second Chamber, 1986-1987, 17 408, no. 25-26. SDU, The Hague.

Ministry of V&W, Directorate-General for Shipping and Maritime Affairs (V&W/DGSM) (1991): unpublished data over 1981-1987, collected according to the VONOVI-method (publication expected in spring 1992).

Traffic density: course-restricted traffic

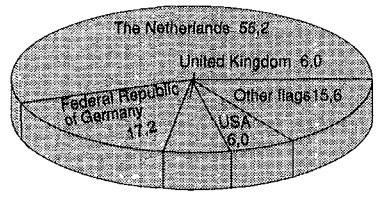


Traffic density: random traffic

By random traffic is meant all shipping not classified as fishing or route-committed shipping. A high proportion of this is supply shipping. Use is made of helicopters and supply ships for the transport of persons and goods to drilling platforms and production platforms. During the period 1983-1986 the share of supply ships in the total shipping traffic in the Netherlands sector of the North Sea amounted 4%; that percentage is now somewhat higher.

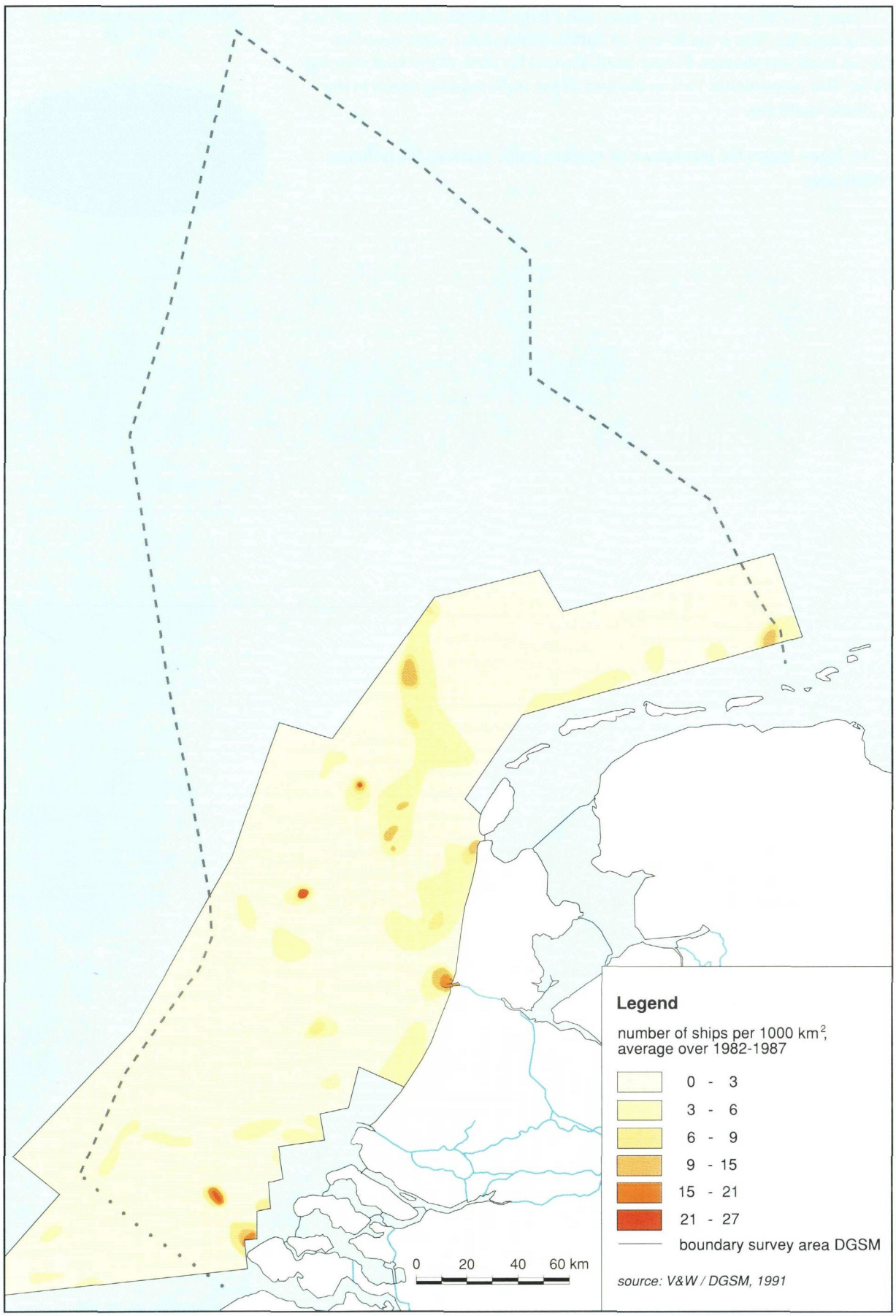
The figure shows the breakdown of random traffic between the different nationalities.

Nationality breakdown supply vessels, 1983 - 1986
(%)



Source:
Ministry of Transport, Public Works and Water Management (V&W) (1987). Beleidsnota Scheepvaartverkeer Noordzee" Op koers" (free translation: Maritime Traffic North Sea: Netherlands policy report "On course"). Second Chamber, 1986-1987, 17 408, no. 25-26. SDU, The Hague.
Ministry of V&W, Directorate-General for Shipping and Maritime Affairs (V&W/DGSM) (1991): unpublished data over 1981-1987, collected according to the VONOVI-method (publication expected in spring 1992).

Traffic density: random traffic

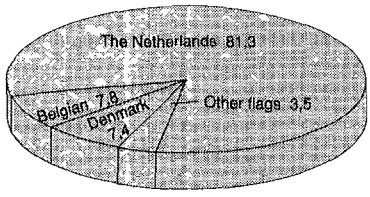


Traffic density: fishing traffic

Shipping routes are situated in areas with a large amount of mainly small sea fishing activities. This is the fishing for flatfish (plaice, sole), some roundfish species (cod) and shrimps. Fishing boats account for 29% of the total shipping traffic. This proportion is 15% in the area of the main shipping routes in the southern North Sea.

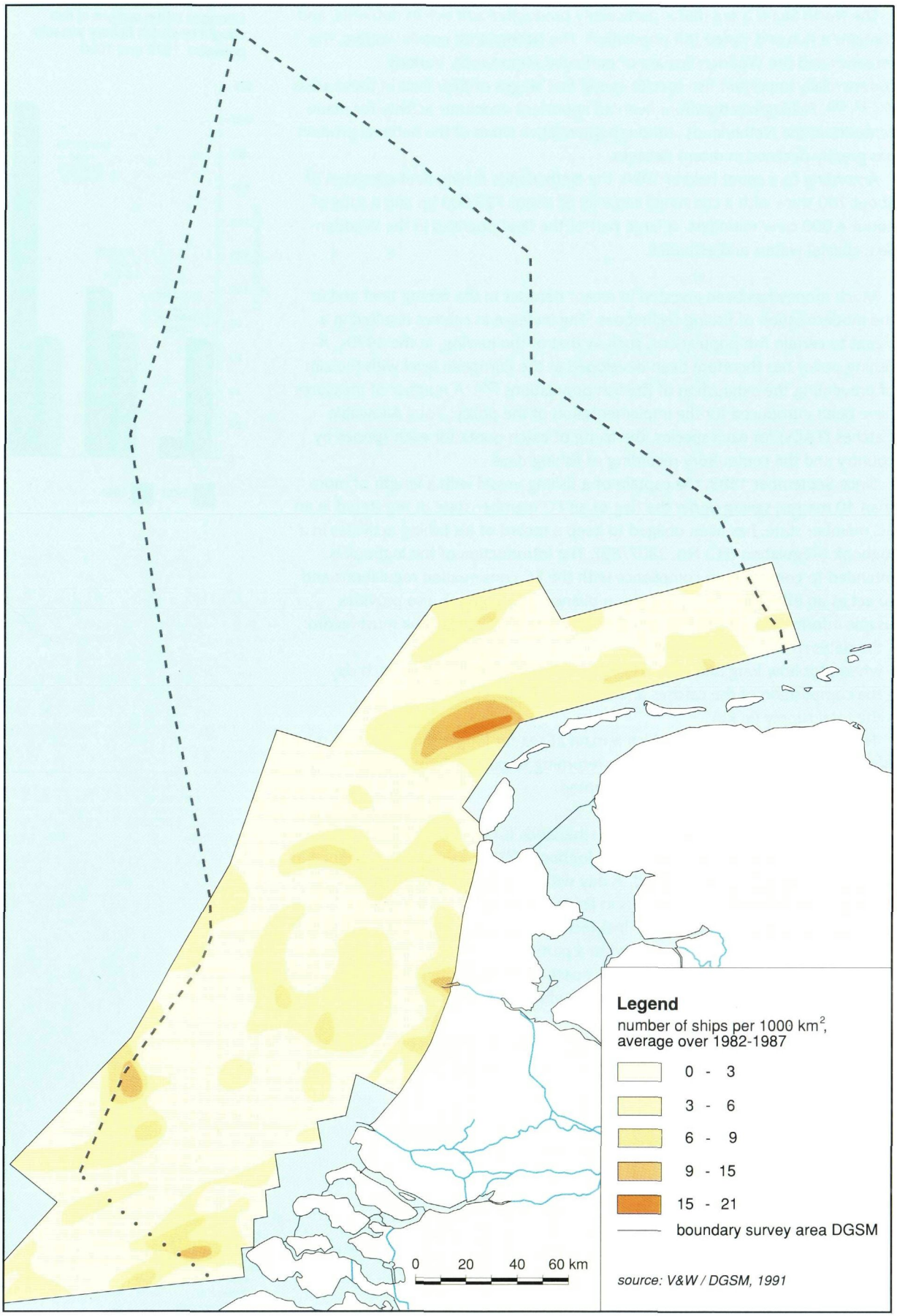
The figure shows the breakdown of random traffic between the different nationalities.

Nationality breakdown fishery, 1983 - 1986
(%)



Source:
Ministry of Transport, Public Works and Water Management (V&W) (1987).Beleidsnota Scheepvaartverkeer Noordzee" Op koers" (free translation: Maritime Traffic North Sea: Netherlands policy report "On course"). Second Chamber, 1986-1987, 17 408, no. 25-26. SDU, The Hague.
Ministry of V&W, Directorate-General for Shipping and Maritime Affairs (V&W/DGSM) (1991). unpublished data over 1981-1987, collected according to the VONOVI-method (publication expected in spring 1992)

Traffic density: fishing traffic



Total number of Netherlands fishing days in 1990

The North Sea is a sea that is particularly productive and rich in nutrients, and contains a rich and varied fish population. The Netherlands coastal waters, the estuaries and the Wadden Sea are of particular importance. Various commercially important fish species spend first stages of their lives in these areas [46, 47, 48]. Fishing has therefore been an important economic activity for many centuries in the Netherlands, although the relative share of the national product has greatly declined in recent decades.

According to a count held in 1990, the Netherlands fishing fleet consisted of about 700 ships with a combined capacity of about 720,000 hp and a total of about 4,000 crew members. A large part of the fleet operates in the Wadden Sea, coastal waters and estuaries.

Much money has been invested in recent decades in the fishing fleet and in the modernisation of fishing techniques. The increase in catches resulted in a threat to certain fish populations, such as that of the herring, in the 1970s. A fishing policy has therefore been developed at the European level with the aim of preventing the exhaustion of the fish populations [95]. A number of measures have been introduced for the implementation of the policy: Total Allowable Catches (TACs) for each species, the fixing of catch quota for each species by country and the compulsory recording of fishing days.

Since September 1983, the captain of a fishing vessel with a length of more than 10 metres, sailing under the flag of an EC member state or registered in an EC member state, has been obliged to keep a record of his fishing activities in a logbook (Regulation (EC) No. 2807/83). The introduction of the logbook is intended to contribute to compliance with the EC conservation regulations and to act as an effective check on this compliance. The logbook also provides usable information for the fish population estimates. The logbook must record:
- the dates of departure and return
- where, for how long and with what gear fishing has taken place each day
- the composition of the catches and the returned by-catch
- the total supply (in kg).

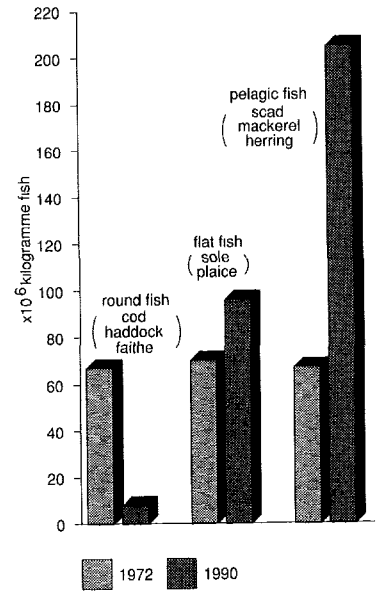
Netherlands fishing vessels which remain at sea for longer than 24 hours must hand in their completed logbook after returning to port. Fishing vessels which return to port within 24 hours are exempted.

The number of fishing days for the Netherlands fishing fleet for each ICES quadrant has been derived from the EC logbooks [95]. A fishing day is defined as a day on which a catch is recorded. A day without a catch is therefore not recorded, but the latter rarely occurs in fishing practice.

In 1990 the Netherlands fishing fleet recorded a total of 68,689 fishing days, 6,596 of which could not be assigned to a particular ICES bloc. The map shows that the sea area along the Netherlands coast is the most intensively fished. The fishing is done mainly with "Euro cutters", which have an engine capacity of up to 300 hp.

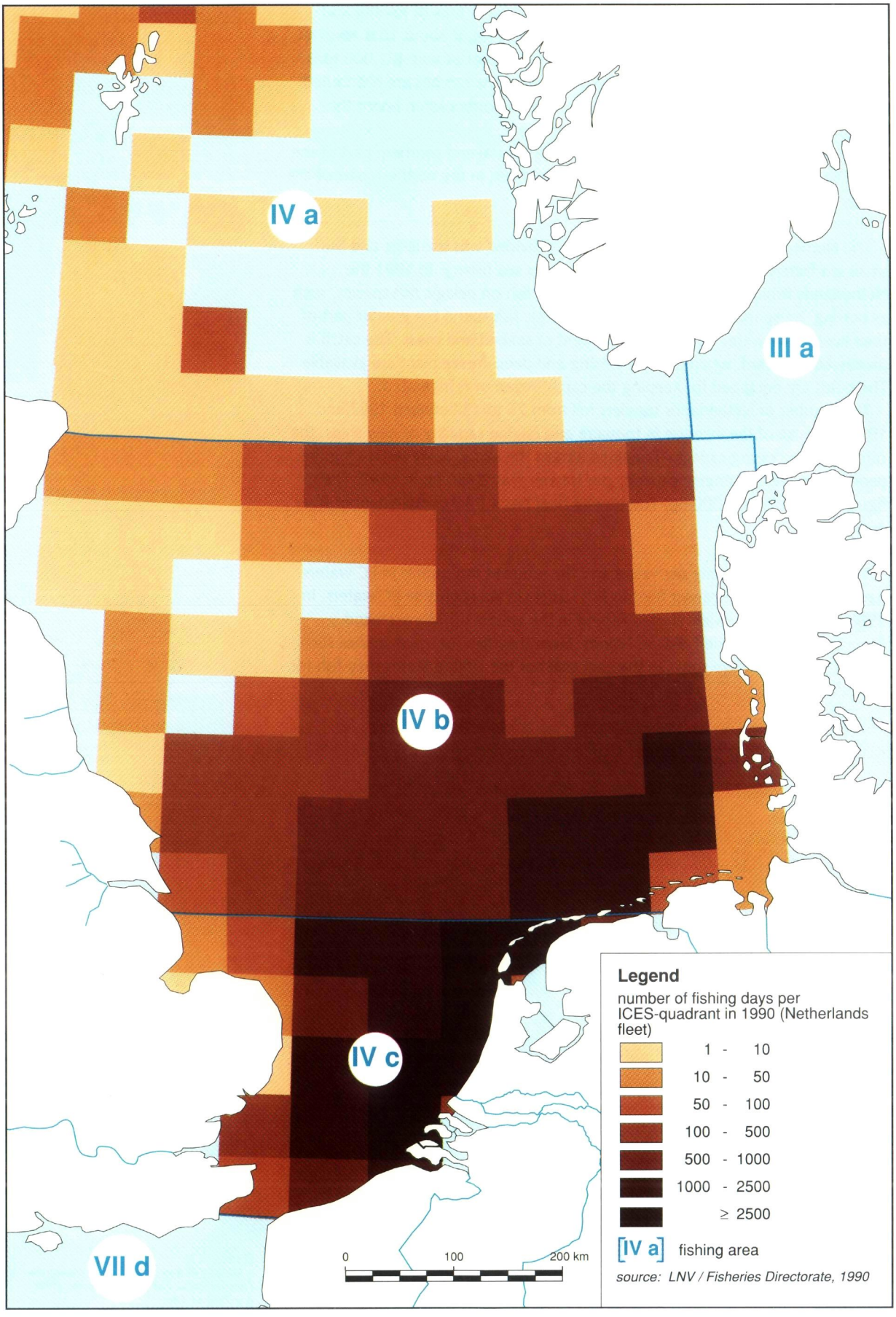
As a result of the changes in fish populations, the techniques employed, and the policy pursued, the pattern of catches changed radically between 1972 and 1990; see the accompanying figure.

