82

Indicator system for biodiversity in Dutch marine waters

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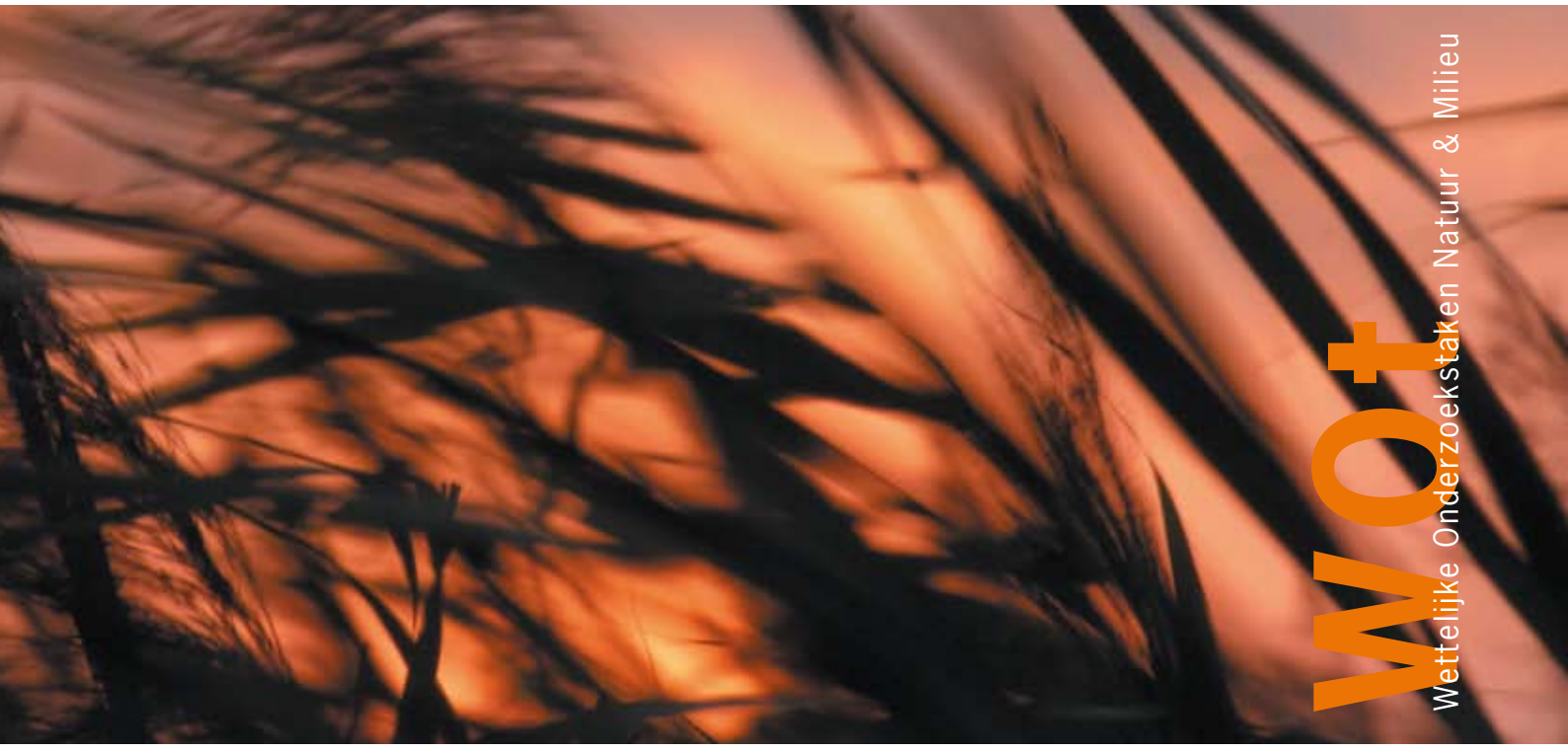
P.J.H. Reijnders & R. Witbaard

rapporten



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Wettelijke Onderzoekstaken Natuur & Milieu

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Indicator system for biodiversity in Dutch marine waters

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WOt Report 82 presents the findings of a research project commissioned by the Netherlands Environmental Assessment Agency (PBL) and funded by the Dutch Ministry of Agriculture, Nature and Food Quality (LNV). This document contributes to the body of knowledge which will be incorporated in more policy-oriented publications such as the Nature Balance and Environmental Balance reports, and Thematic Assessments.

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II. Ecoprofiles of indicator species for Wadden Sea, North Sea and Delta Area

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Rapport 82

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Abstract
Meesters, H.W.G., R. ter Hofstede, C.M. Deerenberg, J.A.M. Craeijmeersch, I.G. de Mesel, S.M.J.M. Brasseur, P.J.H. Reijnders & R. Witbaard with contributions by SOVON, 2008. *Indicator system for biodiversity in Dutch marine waters; II. Ecoprofiles of indicator species for Wadden Sea, North Sea and Delta Area*. Wageningen, Statutory Research Tasks Unit for Nature and the Environment. WOt-report 82. 164 p; 4 Tab.; 17 Ref. 1 Annex.