Changes in the pattern of fish caught by Dutch fishery vessels between 1972 and 1990



Source:
FAO, Yearbook of fishery statistics, vol. 44 en 64.
Ministry of Agriculture, Nature Management and Fisheries (LNV), Fisheries Directorate, (1990): unpublished data.

Total number of Netherlands fishing days in 1990



Netherlands herring catch in 1990

The Netherlands fishing fleet caught a total of 74,811 tons of herring and brisling in 1990 in the area shown. This was an increase of about 10% relative to 1988. The relevant portion of the TACs for these species was 472,000 tons for all EC countries combined. The map shows how the catches are distributed over the ICES quadrants. The data are based on the logbooks on board the Netherlands ships.

The catches show an arbitrary pattern. In the central and southern part of the North Sea they were made mainly by the cutter fleet; in the northern part of the sea by the trawler fleet.

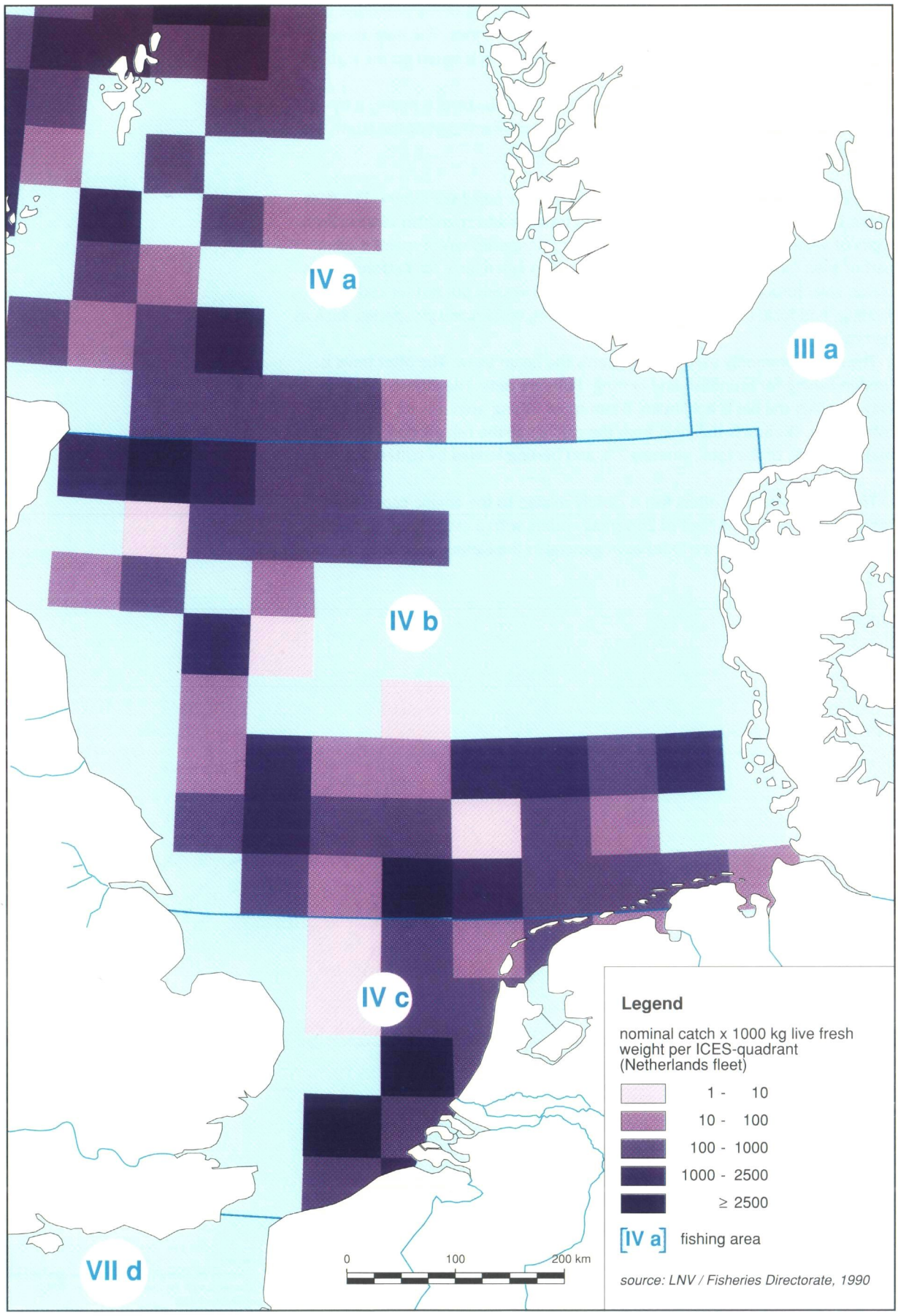
The Netherlands fishing fleet is traditionally divided into the large and the small sea fishery. Trawlers form part of the large sea fishery. In 1991 the Netherlands fishing fleet had 13 trawlers. They fish on pelagic fish species, such as herring, horse mackerel and mackerel. Pelagic fish spend the greater part of their lives in the water column, independent of seabed and coast. The catch is processed on board, where fish processing and deep-freeze plant are available. The holds are equipped for keeping the catch frozen or refrigerated.

The number of Netherlands trawlers fell from 26 to 13 between 1982 and 1991. Because of the increase in tonnage and engine capacity of new ships, the catch and processing capacity remained almost the same, however, during the period. The average engine capacity per trawler was 2,450 hp in 1982. The figure now is about 6,000 hp. The trawler fleet has a total complement of over 400 persons.

The increase in capacity per vessel and the reduced fish quotas in EC waters have encouraged the trawler fleet to fish largely in areas outside EC waters. In 1988 Netherlands trawlers started fishing in the waters off Morocco and Mauritania and near the Falkland Islands. Here they fish for squid species such as *Illex spp.* and *Loligo spp.* On the east coast of the United States they fish for mackerel.

Source:
Ministry of Agriculture, Nature Management and Fisheries (LNV), Fisheries Directorate, (1990): unpublished data.

Netherlands herring catch in 1990



Netherlands mackerel catch in 1990

In 1990 the Netherlands fishing fleet caught 1118 tons of the permitted quota of 1650 tons of mackerel. In 1988 the catch was 2265 tons. The map shows the distribution of the catches over the ICES quadrants and is based on the logbook returns of the Netherlands ships.

In the central and southern part of the North Sea mackerel is mainly a by-catch of the cutter fleet (about 450 tons). In the northern part of the North Sea the trawlers fish specifically for mackerel (670 tons).

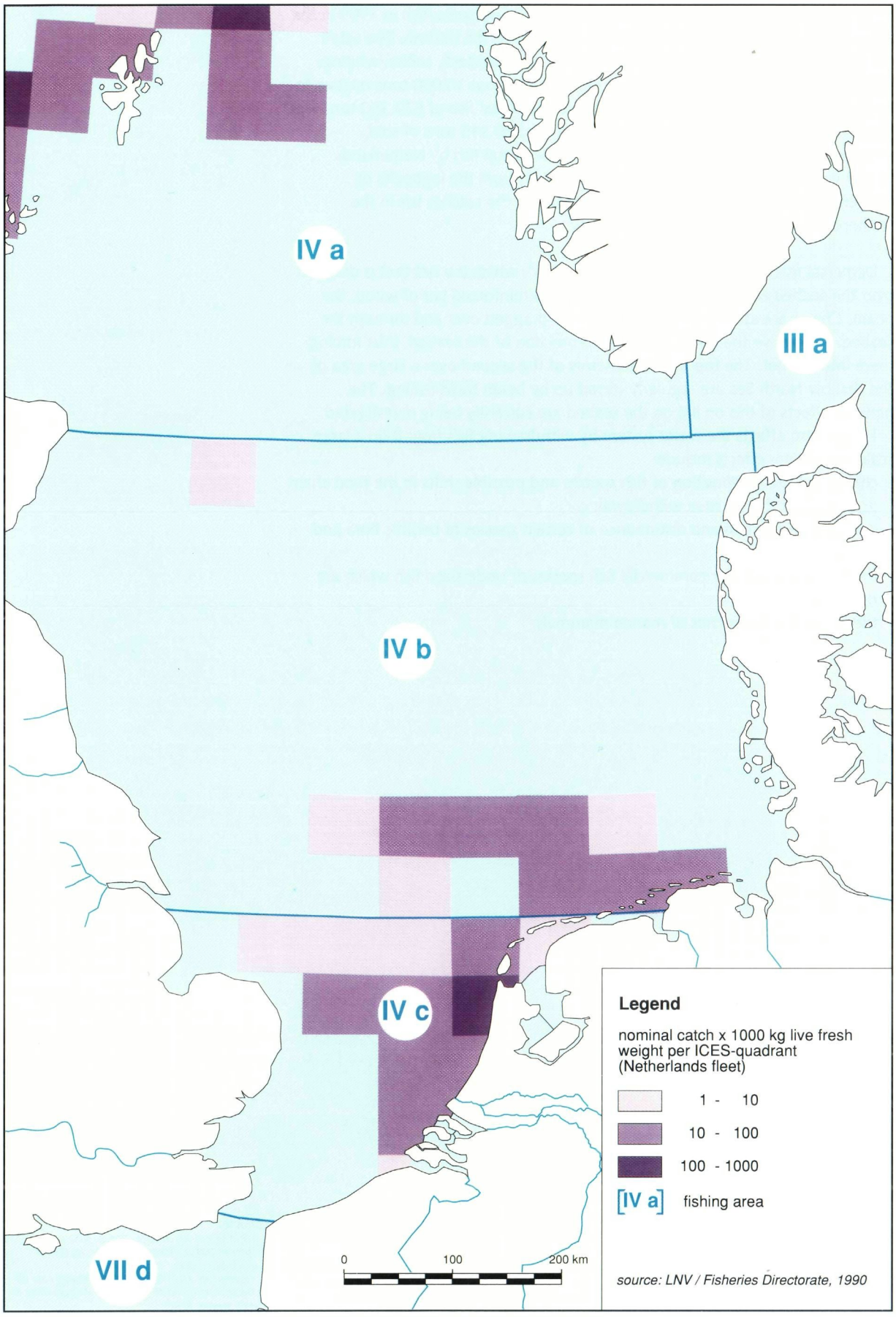
Besides the large (trawler) fishing there is also the small sea fishery. The fleet of the small sea fishery can be divided into trawlers and roundfish vessels. Both types of vessel fish for demersal fish species, i.e.: species which spend a great part of their (adult) lives on the seabed. Trawlers fish mainly for flatfish such as plaice, sole, turbot, flounder and brill. Roundfish vessels put out for cod, whiting, haddock, latchet and, to a lesser extent, certain pelagic species, such as herring.

The most commonly used fishing gear is the beam trawl. The otter trawl is used in fishing for roundfish and herring. Both are nets. The difference lies in the way in which the net is held open. Beam trawl fishing accounts for 79% of the total return. (Return is the yield from the catches at the fish auction.) Roundfish make up 12% of the total, shrimps 7% and herring landed by cutters 2%.

The area where the cutters fish is closely related to the engine capacity and tonnage of the ships. A fleet of 256 small cutters with a capacity of up to 300 hp (known as "Euro cutters") fishes in general in the Netherlands fisheries zone (12-mile zone).

Source:
Ministry of Agriculture, Nature Management and Fisheries (LNV), Fisheries Directorate, (1990): unpublished data.

Netherlands mackerel catch in 1990



Netherlands demersal fish catch in 1990

Netherlands fishing vessels caught 99,844 tons of demersal fish in 1990 in the area shown. Demersal fish are species which live near the bottom. The catch consisted of plaice, sole, megrim, halibut, brill, cod, haddock, saithe, whiting, hake, catfish and wolffish. This was an increase of about 10,000 tons relative to 1988. The Netherlands quota of the TACs for demersal fish of 620,350 tons was 102,590 tons, including 66,120 tons of plaice and 20,315 tons of sole.

The map gives an overview of the catch of demersal fish by Netherlands fishing vessels in 1990 and is based on data taken from the logbooks of Netherlands fishing boats. The centre of gravity of the catches lies in the Netherlands sector of the Continental Shelf.

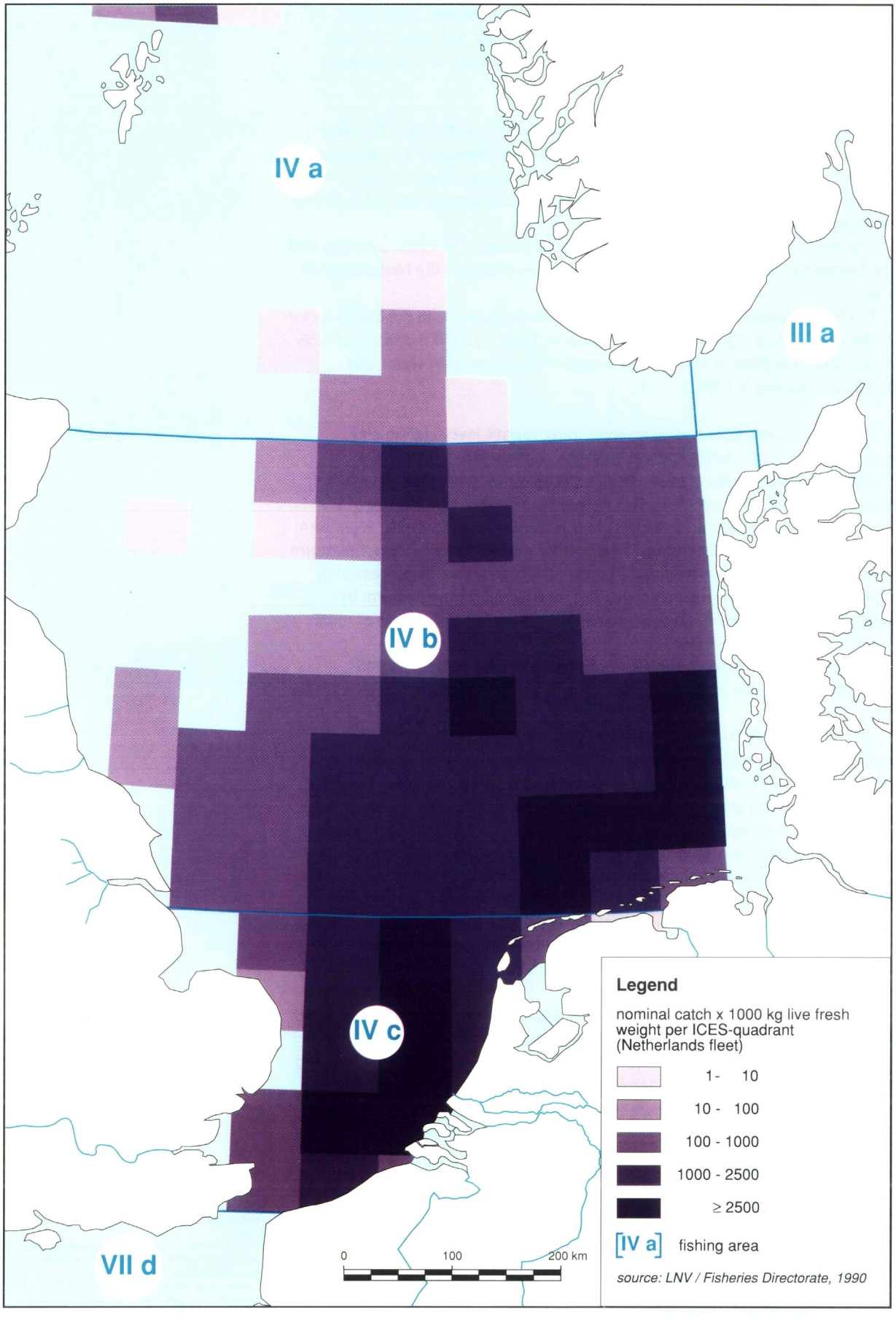
Demersal fish are caught using the beam trawl, which is a net that is dragged over the seabed and held open at the front by a reinforced bar of wood, the beam. Chains are attached to the beam to be dragged over and through the seabed. They drive the fish up from the protection of the seabed, thus forcing them into the net. The top few centimetres of the seabed over a large area of the shallow North Sea are regularly stirred up by beam trawl fishing. The harmful effects of this on life on the seabed are currently being investigated.

Fishing also affects the water system by withdrawing fish from it on a large scale. Secondary effects include:

- changes in the composition of fish species and possible shifts in the food chain as a result of this massive withdrawal;
- damage, destruction and disturbance of certain species of benthic flora and fauna;
- the by-catches of non-commercial fish species or undersized fish which are discarded;
- the incidental by-catches of marine mammals.

Source:
Ministry of Agriculture, Nature Management and Fisheries (LNV), Fisheries Directorate, (1990): unpublished data.
Welleman, H. (1989). Literatuurstudie naar de effecten van de bodemvisserij op de bodem en het bodemleven. RIVO.

Netherlands demersal fish catch in 1990



Production platforms and pipelines in the North Sea

Maps 68 to 73 deal with the activities on the North Sea and, particularly, on the NCS concerned with the extraction of raw materials. A division has been made between oil and gas production and the extraction of surface minerals. The latter are dealt with by maps 72 and 73.

Exploration of the gas and oil reserves in the North Sea started in the early 1960s. The conclusion in 1958 of the Convention of Geneva which introduced rules for the delimitation of the Continental Shelf and laid down the rights of the coastal states in respect of the natural resources of the Continental Shelf, played an important part in this (4).