The report presents a large number of brief ecological descriptions, so-called ecoprofiles, of important indicator species for the Dutch marine waters. The species include birds, fish, sea mammals and invertebrates. Each ecoprofile offers information on important characteristics of the species, such as morphometric data, life history information, diet and dispersal information. It also provides information on the species' sensitivity to environmental pressures and on the current monitoring programme and the data set available. Where available, mean numbers for each indicator are presented for the Wadden Sea, North Sea and Delta Area (in the south-western part of the Netherlands) over the 2001-2004 and 1999-2002 periods. Most ecoprofiles include natural reference values that are subsequently used to calculate Nature Quality. Results show that nature quality can differ substantially between indicators, periods and regions. The report argues for careful evaluation of the choice of indicators used to assess marine biodiversity.

Keywords: marine indicators, North Sea, Wadden Sea, Delta Area, biodiversity, ecoprofiles, nature quality, natural capital index.

Referaat
Meesters, H.W.G., R. ter Hofstede, C.M. Deerenberg, J.A.M. Craeijmeersch, I.G. de Mesel, S.M.J.M. Brasseur, P.J.H. Reijnders & R. Witbaard, met bijdragen van SOVON, 2008 *Indicatorsysteem voor biodiversiteit in Nederlandse mariene wateren, II Ecoprofielen van indicatorsoorten voor de Waddenzee, Noordzee en Delta.* Wageningen, Wettelijke Onderzoekstaken Natuur & Milieu, WOt-rapport 82. 164 blz.; 4 tab.; 17 ref. 1 Bijlage.

In het rapport wordt een groot aantal korte ecologische beschrijvingen, zogenaamde ecoprofielen, gepresenteerd voor belangrijke indicatorsoorten voor de Nederlandse mariene wateren. Het gaat hierbij om vogels, vissen, zeezoogdieren en invertebraten. Elk ecoprofiel biedt informatie over belangrijke kenmerken van de soort, zoals morfometrische gegevens en informatie over leefwijze, voedingsgewoonten en verspreidingsmechanismen. Voorts bevat het profiel informatie over de gevoeligheid van de soort voor milieudruk en over bestaande monitoringsprogramma's en beschikbare gegevensverzamelingen. Voor elke indicatorsoort worden (voor zover beschikbaar) de gemiddelde aantallen gegeven voor de Waddenzee, Noordzee en het Deltagebied, over de periode 2001-2004 en 1999-2002. In de meeste ecoprofielen zijn ook natuurlijke referentiewaarden opgenomen, die worden gebruikt om de natuurkwaliteit te berekenen. Uit de resultaten blijkt dat de natuurkwaliteit sterk kan verschillen tussen de diverse indicatorsoorten, perioden en locaties. Gepleit wordt voor een zorgvuldige evaluatie van de keuze van indicatorsoorten voor de bepaling van de mariene biodiversiteit.

Trefwoorden: mariene indicatorsoorten, Noordzee, Waddenzee, Deltagebied, biodiversiteit, ecoprofielen, natuurkwaliteit, Natural Capital Index

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Preface

This report is one of the results of a long-term programme commissioned by the Netherlands Environmental Assessment Agency (PBL) and carried out as statutary research task by IMARES. The programme aims to develop an indicator system for the marine environment that can be used to evaluate the status and biodiversity of the marine environment and the effectiveness of nature policy. The programme started in 2003 with a general overview of marine indicators and relevant international agreements, and resulteding in a list of potential indicators. The present report is a follow-up to that overview; it evaluates current knowledge about a large number of these indicators and presents a preliminary calculation of nature quality. The project was carried out in cooperation with SOVON, the Dutch Centre for Field Ornithology.

Erik Meesters,
Project manager

Inhoud

Summary

One of the most important issues in efforts to assist policy makers is the development of biodiversity indicators that accurately reflect the state of the environment. The Netherlands Environmental Assessment Agency (PBL) has developed a system of indicators to assess current biodiversity. Nature quality in terms of biodiversity is expressed as a percentage of the biodiversity that would exist in a natural situation, without human disturbance. Previous studies by IMARES have provided information on relevant biodiversity indicators for the marine environment based on international treaties, research and data availability.

This report presents a number of brief ecological profiles, so-called ecoprofiles, for important species of the Dutch marine waters. The species include birds, fish, sea mammals and invertebrates. Each ecoprofile offers information on important state variables such as morphometric data, life history, diet and dispersal. It also provides information on species' sensitivity to environmental pressures and on the monitoring programme and data set available. Where available, mean numbers for each indicator are presented for the Wadden Sea, North Sea and Delta Area for the 2001-2004 and 1999-2002 periods. Where possible, natural reference values are given. Finally, nature quality is calculated for each area in each period. Results show that nature quality can differ substantially between indicators, periods and regions.