The first exploration licences were granted by Denmark in 1963. Germany and the United Kingdom followed in 1964; Norway in 1965 and the Netherlands in 1968.

The first commercially attractive natural gas find was made in the British sector of the North Sea in 1965. Production began in 1968. In 1970 the first profitably exploitable quantities of oil were discovered in the Norwegian sector and production started in 1971.

The exploration of gas and oil reserves using seismic investigation and exploratory drilling is further described in the commentary to map 71.

If an exploratory drilling is successful, a decision has to be made on whether to open the field for production. This decision is influenced by the size of the field, the depth of water and nearness to the coast or to other fields. A platform of sometimes gigantic dimensions is erected for production. The largest platform stands on the Norwegian shelf, is 271 metres high and has a deck measuring 114 by 55 metres. A considerable area can be covered from a platform by drilling a number of wells, however to deplete a field fully, often one or more satellite platforms are needed.

Oil and gas are transported mainly by pipeline. In the mid-1970s 940 kilometres of pipeline in the North Sea were available and 2000 kilometres in the early 1980s.

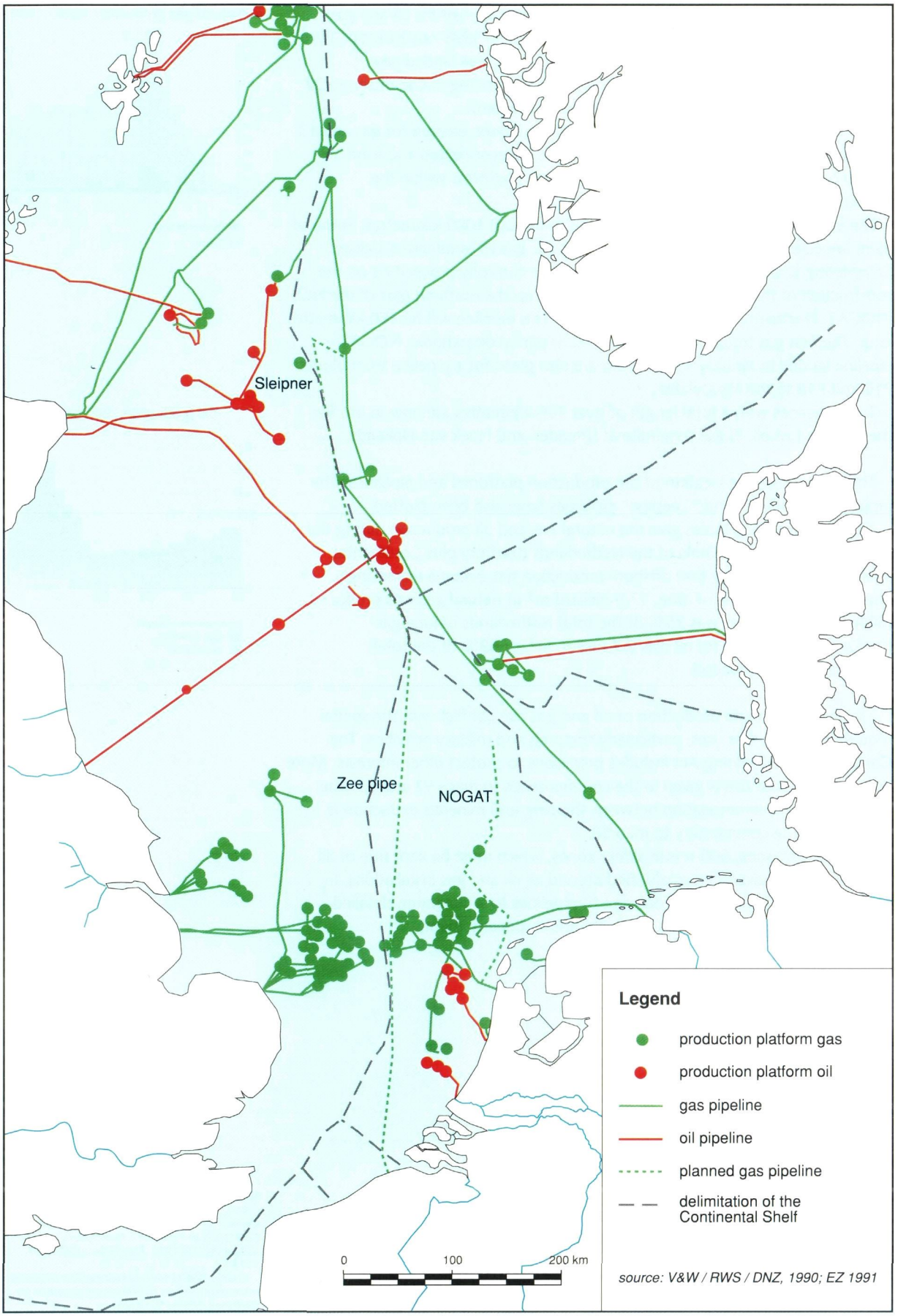
Gas fields are often connected together for transporting the gas to the mainland through a collection pipeline. The same applies to oil. However offshore loading (in ships) does occur in some parts of the North Sea.

Work is currently proceeding on "Zeepipe". This gas pipeline will transport gas from the Norwegian fields to Zeebrugge in Belgium. From there it will be further transported to six Western European countries which have contracted to receive it. 800 kilometres of pipeline will be constructed in the first stage. Later there will be extensions of 300 and 155 kilometres, respectively, to other Norwegian gas fields. When it is complete, Zeepipe will be the longest marine pipeline in the world. The gas reserve in the Norwegian fields concerned is 1790 milliard m^3.

The map shows the production platforms and pipelines on the whole of North Sea. Because the data from different sources do not exactly correspond, this map gives only an overall impression. The reliability of the data can be vouched for only for the Netherlands sector of the North Sea (69).

Source:
Ministry of Economic Affairs, Directorate-General for Energy, Information Directorate (EZ) (1991). Oil and gas in the Netherlands, exploration and production 1990. The Hague. ISSN: 0925-7993.
ICONA (1981). Inventarisatierapport Noordzee. Interdepartmental Co-ordinating Committee for North Sea Affairs. The Hague.
Ministry of V&W, RWS, North Sea Directorate (V&W/RWS/DNZ) (1990): unpublished data.

Production platforms and pipelines in the North Sea



Production platforms and pipelines on the NCS

The Netherlands sector of the North Sea has been opened for oil and gas prospecting since 1968. The first gas find was made in 1969 northwest of Texel. Production started in 1975. This gas, from block L10, was landed near Uithuizen, quickly followed by gas from block K13, landing in Callantsoog. Oil production did not begin until 1982, in block Q1 (Helm).

At 1 January 1991, 67 production platforms had been erected for gas and 13 for oil on the NCS. Some of these platforms are interconnected and form a system of installations. There are two further gas platforms within the Netherlands territorial sea.

The length of the gas pipelines on the NCS is about 1000 kilometres. Some of them are collection pipelines. They transport the gas to terminals in Velsen, Callantsoog (2 pipelines) and Uithuizen. Work is currently proceeding on the construction of the "NOGAT" pipeline to open up the northern part of the NCS (NOGAT: Northern Offshore Gas Transport). This pipeline will be 460 kilometres long. The first gas trough the, at the moment partial operational, NOGAT pipeline landed in January 1992. There are also plans for a pipeline from blocks P15 and P18 to the Maasvlakte.

Two pipelines with a total length of over 100 kilometres are now in use for the transport of oil. These terminate at IJmuiden and Hoek van Holland.

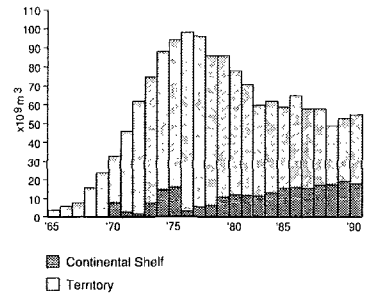
The map shows the location of the production platforms and pipelines. The projected "NOGAT" and "Zeepipe" pipelines have also been plotted.

The accompanying tables give the natural gas and oil production during the past few years for the whole of the Netherlands (territory plus Continental Shelf). The figures show that offshore production has become increasingly important in the course of time. 17.9 milliard m^3 of natural gas was produced offshore in 1990. That was 25% of the total Netherlands natural gas production. The figure for oil was 2.7 million m^3, or 69% of the total Netherlands oil production.

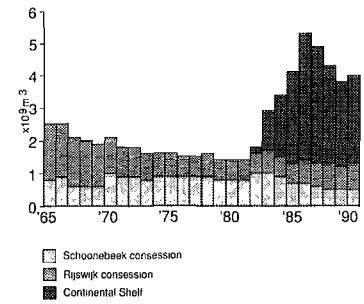
The exploration and production of oil and gas can conflict with the spatial requirements of other uses, particularly shipping and military activities. The Continental Shelf Mining Act includes provisions to protect other interests. More information about this is given in the commentaries to maps 92 and 93. The medium-term accommodation between shipping and minerals extraction is discussed in the commentary to map 58.

For safety reasons, 500-metre safety zones, which must be kept free of all other activities, have been established around all oil and gas installations. In order to reduce the chance of damage to pipelines to a minimum, detailed requirements can be laid down for laying and inspecting them.

Natural gas production,1965 - 1990



Oil production,1965 - 1990

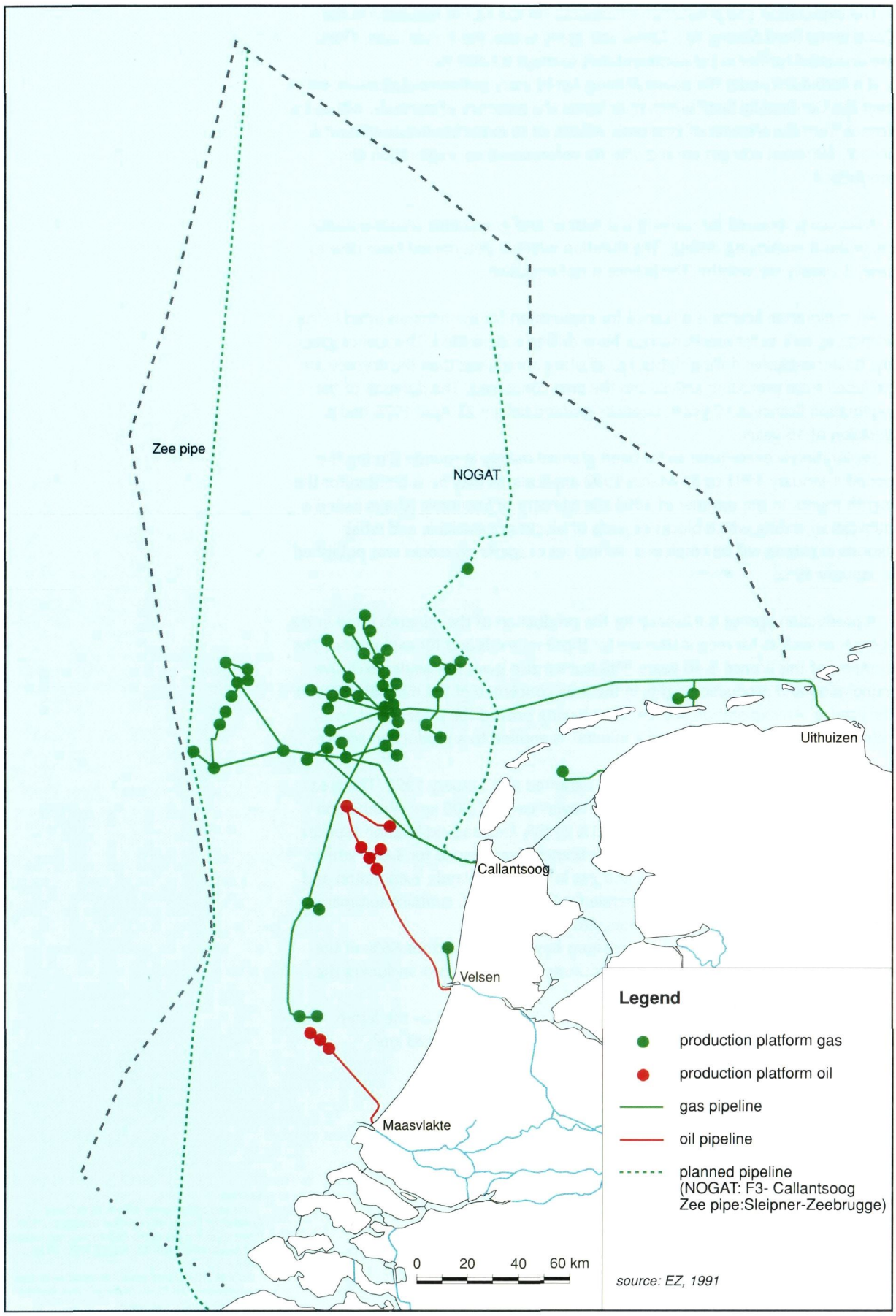


Source:

Ministry of Economic Affairs, Directorate-General for Energy, Information Directorate (EZ) (1991). Oil and gas in the Netherlands, exploration and production 1990. The Hague. ISSN: 0925-7993.

ICONA (1981). Inventarisatierapport Noordzee. Interdepartmental Co-ordinating Committee for North Sea Affairs. The Hague.

Production platforms and pipelines on the NCS



Exploration and production licences

The exploration and production of minerals on the NCS is regulated in the Continental Shelf Mining Act. Other acts apply within the 3-mile zone. These are discussed further in the commentaries to maps 92 and 93.

It is forbidden under the above Mining Act to carry out investigations in, on or over the Continental Shelf which may reveal the presence of minerals, without a licence from the Minister of Economic Affairs, or to extract minerals without a licence. Different licences are required for reconnaissance, exploration and production.

A licence is required for carrying out seismic and gravimetric reconnaissance, i.e. without employing drilling. The duration which is determined from case to case, is usually six months. The licence is not exclusive.

An exploration licence is a licence for exploration for the minerals listed in the licence, as well as for reconaissance. Now drilling is permitted. The licence gives the holder exclusive drilling rights, i.e. all other companies than the licensee are excluded from preceding activities in the area concerned. The duration of the exploration licence is 10 years. Licences granted before 23 April 1976 had a duration of 15 years.

Exploration licences have so far been granted mainly in rounds. During the period 1 January 1992 to 31 March 1992 applications may be submitted for the eighth round. In the summer of 1991 the Ministry of Economic Affairs issued a publication stating which blocks or parts of blocks are available and what allocation criteria will be employed. A final list of (parts of) blocks was published in January 1992.

A production licence is a licence for the production of the minerals listed in the licence, as well as for reconnaissance for those minerals and for exploration. The duration of this licence is 40 years. This licence also gives the holder exclusive exploration and production rights in the area concerned of the minerals listed in the licence. An exploration licence, after having proved the presence of an economic exploitable quantity of a mineral, is entitled to a production licence.

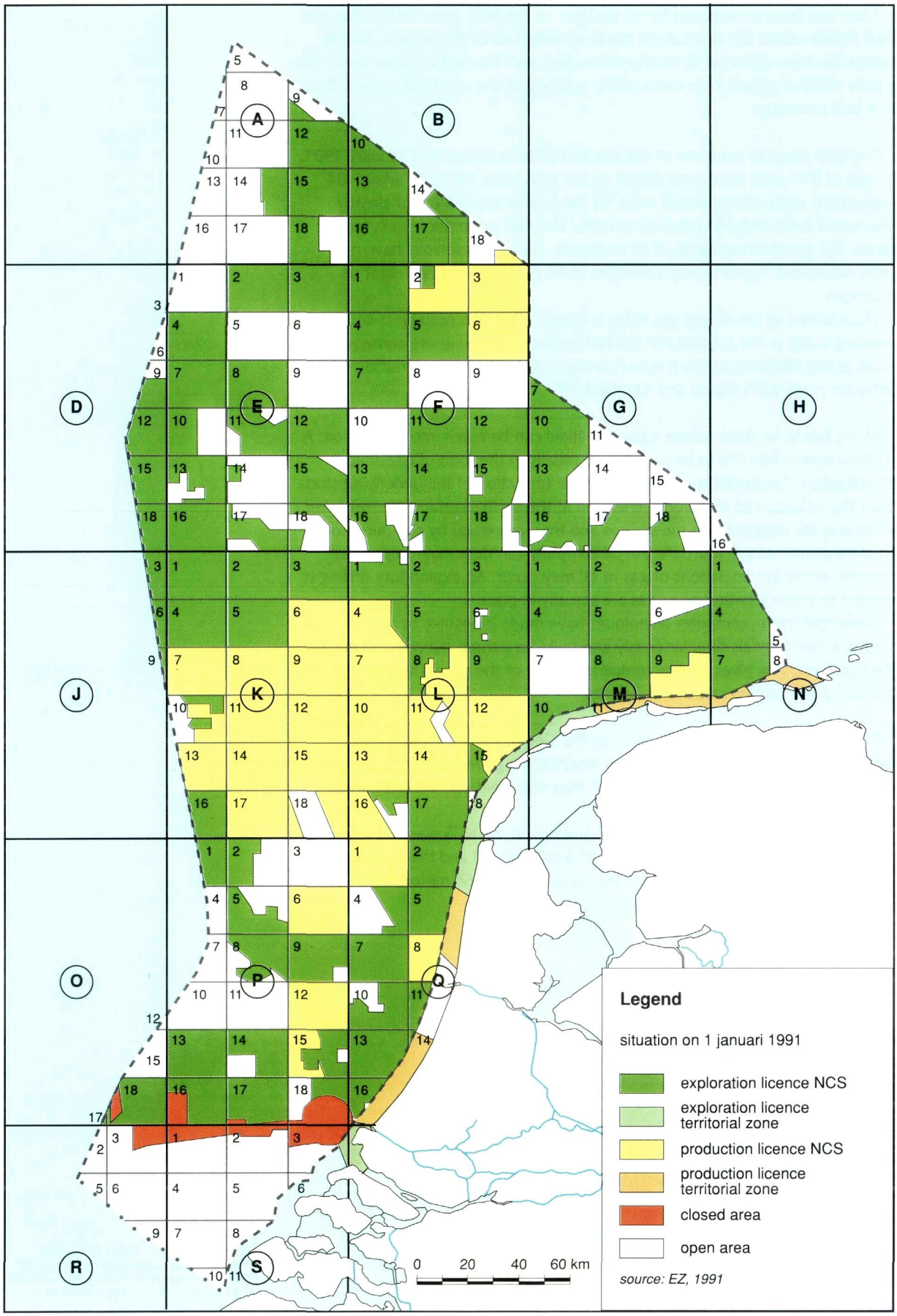
The map gives an overview of licences granted at 1 January 1991. The area available for exploration and production covers over 57,000 km^2. Production licences have already been issued for 20% of this area and exploration licences for approximately 50%. Reconnaissance licences were issued for 3,690 km^2 in 1990. The annual publication "Oil and gas in the Netherlands, exploration and production" of the Directorate-Generale for Energy of EZ, contains summaries of licence holders, duration of licences, etc.

Offshore drilling licences and concessions have been issued for 66% of the surface of the whole of the Netherlands territory (41,785 km^2). Including the territorial sea (3-mile zone).

The NCS is divided into a number of segments, designated by the letters A to T. Each of these segments is subdivided into blocks of about 400 km^2, numbered from 1 to 18.

Source:
Ministry of Economic Affairs, Directorate-General for Energy, Information Directorate (EZ) (1991). Oil and gas in the Netherlands, exploration and production 1990. The Hague. ISSN: 0925-7993.
ICONA (1981). Inventarisatierapport Noordzee. Interdepartmental Co-ordinating Committee for North Sea Affairs. The Hague.

Exploration and production licences



Oil and gas reserves

There has been prospecting for oil and gas on the NCS since 1968. Little was then known about the structure of the deep substrata of the seabed. The oil companies have collected so much information over the past 20 years or so, that a fairly detailed picture now exists of the geology of the substrata up to a depth of 4 to 5 kilometres.

The map gives an overview of the gas and oilfields known at 1 January 1991. A total of 858 wells have been drilled on the NCS since 1967, including 484 exploration wells, 110 appraisal wells for the further exploration of already discovered fields and 264 production wells. The 484 exploration wells have struck 137 gas reservoirs and 20 oil reservoirs. Two gas reservoirs have now been exhausted. Pipelines are connected to 45 gas reservoirs and eight oil reservoirs.

The location of the oil and gas fields is closely related to northwest-southeast trending faults in the substrata of the Netherlands. The fields are consequently more or less concentrated in a zone running in a northwesterly direction between Hoek van Holland and Ameland (68).

Much has to be done before a gas or oilfield can be taken into production. A reconnaissance has first to be carried out, usually in the form of a seismic investigation. Geologists try to determine the formation of the underlying strata from the reflection of vibrations generated at the earth's surface. The reflected vibrations are registered on the surface and then processed by computer to create a picture of the substrata. An oil company can determine from these pictures where accumulations of gas or oil may occur. An exploratory drilling is needed to prove whether oil or gas are actually in place.

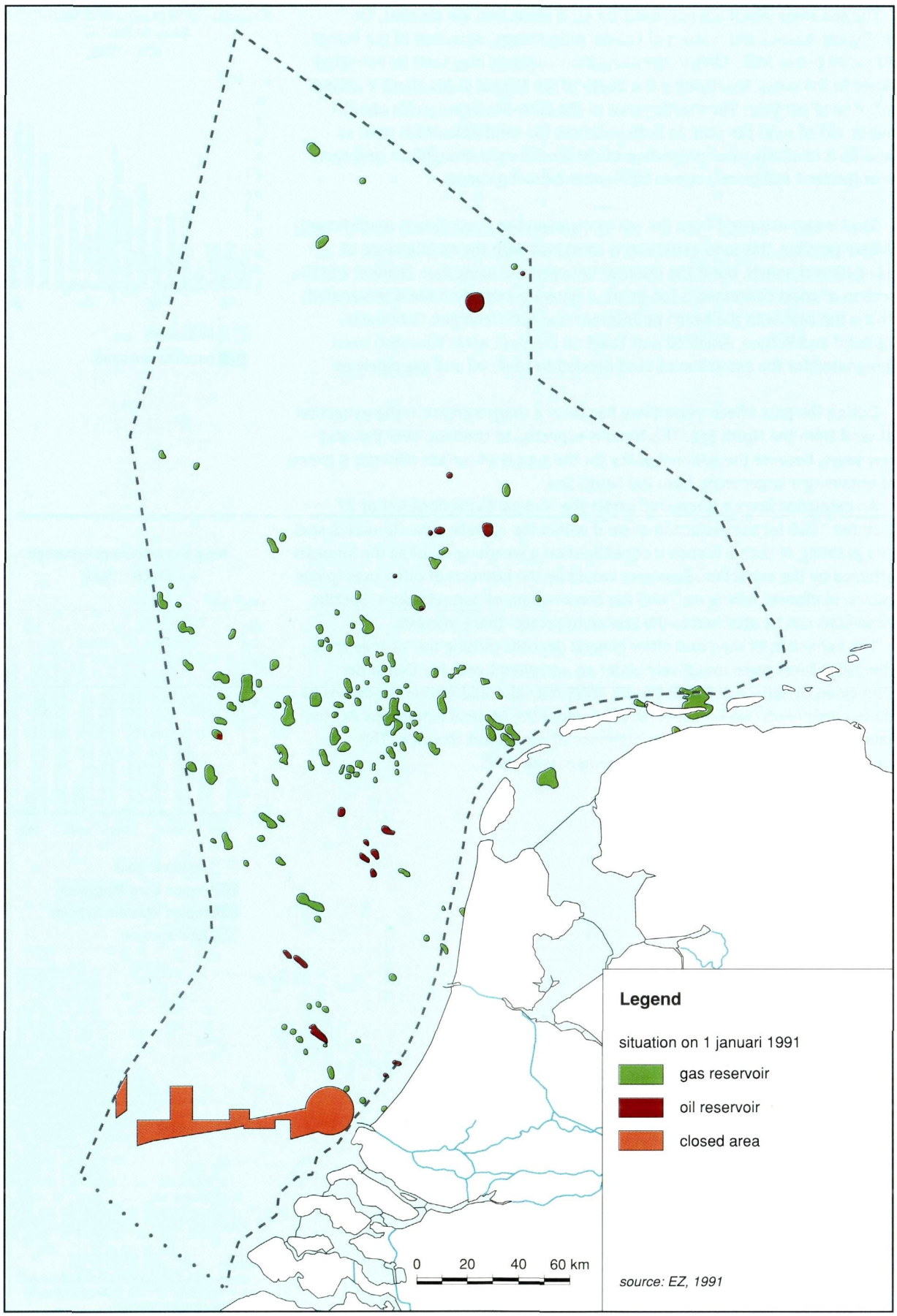
Developments in computer techniques have made it possible to process several seismic signals simultaneously and build up a three-dimensional image of the substrata. This gives a more complete picture of the substrata, thus increasing the success rate of the drillings.

The estimates of reserves are made by the Geological Survey of the Netherlands. They relate to the proved reservoirs in geological structures. All the fields are covered, including those which may not eventually be taken into production.

The remaining anticipated natural gas reserve on the NCS was 333 milliard m^3 at 1 January 1991 (Netherlands total: 2,113 milliard m^3) and the remaining anticipated oil reserve 24 million m^3 (Netherlands total: 64 million m^3).

Source:
Ministry of Economic Affairs, Directorate-General for Energy, Information Directorate (EZ) (1991). Oil and gas in the Netherlands, exploration and production 1990. The Hague. ISSN. 0925-7993.

Oil and gas reserves



Current sand extraction areas

The sea areas which are now used for sand extraction are situated, for ecological reasons and reasons of coastal morphology, seawards of the line of 20 metre below MSL. Only in the navigation channels may sand be extracted closer to the coast. Maintaining the depth of the IJ-geul yields about 7 million m^3 of sand per year. The maintenance of the Euro-Maasgeul yields about 1 million m^3 of sand per year. In both instances the sand obtained is used as landfill. A relatively small proportion of the landfill sand brought on land each year (under 1 million m^3) comes from other extraction areas.

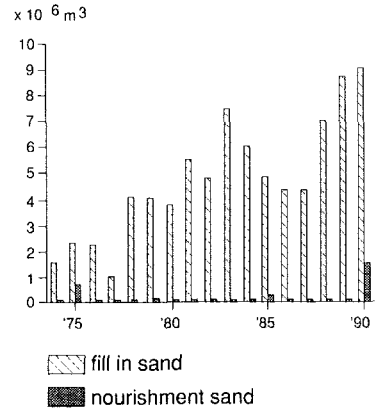
Sand is also extracted from the sea to maintain the coast (beach nourishment). Where possible, this sand extraction is combined with the maintenance of navigation channels, but if the distance between the navigation channel and the section of coast concerned is too great, a separate extraction site is designated. This is the case with the beach nourishments at Scheveningen, Schouwen, Egmond and Bergen, Ameland and Texel. In the past, areas have also been designated for the extraction of sand needed to cover oil and gas pipelines.

During the past fifteen years there has been a sharp increase in the extraction of sand from the North Sea. This trend is expected to continue over the next few years, because the national policy for the supply of surface minerals is aimed at obtaining a larger share from the North Sea.

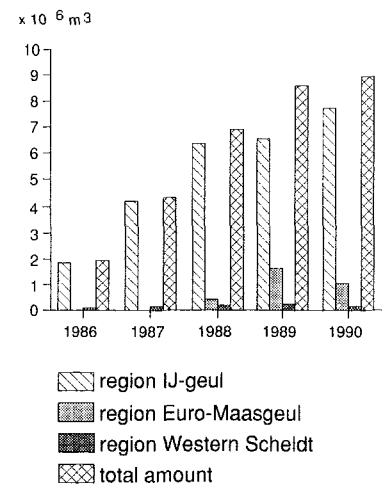
An extraction licence is required under the Mineral Extractions Act of 27 October 1965 for the extraction of sand within the 12-mile zone (territorial sea). The granting of such a licence is dependent on a weighing up of all the interests affected by the extraction. Examples would be the interests of other uses (pipes, cables, platforms, fishing etc.) and the conservation of natural values. Specific conditions can be attached to the licence to protect these interests.

The extraction of sand and other mineral deposits outside the 12-mile zone (the NCS) takes place exclusively under an agreement with the Dienst der Domeinen (= Service of Public Lands). RWS may also add further conditions to these agreements. No licence is required under the Mineral Extractions Act for sand extraction as part of the maintenance of navigation channels. This extraction is carried out under an agreement with RWS.

Extraction of fill in sand and nourishment sand on the NCS
(1974 - 1990)

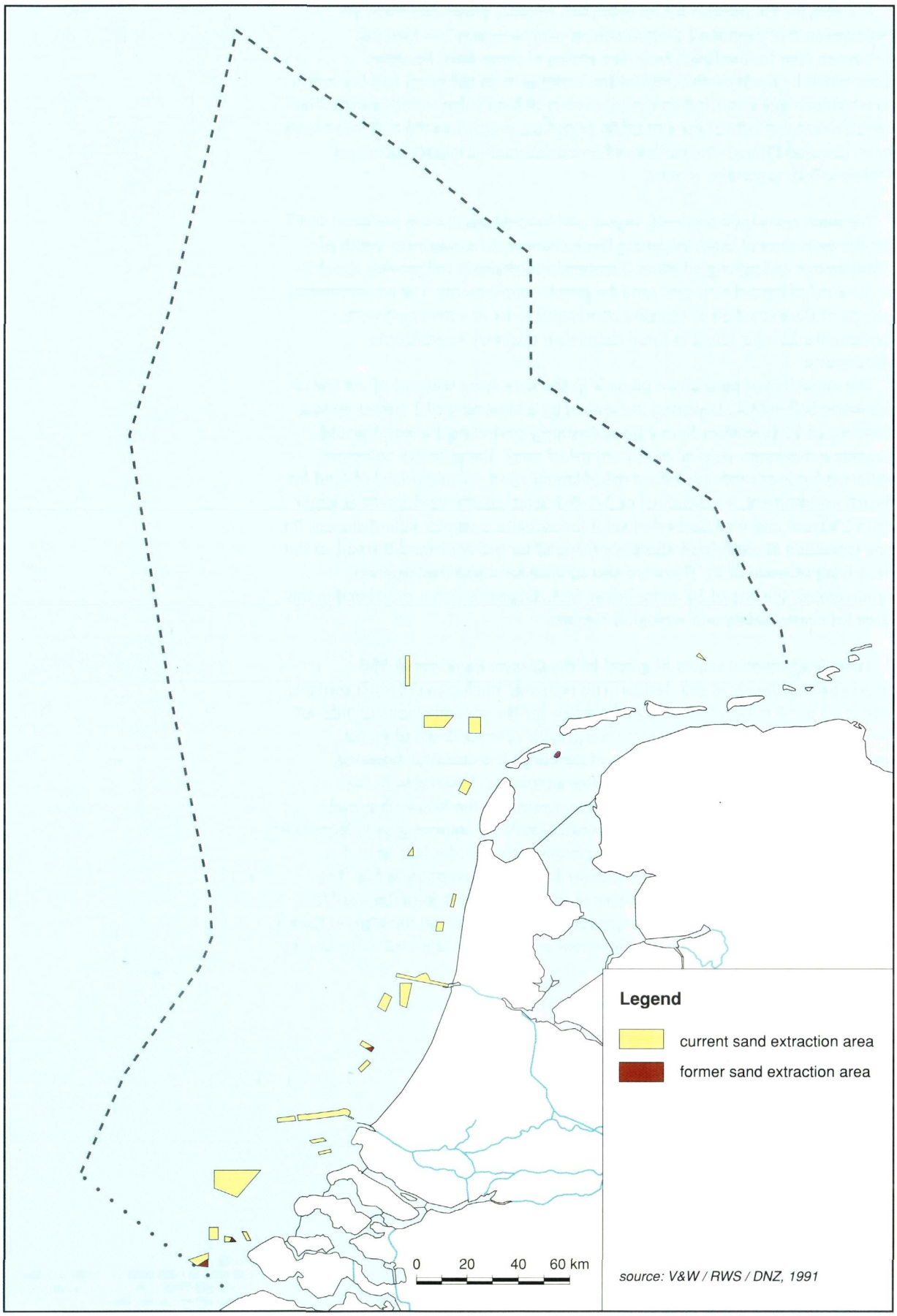


Area and amount of extraction
(1986 - 1990)



Source:
Ministry of V&W, RWS, North Sea Directorate (V&W/RWS/DNZ) (1991). Ontwerp Regionaal Ontgrondingenplan Noordzee.

Current sand extraction areas



Potential surface mineral extraction areas

The sites for the possible future extraction of sand, gravel and shells are indicated in the "Regionaal Ontgrondingenplan Noordzee" (= Regional Extraction Plan for the North Sea). The choice of these areas has been determined by the layer thickness of the material to be extracted and the extent to which damage or obstruction are caused to natural values or other uses. The environmental effects of the extraction of surface minerals in the North Sea have been assessed through the medium of an environmental impact statement (milieu-effectrapportage: m.e.r.).

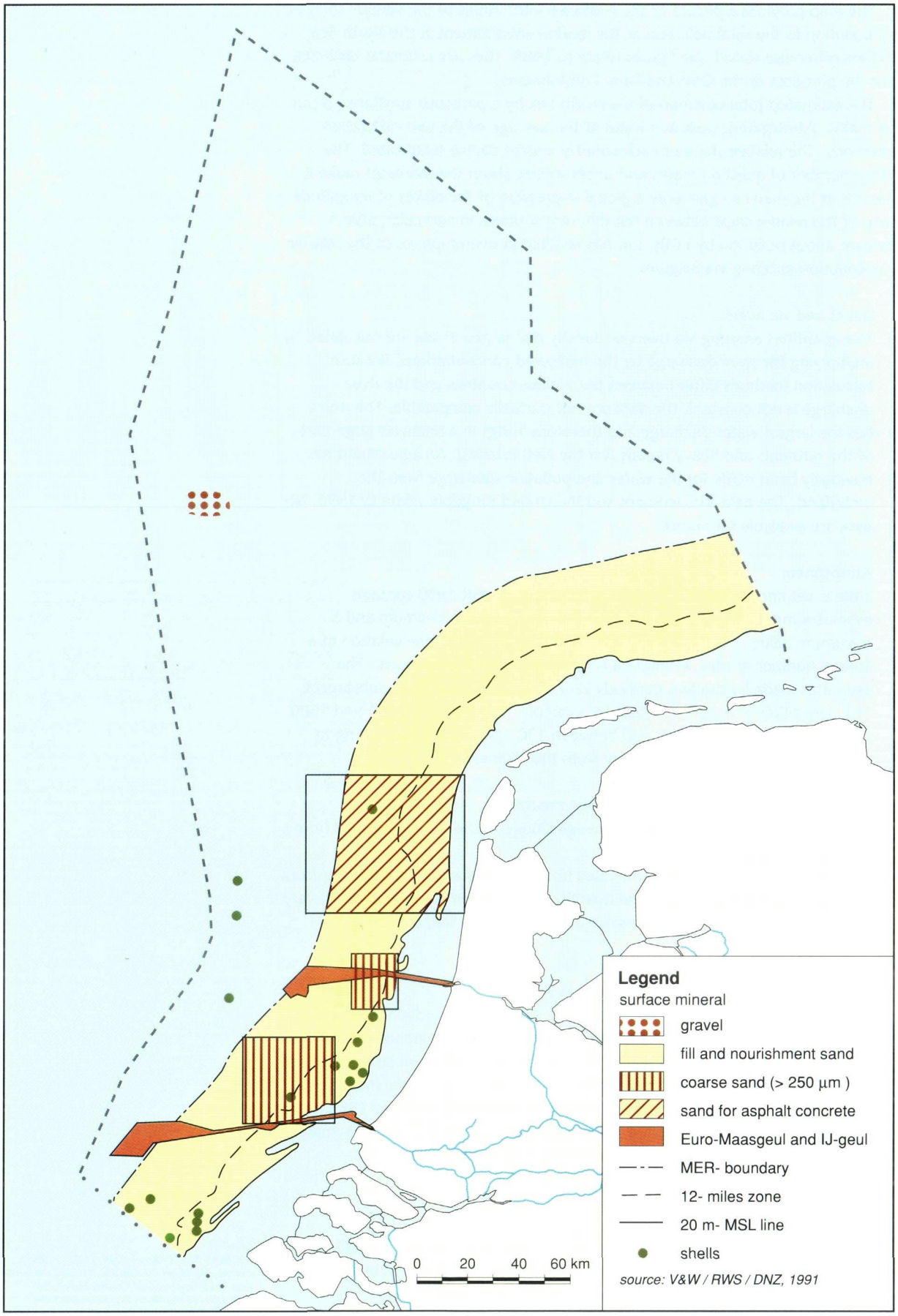
The main navigation channels, IJ-geul and Euro-Maasgeul, are preferred sites for the extraction of sand. Widening these channels to a maximum width of 1500 metres and adding a further 2 metres to their depth will provide about 1 milliard m^3 of landfill sand and sand for beach nourishments. The environmental effects of the extraction of sand are considered to be at a minimum here, because the benthic fauna in these channels is relatively insensitive to disturbance.

The extraction of sand is also possible in the zone lying seaward of the line of 20 metre below MSL. Lowering the seabed by a maximum of 2 metres up to a distance of 50 kilometres from a possible supply port along the coast would provide a maximum yield of 36 milliard m^3 of sand. The potential comprises different kinds of sand: 16 milliard m^3 of landfill sand, 12 milliard m^3 of sand for beach nourishment, 4 milliard m^3 of 0-1/0-2 sand (course sand; particles larger than 250 µm) and 4 milliard m^3 of sand for asphalte concrete. Potential areas for the extraction of shells have also been mapped for this zone (and the part of the NCS lying seaward of it). There are also suitable sand and shell reserves landwards of the line of 20 metre below MSL, but extraction is prohibited in this area for coastal safety and ecological reasons.

There is a potential source of gravel on the Cleaver Bank, about 150 kilometres northwest of Den Helder. This relatively small area (18 km^2) contains about 30 to 50 million tons of gravel suitable for the concrete industry. Interest in the Cleaver Bank has grown since the gradual running down of gravel extraction on the mainland (province of Limburg). It is doubtful, however, whether the Cleaver Bank offers a suitable alternative, because of its high ecological value. The Cleaver Bank is the only area on the NCS with gravel deposits and consequently an unique benthic fauna. Moreover, gravel deposits have been found to provide attractive spawning grounds for herring. Observations have shown that the Cleaver Bank is no exception to this. The results of a separate m.e.r. to be drawn up for this area will form the basis for determining in due course whether gravel can be extracted on the Cleaver Bank. A separate m.e.r. will also have to be drawn up for large-scale shell extraction in the North Sea.

Source:
Ministry of V&W, RWS, North Sea Directorate (V&W/RWS/DNZ) (1991). Ontwerp Regionaal Ontgrondingenplan Noordzee.

Potential surface mineral extraction areas



Sources of pollution

The map provides a picture of the relative contributions of the various sources of pollution to the total pollution of the marine environment in the North Sea. Unless otherwise stated, the figures relate to 1988. They are estimates collected for the purposes of the Oslo and Paris Commissions.

The estimated total pollution of the North Sea by a particular substance is put at 100%. Atmospheric pollution is put at the average of the two calculation methods. The relative share of each country and/or source is indicated. The large number of question marks and uncertainties about the estimates make it clear that the map can give only a global impression of the orders of magnitude and of the relationships between the different sources. In particular, little is known about pollution by PCBs; this has resulted in overemphasis of the relative contribution entering via Belgium.

- Direct and via rivers
  The quantities entering via rivers or directly discharged at sea are calculated by multiplying the river discharge by the measured concentrations. Because calculation methods differ between the various countries and the river discharge is not constant, the data are not mutually comparable. The Rhine has the largest water discharge and therefore brings in a relatively large part of the nutrients and heavy metals (via the Netherlands). An adjustment has obviously been made for the water and pollution discharge from the hinterland. The data for Denmark and the United Kingdom relate to 1986. No data are available for France.

- Atmosphere
  Little is yet known about atmospheric deposition. QSR 1990 contains estimates made according to two methods, both with a minimum and a maximum value: estimate A is based on measurements in precipitation at a limited number of sites, estimate B is based on model calculations. The estimates made by the two methods vary considerably for some substances. The deposition of copper in 1988, for example, was between 1050 and 1680 tons according to method A, and between 130 and 135 tons according to method B. Lead is deposited mainly from the atmosphere.

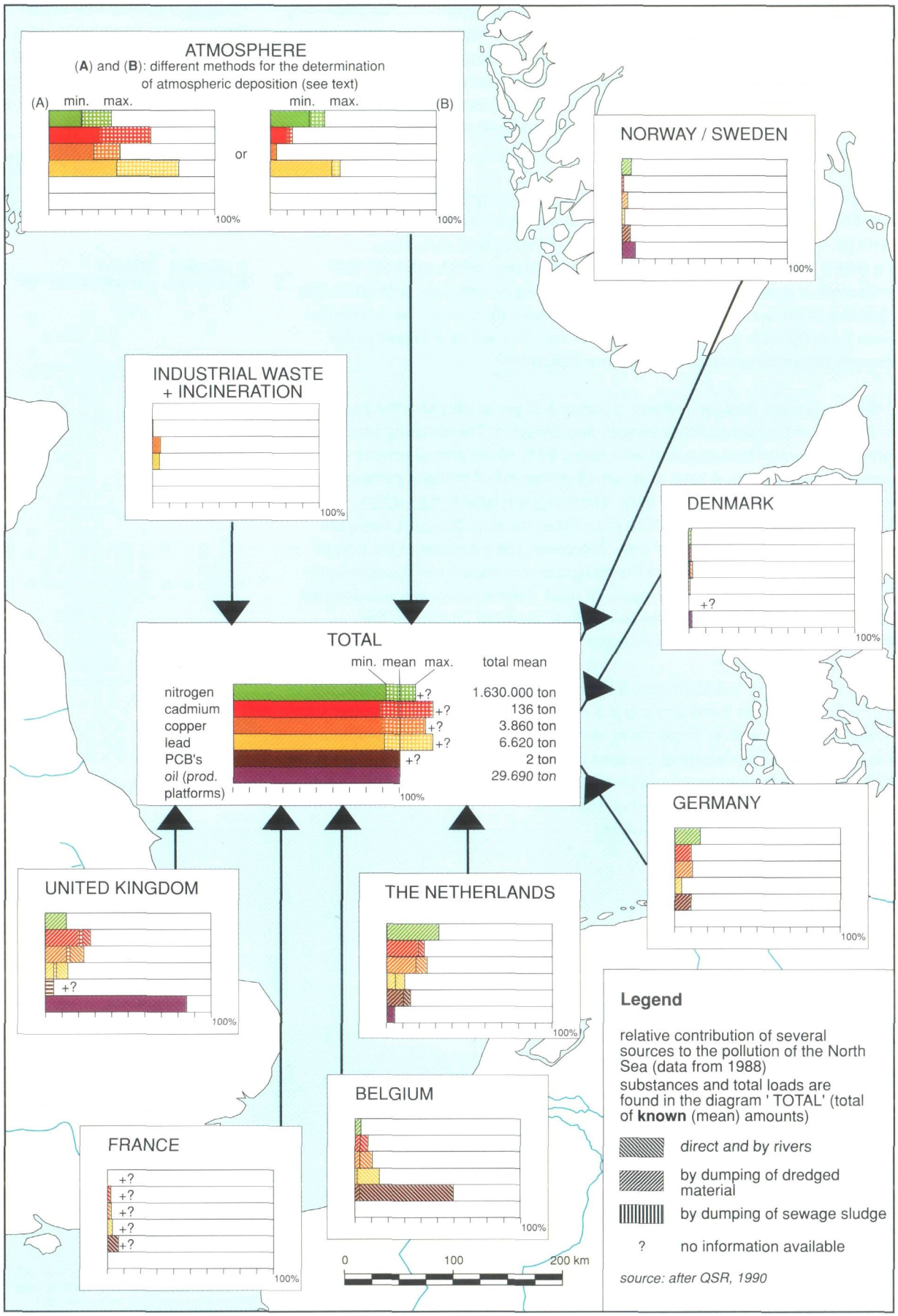
- Dumping of sewage sludge and dredged material
  Only the United Kingdom dumps sewage sludge in the sea. It does this from ships. The map data relate to 1987.
  Half of the dredged material originates from harbours and the remainder from estuaries and nautical canals. The quantities of dumped dredged material vary from year to year. Germany does not dump directly at sea, but in inland waters.

- Discharge and incineration of industrial waste
  In 1988 the United Kingdom, Belgium and West Germany discharged about 1.7 million tons of liquid industrial waste into the sea. The greater part of the waste originated from the titanium dioxide industry in the two latter countries (76). In 1988 the United Kingdom dumped 2 million tons of solid industrial waste in the sea. This waste comes largely from the coal mines. In 1988 nearly 96,000 tons of waste originated from incineration at sea (76). This was mainly chlorine-rich chemical waste. Solid industrial waste made the largest contribution to the pollution of the North Sea.

- Discharges from drilling platforms
  About 225,000 tons of oil find their way annually into the sea. A small proportion of this originates from drilling platforms (30,000 tons in 1988). The oil waste from the German drilling platforms is deposited on land.

Source:
Quality Status Report (QSR) (1990). 1990 Interim Report on the Quality Status of the North Sea. Third International Conference on the Protection of the North Sea; February 1990.

Sources of pollution



Dumping sites of dredged material

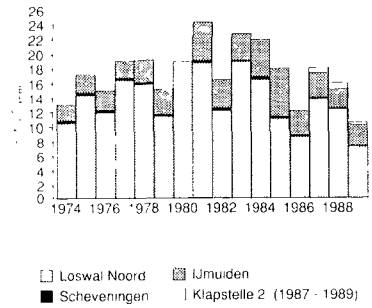
Sand and mud are transported along the Netherlands coast [17]. The rivers also bring in mud and sand. The mud from the sea is generally relatively clean, while the river mud has been polluted by the agriculture, industries and households along the rivers. Mud settles in a quiet environment, such as harbours, which mud up as a result. In order to keep the harbours and approach channels along the Netherlands coast accessible to shipping the deposited material must be removed by maintenance dredging.

The dumping of dredged material at sea is covered by the Pollution of the Sea Act. This act gives exemption only for the dumping of relatively clean dredged material. Polluted dredged material must be stored in land sites. The most important land site is the "Slufter" on the Maasvlakte, which can hold 150 million m^3 of dredged material. This is expected to be adequate until 2002. The objective of the water quality policy is that harbour mud should be sufficiently clean by 2000 for it again to be dumped at sea. This will be achieved partly through the implementation of the Rhine Action Plan.

Relatively clean dredged material is dumped at sea at sites near the harbours of Rotterdam Europoort, Scheveningen and IJmuiden. The dumping sites Loswal Noord and Loswal IJmuiden deal with about 95% of the annual volume (see the accompanying graph). A total of about 15 million m^3 of dredged material a year was dumped at sea in the late 1970s. There was a relatively high storm frequency in the early 1980s, which meant that the mud transport along the Netherlands coast was relatively high. Moreover, the extension of the port of Zeebrugge and the deepening of the navigation channels Euro-Maasgeul and IJ-geul resulted in an additional supply of mud. Polluted mud was also dumped at sea, as no more land sites were being made available because of the pollution. The quantity dumped increased during this period to about 22 million m^3 a year.

The above works had been completed by the second half of the 1980s, the storm frequency was lower and about 3 million m^3 of moderately polluted dredged material was no longer being dumped at sea, but in a special area on the Maasvlakte. The volume of dumped dredged material declined in the second half of the 1980s to about 13 million m^3 a year. Dredged material from other harbours, such as Eemshaven, Delfzijl, Harlingen, Den Helder and Flushing, is not dumped at sea, but in the estuaries.

Dumping of dredged material from Dutch harbours on the North Sea (1974 - 1989)



Source
Ministry of V&W, RWS, North Sea Directorate (V&W/RWS/DNZ) (1991); unpublished data

Dumping sites of dredged material

Former incineration and waste discharge areas

The North Sea was used until recently by the surrounding countries as a communal terminal for waste. Waste acids from the German titanium dioxide industry, for example, were discharged on the Netherlands sector of the Continental Shelf off Hoek van Holland, about 40 kilometres off the coast. Three smaller areas along the coast were also available for the discharge of industrial wastes, but these were seldom used in practice.

Research has been proceeding for many years into the possible effects of these discharges, but they have never been clearly established. This is partly because the diluted wastes are spread over the North Sea by currents. Some of the dumped heavy metals have probably found their way into the seabed, however [32, 33].

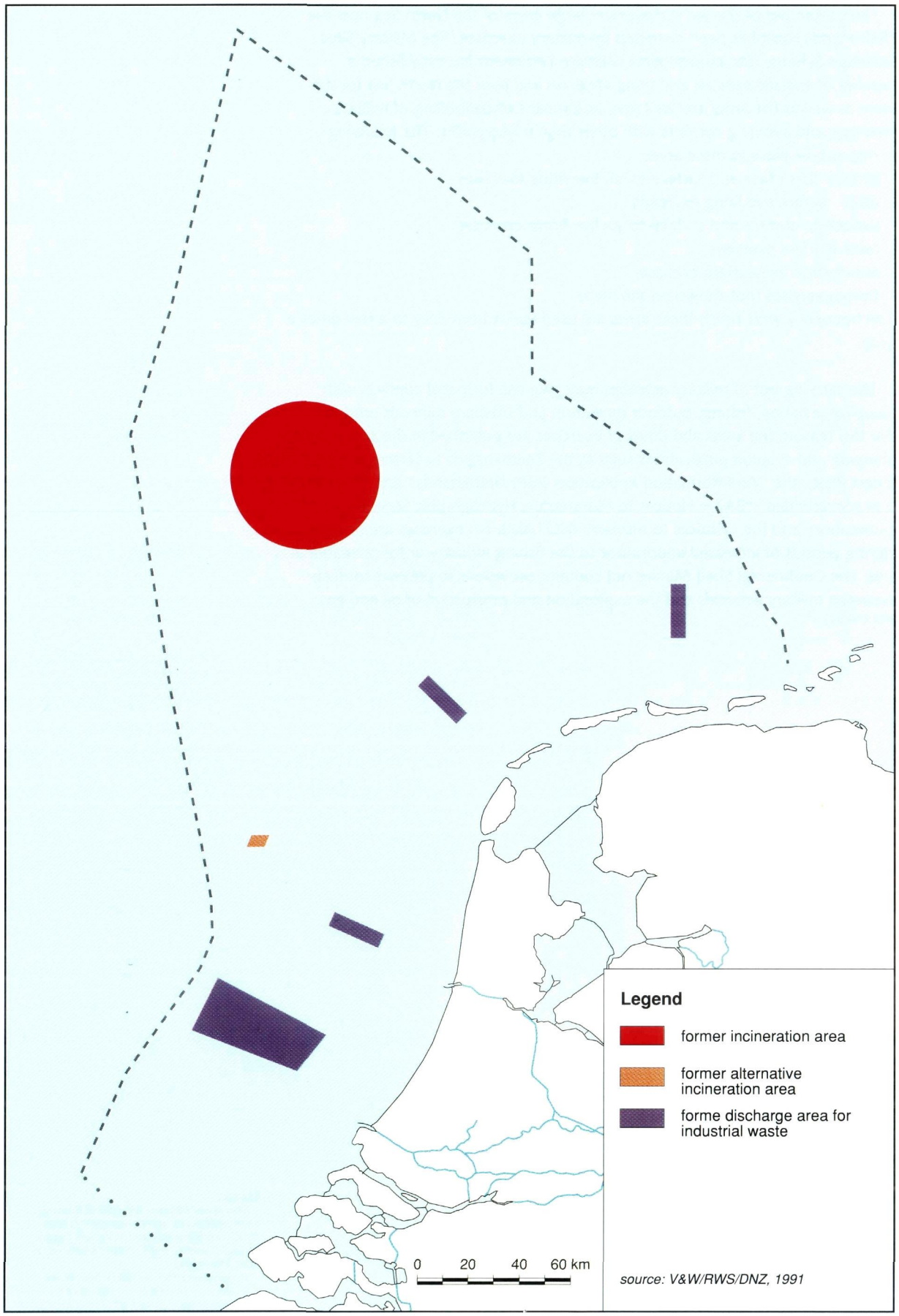
The only incineration area of the North Sea (about 2400 km^2) was also situated on the NCS, as well as an alternative area where chemical wastes from different European countries were incinerated. In 1987 and 1988 a total about 200,000 tons of waste originating from Belgium, Germany (48%), France, Italy, the Netherlands (2%), Norway, Austria, Spain, Switzerland and the United Kingdom was destroyed there.

An exemption is required under the Pollution of the Sea Act for the discharge and burning of wastes. Compliance with the exemption regulations was monitored in practice by means of black boxes installed on board, which recorded course, speed and combustion temperature.

The discharges were terminated on 1 January 1990 under the agreements made at the North Sea Ministers Conference, and burning was ended on 1 February 1991. The termination coincides with the introduction of manufacturing processes which release fewer or no wastes. The treatment facilities on land have also been further expanded.

Source:
Ministry of V&W, RWS, North Sea Directorate (V&W/RWS/DNZ) (1991): unpublished data.

Former incineration and waste discharge areas



Netherlands military exercise areas

The civilian use of the sea surface over large areas of the North Sea near the Netherlands coast has been restricted by military exercises. The Military Sites Structure Scheme (Structuurschema Militaire Terreinen) has established a number of specific exercise and firing areas on and over the North Sea for the navy as well as the army and air force, as a means of controlling of military exercises and avoiding conflicts with other than military uses. The following activities take place in these areas:

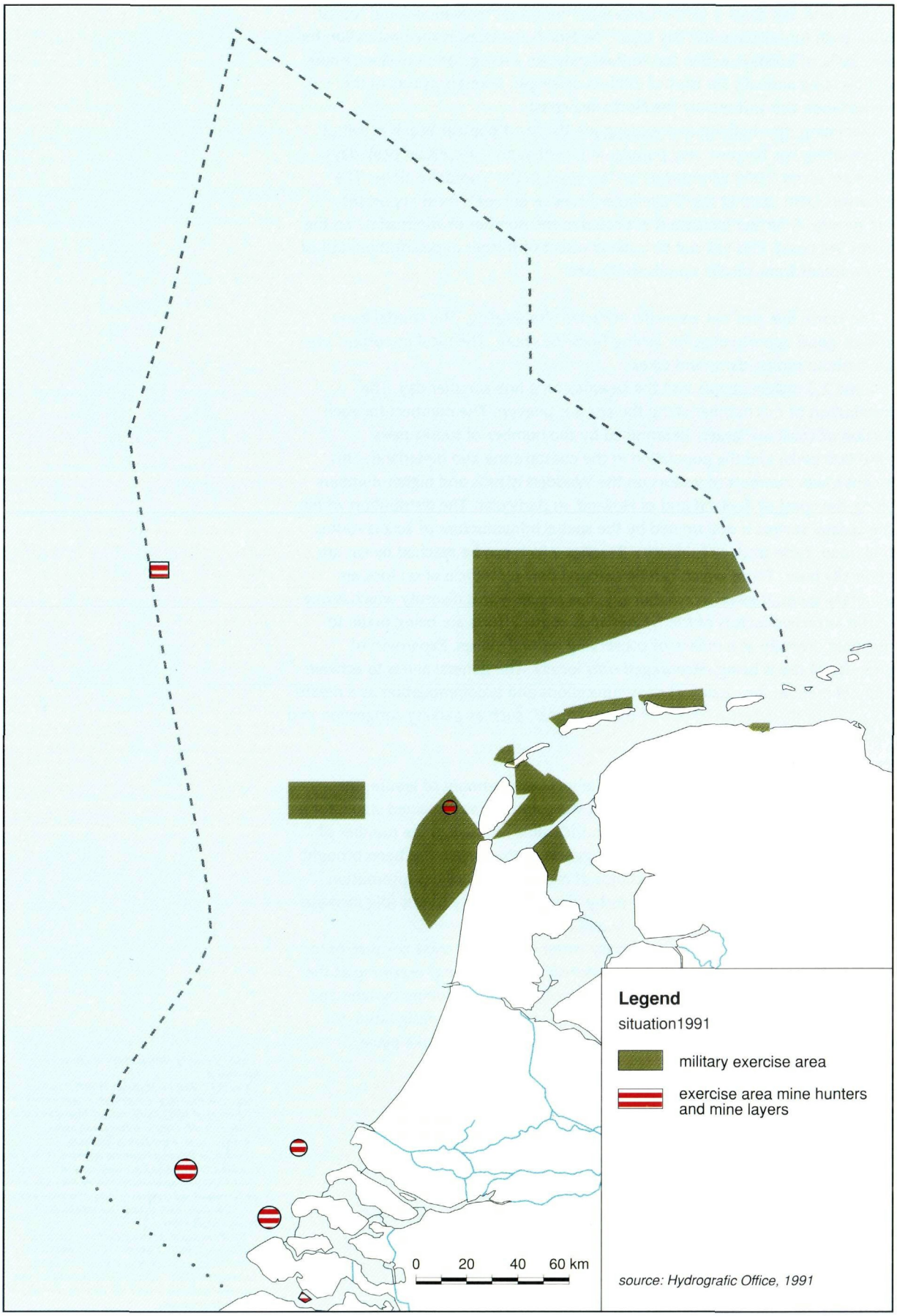
- surface-to-surface and surface-to-air live firing exercises
- air-to-surface live firing exercises
- surface-to-surface and surface-to-air live firing exercises
- mine warfare exercises
- anti-submarine warfare exercises
- flying exercises (not shown on the map).

The frequency with which these areas are used varies from daily to a few times a year.

The carrying out of military activities may give rise to spatial conflicts with shipping, aviation, fishing, outdoor recreation and offshore minerals production. For this reason, the areas and times of exercises are published in the appropriate shipping and aviation publications such as the Zeemansgids (= Netherlands Coast Pilot), the "Air Information Publication (AIP) Netherlands" and "Berichten aan zeevarenden" (BAZ = Notices to Mariners), a Hydrographic Service publication, and the "Notices to Airman" (NOTAM). No exercises are held during periods of increased importance to the fishing industry or for recreational use. The Continental Shelf Mining Act contains provisions to prevent conflicts between military activities and the exploration and production of oil and gas (92 and 93).

Source:
Ministry of Defence, Ministry of Housing, Physical Planning and Environment (1984). Structuurschema Militaire Terreinen, Deel d. Second Chamber, 1983-1984, 16 666, no. 9-10. SDU, The Hague.
Hydrographic Office (1991). Bericht aan Zeevarenden. Hydrographic Service of the Royal Netherlands Navy. BAZ 1-39; 116 volume no. 1.

Netherlands military exercise areas



Beach and shoreline recreation

The North Sea coast is Netherlands most important recreational and tourist zone, both for holidays and day trips. The North Sea coast is the destination for over 20% of holidays within the Netherlands. An average of 38 million people visit the area annually for trips of 2 hours or longer. Foreign visitors to the Netherlands also visit mainly the North Sea coast.

Swimming, sun-bathing and walking are the most popular beach activities. Windsurfing has become very popular in recent years. On certain peak days there are some 6,000 windsurfers on the coast in the Voordelta alone. The Brouwers Dam (dam at the Grevelingen) is even Europe's most important surfing site. A further increase is expected in the number of windsurfers on the North Sea coast. This will not be a direct effect of further popularisation, but of a movement from smaller waters to the sea.

The North Sea also has a specific attraction for angling. The coastal zone affords good opportunities for fishing from the shore. The most important sites are harbour moles, dams and dikes.

Some 2.5 million people visit the beaches on a fine summer day. The distribution of this number along the coast is uneven. The numbers for each section of coast are largely determined by the number of tourist beds (350,000 beds) and the population in the coastal zone and hinterland. This means lower numbers of visitors on the Wadden Islands and higher numbers along the coast of Zeeland and of Holland, in particular. The distribution within the coastal sectors is determined by the spatial infrastructure of access routes (rail, road, cycle track or footpath). Beaches which can be reached by car are generally busy. Those which can be reached only by bicycle or on foot are generally quiet. Viewed internationally, it is precisely this diversity which is one of the attractive factors of the Netherlands coast. Efforts are being made to maintain diversity as a means of conserving natural values. Expansion of intensity of use is being encouraged only locally. The general aim is to achieve improvement in the quality of communications and accommodation as a means of reducing the adverse effects of the motor car, such as parking congestion and traffic queues.

Despite the population growth and the increased amount of leisure, the number of visitors to the beaches during the summer has remained stable for a long time, although there has been a considerable increase in the number of visitors outside the summer. This prolongation of the season has been brought about by an improvement in the choice of recreational facilities (promotion, special arrangements, etc.), as well as by changing holiday trends (big increase in short breaks, especially in the early and late season).

Safety problems may arise in the busy water and beach areas because of too many activities (sailing, windsurfing, water-skiing, swimming) occurring at the same time. Many communities have therefore introduced zoning by time and place in order to regulate the various uses. Areas have been designated, for example, where windsurfing or waterskiing may or may not take place.

Source:

ANWB (1987). Windsurfinformatiekaart van Nederland.

Central Office for Statistics (1987). Stuctuur-onderzoek naar dag- en verblijfsrecreatie 1985.

Ministry of Agriculture, Nature Management and Fisheries (LNV) (1991): information about important near-shore fishery locations.

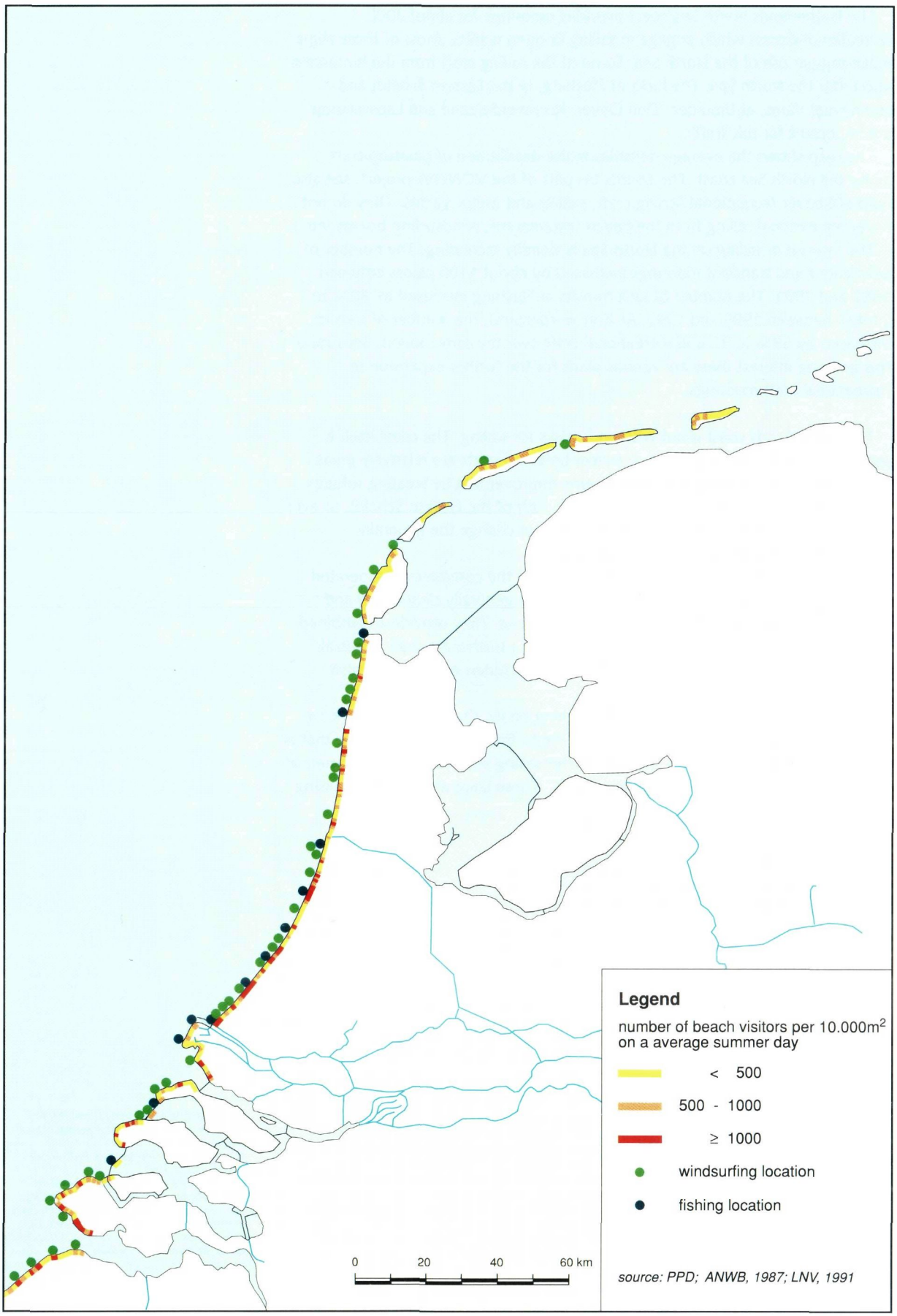
Provincial Physical Planning Agencies (PPDs) of Friesland, Noord and Zuid-Holland and Zeeland and Ministry of Agriculture, Nature Management and Fisheries: adaptation of data of several years.

Continu Holidays Survey Foundation (1991). Yearly report 1990.

The Provisional Advisery Body for Outdoor Recreation (1990). Kampeerregistratiebestand.

The Provisional Advisery Body for Outdoor Recreation (1990). Voordelta, op den duur - een toekomstverkenning voor toerisme en recreatie in en om de Voordelta.

Beach and shoreline recration



Water recreation

The Netherlands North Sea coast provides moorings for about 3000 recreational vessels which engage in sailing in open waters. Most of these ships make regular use of the North Sea. Some of the sailing craft from the hinterland also enter the North Sea. The locks at Flushing, in the Eastern Scheldt and Haringvliet dams, at IJmuiden, Den Oever, Kornwerderzand and Lauwersoog are important for this traffic.

The map shows the average densities in the distribution of pleasure craft along the North Sea coast. The counts (as part of the VONOVI-project, see also map 60) cover recreational fishing craft, sailing and motor yachts. They do not cover recreational sailing from the beach (catamarans, windsurfing boards, etc.).

The interest in sailing on the North Sea is steadily increasing. The number of permanent and transient moorings increased by about 1100 places between 1983 and 1991. The number of lock transits at Flushing increased by 30% to 21,424 between 1985 and 1990. At Kornwerderzand, the number of transits increased by 58% to 32,636 recreational craft over the same period. Because of this growing interest there are various plans for the further expansion of recreational craft moorings.

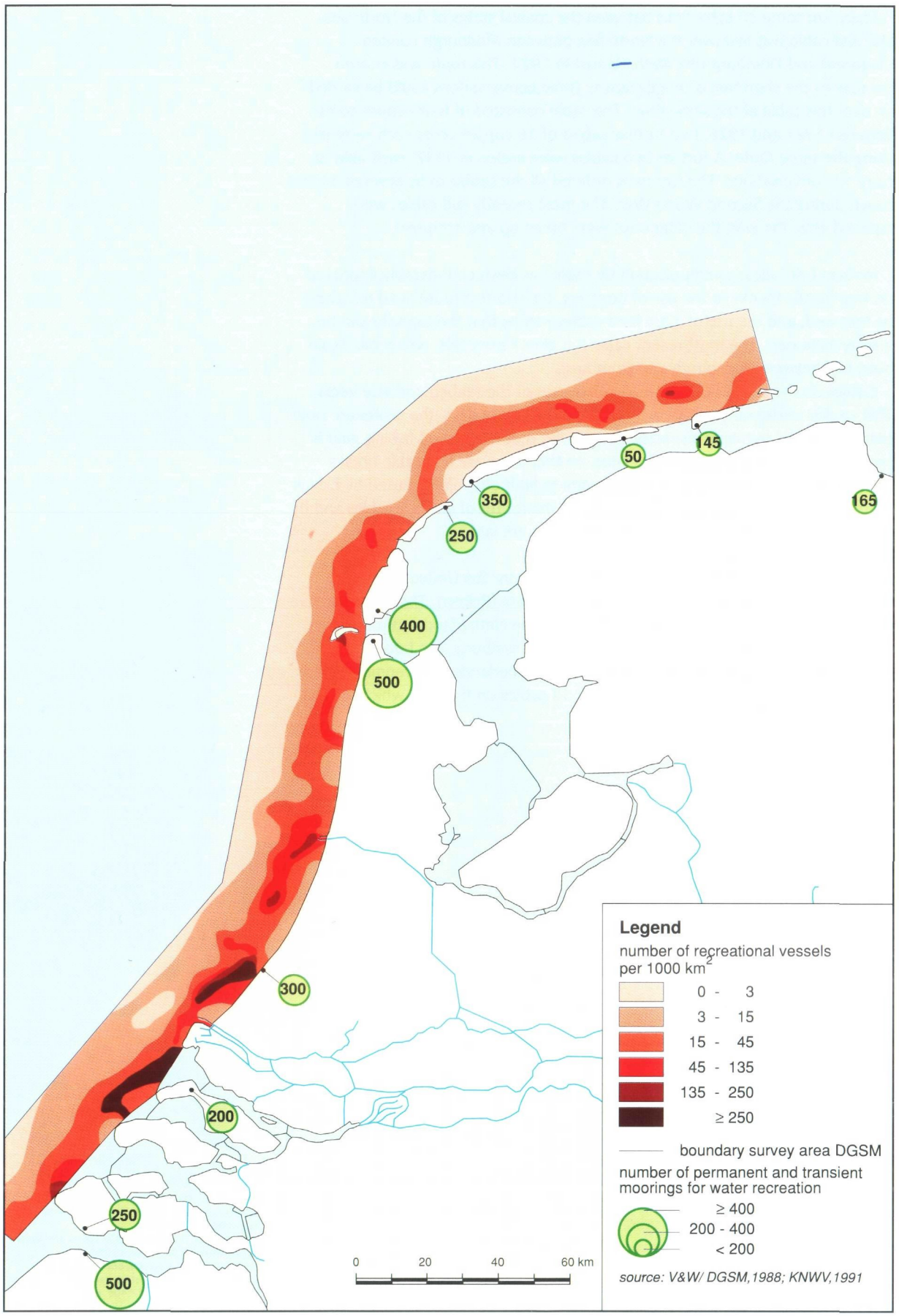
The Netherlands coast is not without its risks for sailing. The coast itself is generally weather shore and the distances between ports are relatively great. Efforts are being made to bring about some improvement by creating refuges, such as that near Neeltje Jans island at the mouth of the Eastern Scheldt, or even by constructing new yacht harbours. This will not change the generally unsheltered character of the coast, however.

A separate branch of water recreation is that of the commercially-operated hired ships for sea angling. These consist of thirty generally cleaned-up and converted fishing craft, stationed directly on the sea. They provide a combined capacity of nearly 1300 places for anglers. There a further 80 angling vessels with a capacity of 3300 places in the Delta and Wadden zones. These also largely set course for the North Sea.

There is also much angling from open fishing boats. On busy days there are many hundreds of these craft at sea. They like to find wreck sites because that is where fish congregate. Lastly, there is charter sailing with traditional commercial sailing craft, referred to as the "Brown Fleet". These ships also make increasing use of the North Sea.

Source:
Royal Netherlands Yachting Union (KNWV) (1991): information about 3000 permanent and transient places.
Dutch Association of Sportfish Federations (1991). Bootgids 1991.
Ministry of V&W, Directorate-General for Shipping and Maritime Affairs (V&W/DGSM) (1988): density of recreation off the Dutch coast.
Ministry of V&W, RWS, Transportation and Traffic Research Division and Regional Directorate Zeeland Rotterdam/Middelburg (1991): information about the amount of passages through locks.
Foundation on Recreation (1983). Waterrecreatie langs de Nederlandse kust.

Water recreation



Telecommunication cables

There are some 30 cable links between the coastal states of the North Sea. The first cable was laid over the North Sea between Aldeburgh (United Kingdom) and Domburg (the Netherlands) in 1922. This route was chosen because of the shortness of the distance. Three conversations could be carried on over this cable at the same time. The cable consisted of four copper cores. Between 1924 and 1926, two further cables of 16 copper cores each were laid along the same route. A further two cables were added in 1937, each able to carry 12 conversations. The Germans ordered all the cables to be severed on the beach during the Second World War. The most recently laid cables were repaired after the war; the older ones were taken up and scrapped.

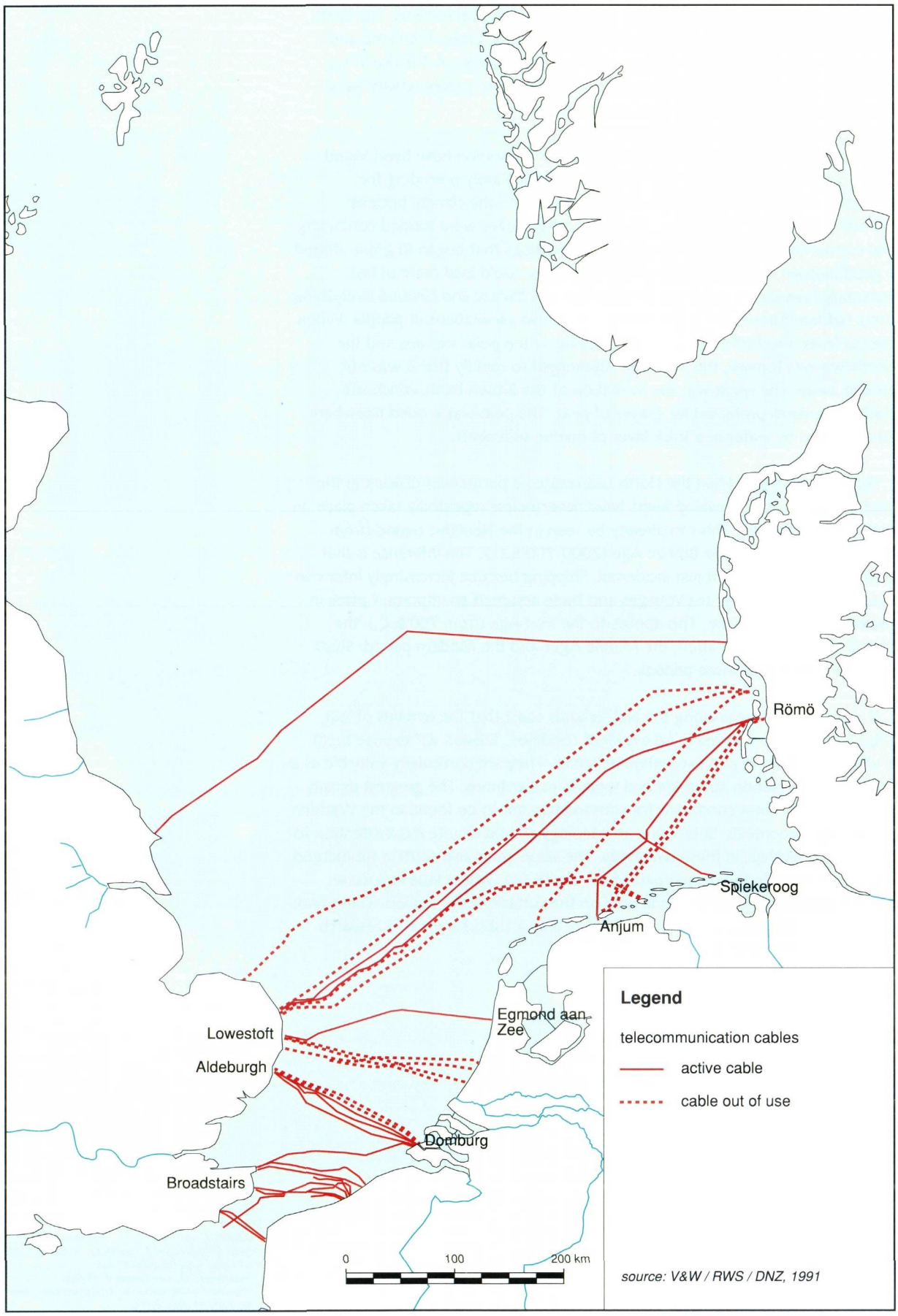
In recent decades, communication by cable has been considerably improved on two fronts: thanks to the use of boosters, the shortest route need no longer be followed, and the use of glass fibre cables means that the capacity can be greatly increased. The most recent cable is a glass fibre cable, which has again been laid between Aldeburgh and Domburg.

Cables on the seabed can obstruct other uses of the seabed and vice versa. This applies particularly to fishing. In contrast to earlier days, the cables are now entrenched and regularly inspected. Moreover, modern seabed fishing gear is provided with anti-cable fouling devices, so that there are few cable breaks caused by fishing. Attempts are being made to limit difficulties caused by cables on the seabed by improving the mapping of the routes of existing cables and by taking other uses into account when new cables are laid.

There are at present two cables over the NCS from the United Kingdom (Winterton) to Germany (Spiekeroog) and Denmark (Rømø). There are also five connections between the United Kingdom and the Netherlands (Broadstairs-Domburg, three cables between Aldeburgh and Domburg, and Lowestoft-Egmond aan Zee) and one cable between the Netherlands and Denmark (Anjum-Rømø). Lastly, there are a further 13 cables on the NCS which are out of use and have partly been removed.

Source:
Ministry of V&W, RWS, North Sea Directorate (V&W/RWS/DNZ) (1991). Overzicht offshore activiteiten Nederlands deel van het Continentaal Plat. Map April 1991.
Ministry of Transport, Public Works and Water Management (1990). Harmonisatie Noordzeebeleid; Noordzeebrief 1990 met voortgangsrapportage actieprogramma. Second Chamber, 1990-1991, 17 408, no. 54. SDU, The Hague.

Telecommunication cables



Sites of archaeological value

The Netherlands delta is extremely rich in archaeological remains. The Delta and coastal zone have been inhabited since prehistoric times. Both land and water were intensively used. Because of the subsiding sobsoil, the rise in sea level and a continuous supply of sediment, the traces of earlier activity have been particularly well covered over and protected.

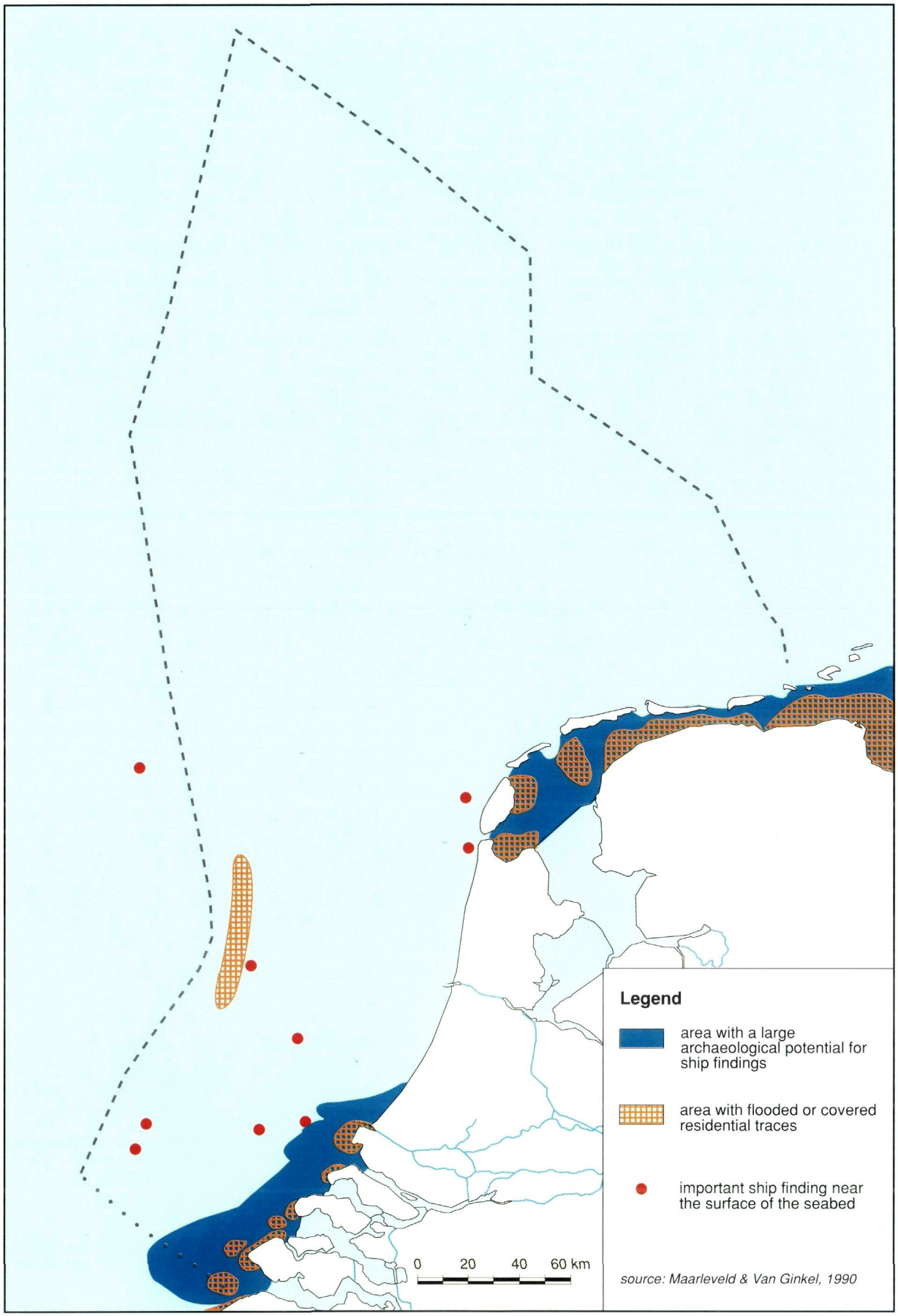
In the middle of the North Sea the remains of habitation have been found. These residential traces date from the period immediately preceding the formation of the North Sea (8000-5000 B.C.). When the climate became warmer and wetter at the end of the last Ice Age, lakes were formed containing and surrounded by a luxuriant vegetation. The bogs that began to grow offered a good biotope for people. For the first time they could lead more or less sedentary lives there. The bogs grew thicker and thicker and covered everything used, hidden, thrown away and lost by successive generations of people. When the sea level rose further through the melting of the polar ice caps and the North Sea was formed, the peat was submerged so rapidly that it was not eroded away. The result was the formation of the Brown Bank, which still contains remains protected by a layer of peat. The peat was eroded elsewhere and replaced by water or a thick layer of marine sediments.

From the moment when the North Sea created a permanent division in the land, parallel cultural developments have nevertheless repeatedly taken place on both sides of the sea. This can already be seen in the Neolithic period (from about 4000 B.C.) and the Bronze Age (2000-700 B.C.). The inference is that overseas contact was not just incidental. Shipping became increasingly intensive in later periods. Fishing, sea voyages and trade assumed an important place in the economy and culture. This applies to the Iron Age (from 700 B.C.), the period of Roman domination, the Middle Ages and the Modern period. Ships were sunk during all those periods.

It is precisely in areas along the Netherlands coast that the remains of lost ships have been preserved in an excellent condition. Erosion will expose them and so will dredging and excavation activities. They are particularly valuable as a source of information about life and work in earlier times. The greatest density of finds and the best conditions for conservation are to be found in the Wadden Sea and the Voordelta. Submarine archaeology should devote most attention to the remains of ships in these two areas. The same areas also contain submerged settlement sites. In the deeper part of the North Sea, where little Holocene sediment remains, finds are made only on the surface of the seabed. These finds are seldom undamaged, however, and they play a subsidiary role in research and conservation policy.

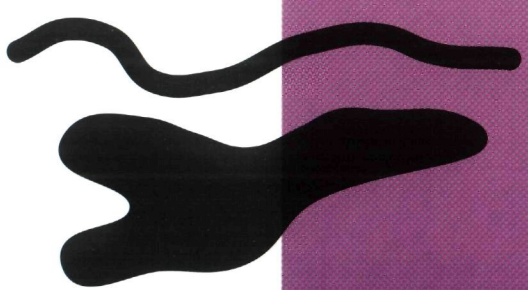
Source:
Adams, J., van Holk, A.F.L., Maarleveld, Th.J. (1990). Dredgers and Archaeology. Shipfinds from the Slufter. ISBN 90-800467-1-X.
Maarleveld, T., van Ginkel, E. (1990). Archeologie onder water. Verleden van een varend volk. ISBN 90-290-96196

Sites of archeological value



Effect of spatial use on the environment

Oil pollution (map 82 and 83)
Eutrophication (map 84)
Contamination of organisms (map 85 to 88)
Fish diseases (map 89 to 91)



Reported oil spills in 1989

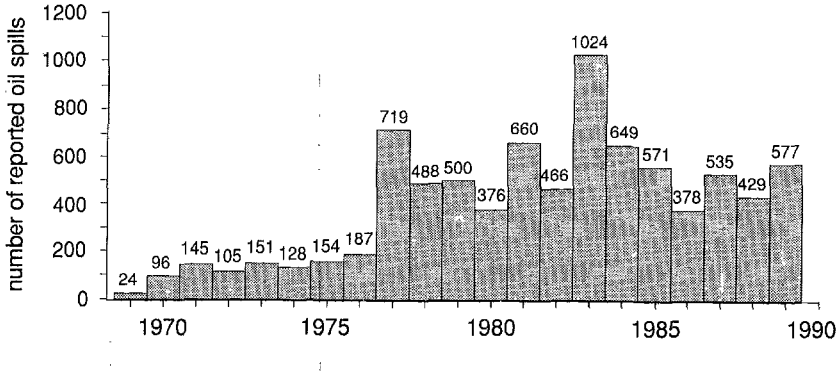
Shipping and offshore activities cause oil pollution. This may be the result of accidents, operational discharges or illegal discharges. Operational discharges are permitted. They occur during the washing out of tanks or drilling for oil (94). Illegal discharges are discharges which exceed the permitted standards. They are usually visible in the form of slicks and currently constitute the most important source of oil pollution on the North Sea. Seabirds are their most frequent victim. Moreover, fishing and recreational interests may be harmed if an oil slick reaches the coast.

Oil spills have been recorded by RWS since 1969. An aircraft has been available for detection since 1975. It has been equipped with remote sensing apparatus since 1983, so that observations can also be made at night and in fog. This initially resulted in a steep increase in the number of oil slicks reported (see graph). Flights have been made by the Coastguard since 1987.

A total of 577 oil spills was reported on the NCS in 1989. In 61 instances the cause was a ship and in 74 instances an offshore installation. In the other instances the cause was unknown. The relationship between shipping and oil slicks is clearly visible in the shipping route along the Wadden Islands. Statistical studies have shown that most of the slicks have a volume of under 1 m^3. Slicks with a volume of 50 to 1000 m^3 seldom occur, but do make up the greater part of the total oil pollution by shipping and offshore activities. The provisions for cleaning up oil slicks are aimed mainly at these large slicks. In 1989 the magnitude of an oil slick was so great on five occasions, that it was dealt with by the Coastguard at sea.

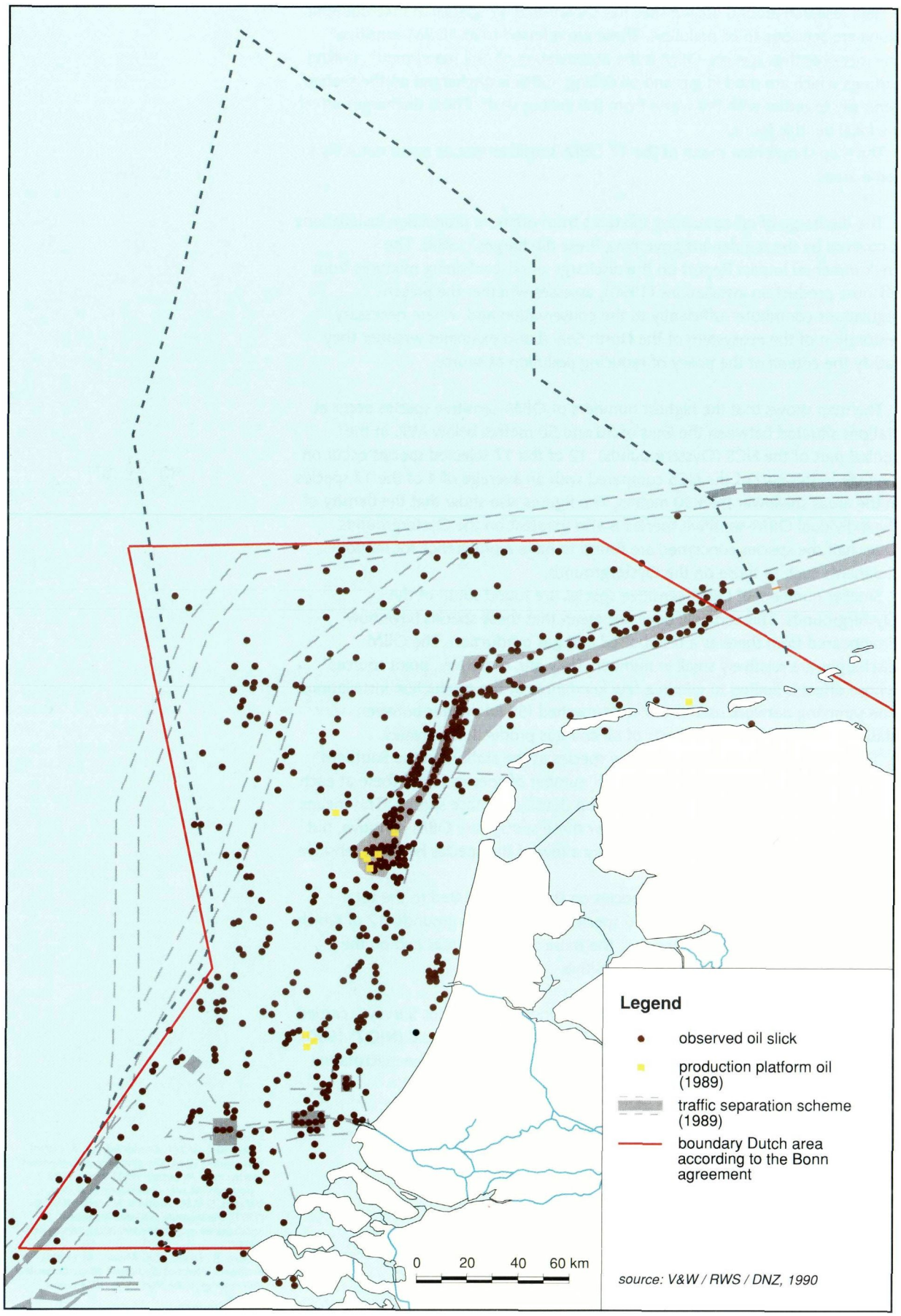
Because the map shows data for 1989, the traffic separation schemes existing at that time is shown.

Total number of reported oil spills in 1969 - 1989



Source:
Ministry of V&W, RWS, North Sea Directorate (V&W/RWS/DNZ) (1990). Olieverontreinigings-rapportage 1989. Notitie NZ-N-90.05.

Reported oil spills in 1989



Macrobenthic species sensitive to oil pollution

Field research around drilling sites has shown that 17 species of macrobenthic fauna are sensitive to oil pollution. These are referred to as "OBM-sensitive" macrozoobenthos species. OBM is the abbreviation of "oil based mud", drilling cuttings which are used in gas and oil drilling. OBM is discharged on the seabed, generally together with the waste from the drilling shaft. These discharges affect the local benthic fauna.

The map shows how many of the 17 OBM-sensitive species occur naturally in some areas.

The discharge of oil-containing mixtures from offshore production installations is covered by the regulations governing these discharges (1988). The Environmental Impact Report on the discharge of oil-containing mixtures from offshore production installations (1990), assesses whether the present regulations contribute sufficiently to the conservation and, where necessary, restoration of the ecosystem of the North Sea. It also examines whether they satisfy the criteria of the policy of reducing pollution at source.

The map shows that the highest numbers of OBM-sensitive species occur at stations situated between the lines of 30 and 50 metres below MSL in the central part of the NCS (Oystergrounds). 12 of the 17 selected species occur on average in this part of the NCS compared with an average of 4 of the 17 species in the areas shallower than 30 metres. The figures also show that the density of the individual OBM-sensitive species is also greatest on the Oystergrounds. Over half the species concerned are found to have a preference for muddy sediments such as those on the Oystergrounds.

Smaller numbers of OBM-sensitive species are found south of the Oystergrounds. This certainly does not mean that these species have now disappeared from there as a result of oil and gas production. The OBM discharges are relatively small in number. They are, moreover, point sources whose effect is limited to within a few kilometres of the production installations. The sampling network used is too wide-meshed (55 kilometres between stations) to show the local effects of oil and gas production activities.

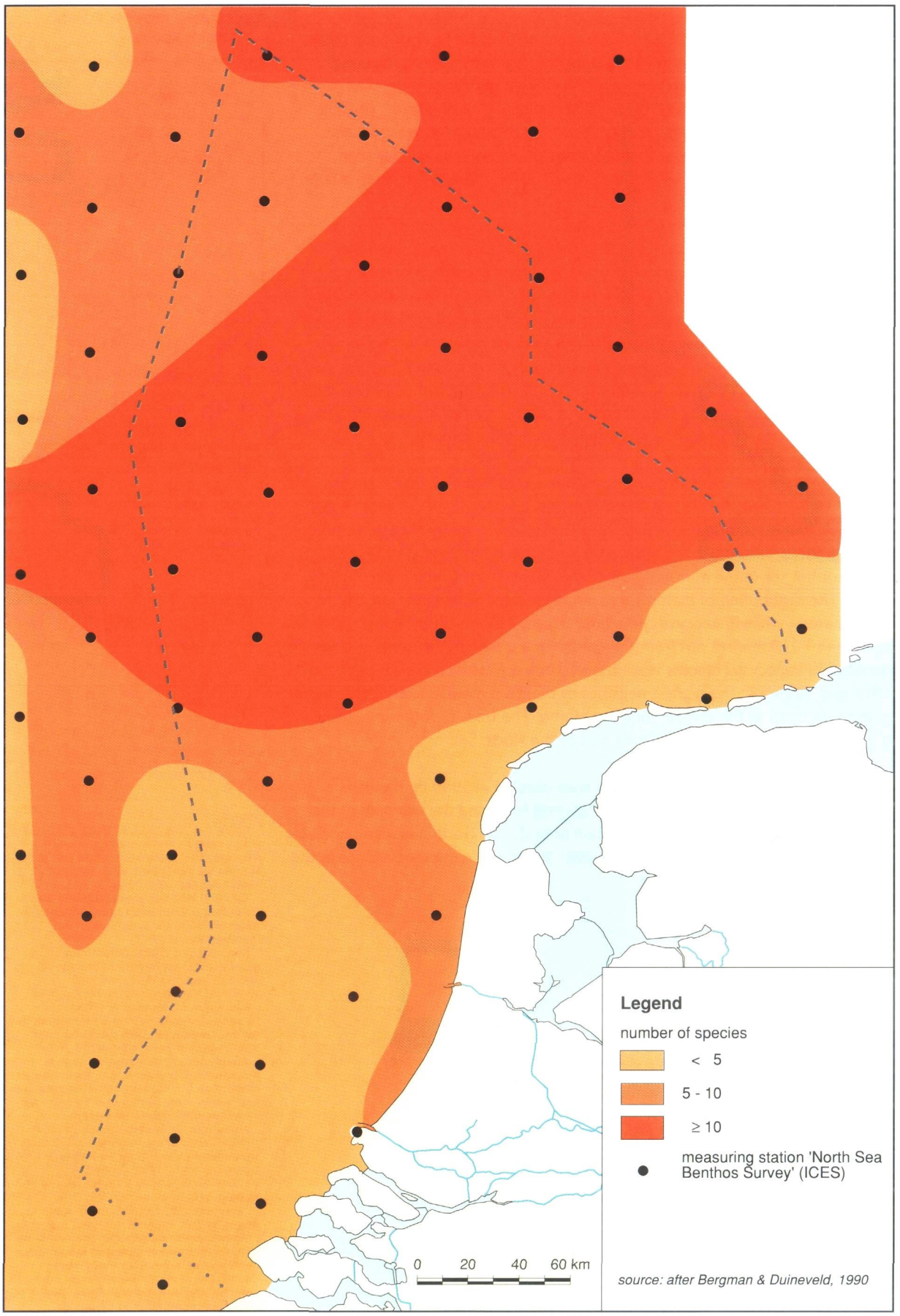
The small number of OBM-sensitive species at the stations in the Southern Bight is related to the relatively low total number of species found there at each station and to the naturally low population density of those species. This means that it is difficult to demonstrate whether these species are OBM-sensitive, but one may not conclude from this that only a few of the species here are sensitive to OBM pollution.

The number of OBM-sensitive species on the NCS is related to the total number of species. This averages 56 species on the Oystergrounds, 12 of which are OBM-sensitive, and 31 species in the more southerly areas and on the Dogger Bank, 4 of which are OBM-sensitive.

The map is based on data from the ICES "North Sea Benthos Survey", carried out in April-May 1986 and reworked by Bergman and Duineveld (NIOZ; 1990). Five seabed samples were taken at each sampling station and the macrofauna was identified.

Source:
Bergman, .M.J.N., Duineveld, G.C.A. (1990). Verspreiding van OBM-gevoelige macrobenthos-soorten in de Noordzee. NIOZ-report 1990-7.
Bergman, M.J.N., Lindeboom, H.J., Peet, G., Nelissen, D.H.M., Nijkamp, H., Leopold, M.F. (1991). Beschermde gebieden Noordzee - noodzaak en mogelijkheden. NIOZ/LNV-report 1991-3.
Daan, R., Lewis, W.E., Mulder, M. (1990). Biological effects of discharged oil-contaminated drill cuttings in the North Sea. NIOZ-report 1990-5.

Macrobenthic species sensitive to oil pollution



Potentially toxic or inconvenient algae in 1989

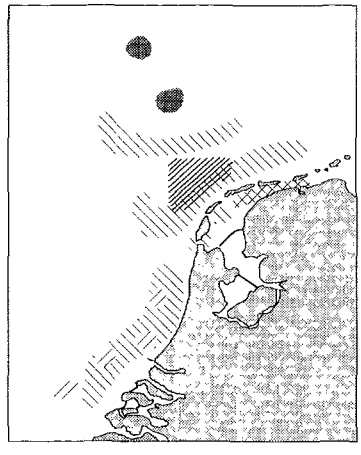
The phytoplankton in Netherlands coastal waters is dominated by diatoms (siliceous algae). In seasons of "algal blooms" the biomass increases steeply to five to ten times the average winter value. During summer periods the microflagellates and dinoflagellates, which include a number of potentially toxic species, predominate. The blooming and formation of floating layers of algae are partly caused by an excess supply of nutrients, notably nitrogen (N) and phosphorus (P) under suitable climatic conditions, i.e. sunny weather and absence of mixing of the water column, which often occurs when there is little wind.

Probably, there has been an increase in the size of algal blooms and the frequency of their occurrence since the 1950s. This is related to increased eutrophication over this period. During the period 1979 to 1990 between 30 and 10,000 km^2 of the sea surface on the NCS were covered with floating layers of algae for one or more days during the growing season (spring-summer-autumn). These massive surface algal layers, usually consisting of *Noctiluca*, are not toxic as such, but may cause a reduction in the oxygen content when they die off, thus threatening the lives of fish and benthic fauna. Areas where very low oxygen concentrations may occur are shown in the figure.

In spring the non-toxic microflagellate *Phaeocystis pouchetii* is dominant. This alga forms gelatinous colonies a few millimetres across, which are whipped up into foam in the surf and on the beaches. During calm weather in late summer, dinoflagellates, including toxic ones, may be dominant in coastal zones and farther out at sea in the northern part of the Netherlands Continental Shelf (NCS). The distribution of diatoms and dinoflagellates is generally not tied to specific areas, while *Phaeocystis pouchetii* usually blooms on the coast, but may also do so 70 kilometres out from the coast. An increase in the duration and density of *Phaeocystis* blooms was observed in the Marsdiep (Texel) between 1973 and 1985/88. The highest densities of the toxic dinoflagellate *Dinophysis acuminata* occur in the coastal zone in autumn. The toxic *Gyrodinium aureolum* is now also found in the Netherlands part of the North Sea.

The Algal Pollution Reporting System was installed in 1989 by the Paris Commission (Working Group on Nutrients) and following the example of the Bonn Agreement (combatting oil pollution at sea). The North Sea member states can use this system to inform and warn each other and request assistance in the event of toxic algal blooms at sea.

Oxygen deficiency in Dutch marine waters



4 - 8 mg O_2/l ('89 - '90) (during stratification)

Regular O_2 deficiency (high organic load)

6 - 7 mg O_2/l ('88) (during Noctulica bloom)

Potential O_2 deficiency ('79 - '90) (during Noctulica bloom)

Source:

Cadee, G.C., Hegeman, J. (1986). Seasonal and annual variation in Phaeocystis pouchetii (Haptophyceae) in the western most inlet of the Wadden Sea during the 1073 to 1985 period. Neth. J. Sea Res. 20: p. 29-36.

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Rademaker, M. (1989). Determinatie fytoplankton in het Nederlands deel van de Noordzee, augustus 1988 - juni 1989. V&W/RWS/DNZ report NZ-N-89.17, p. 1-18

Rademaker, M., Koeman, R. (1990). Determinatie fytoplankton in het Nederlands deel van de Noordzee, juli 1989 - december 1989. V&W/RWS/DNZ report NZ-N-89.19, p. 1-7.

Zevenboom, W., de Vreugd, R.I., van de Nieuwendijk, L.J., Vransen, R.C., Rademaker, M. (1989). Trends in nutrients, NIP ratios, chl.a., and algal species in the Dutch part of the North Sea. V&W/RWS/DNZ nota NZ-N-89.13.

Zevenboom, W., Rademaker, M., Colijn, F. (1990). Exeptional algal blooms in Dutch North Sea waters. Int. Conf. North Sea Pollution, September, 10-14, 1990, Amsterdam. V&W/RWS/DNZ&DGW & TRIPOS nota NZ-N-90.06, p. 1-13.

Zevenboom, W., Colijn, F., Laane, R.W.P.M., Peeters, W.C.H., Peperzak, L. (1991). Basic maps of agreed adverse eutrophiation phenomena and administration map of (potential) eutrophication problem areas in the Dutch marine waters. Contribution of the Netherlands to the mapping excercise. App. 3 revised NUT 6/6/4. V&W/RWS/DNZ&DGW report NZ-N-91.07; app. 3.

Potentially toxic or inconvenient algae in 1989