Samenvatting

Een van de belangrijkste aspecten om beleidsmakers te ondersteunen, is de ontwikkeling van biodiversiteitsindicatoren die de toestand van de omgeving adequaat weergeven. Het Planbureau voor de Leefomgeving (PBL) heeft een systeem van indicatoren ontwikkeld om de huidige biodiversiteit te bepalen. De natuurkwaliteit voor de biodiversiteit wordt hierbij uitgedrukt als percentage van de biodiversiteit die zou bestaan in een natuurlijke situatie, zonder menselijke verstoring. Eerdere onderzoeken van IMARES hebben informatie opgeleverd over relevante biodiversiteitsindicatoren voor de mariene omgeving, gebaseerd op internationale verdragen, onderzoek en beschikbare gegevens.

In dit rapport wordt een aantal korte ecologische profielen (zogenaamde 'ecoprofielen') gepresenteerd van voor de Nederlandse mariene wateren belangrijke soorten. Het gaat hierbij om vogels, vissen, zeezoogdieren en invertebraten. Elk ecoprofiel biedt informatie over belangrijke kenmerken van de soort, zoals morfometrische gegevens, informatie over de leefwijze, voedingsgewoonten en verspreidingsmechanismen. Voorts bevat het profiel informatie over de gevoeligheid van de soort voor milieudruk en over bestaande monitoringsprogramma's en beschikbare gegevensverzamelingen. Voor elke indicatorsoort worden (voor zover beschikbaar) de gemiddelde aantallen gegeven voor de Waddenzee, Noordzee en Deltagebied, over de periode 2001-2004 en 1999-2002. Waar mogelijk worden natuurlijke referentiewaarden gegeven. Ten slotte wordt voor elk gebied en voor elke periode de natuurkwaliteit berekend. Uit de resultaten blijkt dat de natuurkwaliteit sterk kan verschillen tussen de diverse indicatorsoorten, perioden en locaties.

1 Introduction

The Netherlands Environmental Assessment Agency (PBL, formerly MNP) assists national and international policy makers by analysing the environmental impact of policies and of trends in society. PBL provides independent integrated assessments on topics such as sustainable development, energy, air quality, transport, land use, climate change and biodiversity.

One of the most important issues in the efforts to assist policy makers is the development of biodiversity indicators that adequately express the state of the environment (UNEP 1997; Van Breukelen & Ten Brink 2000; Ten Brink *et al.* 2000; Ten Brink *et al.* 2002; Ten Brink & Tekelenburg 2002; Meesters *et al.* 2008). Such indicators are also needed to implement the goals of the Convention on Biological Diversity (CBD). At a 2002 conference in The Hague, the member states agreed to significantly reduce the rate of loss of biodiversity by 2010 at the global, regional and national levels. Shortly afterwards, the European Union and all other European nations agreed to halt the loss of biodiversity by 2010 ("Fifth Ministerial Conference Environment for Europe", Kiev, 2003). In 2004, a global agreement was reached on a small number of indicators for immediate testing in order to review the progress towards the 2010 target and guide policy makers in finding effective measures. Four global indicators of the state of biodiversity have been selected to evaluate the progress towards the 2010 target, for immediate testing: trends in the size of selected biomes, ecosystems and habitats; trends in the abundance and distribution of selected species; changes in the status of threatened species and trends in the genetic diversity of domesticated animals, cultivated plants and fish species of major socio-economic importance.

In May 2004, the 'Message of Malahide' listed a preliminary set of European Biodiversity Headline indicators to evaluate the progress towards the 2010 target at the European level, similar to the above CBD indicators. The European Council urged the European Commission to develop, test and finalise this set by 2006. For reasons of efficiency and consistency, the CBD has recommended the use of similar indicators at the global, regional and national levels. Since 1997, the Dutch government has actively contributed to the consistent development of global and regional indicators in the CBD, OECD and European contexts. The 'Natural Capital Index' (NCI) is an indicator that approximates terrestrial and aquatic biodiversity of natural ecosystems and agricultural land. The NCI regards biodiversity as a stock entity containing all original species and their corresponding abundance values. The NCI is the average abundance of the original species compared to their abundance in the natural or virtually unaffected (pre-industrial) state. NCI is calculated as the product of the size of the remaining ecosystem (quantity) and its quality. The quality is calculated from a representative cross-section of the original species, the so-called shopping bag approach. A crucial question is whether the current trends in species biodiversity loss are likely to continue in the future. The lack of a quantitative overview of global species trends makes it difficult to project development trends into the future.

This report presents brief ecological descriptions, so-called ecoprofiles, for a subset of species that are relevant to the status of the ecosystem from which the organisms originate. The purpose of the ecoprofiles is to collect in one place information on life history variables that can subsequently be used to build models and to understand changes in the indicator. For many species, the most difficult part is to determine a reference value with which the current value can be compared to obtain a relative quality that can be used to calculate the NCI. An example calculation is given in chapter 6. Not all indicators listed in part I of this study

(Meesters *et al.* 2008) are presented here, mainly due to the limited amount of resources available for the present study, but the set of indicators can be easily extended to include more birds and fish. The level of temporal (and spatial) variation in the data differs between and within species groups. Variations in bird numbers are generally smallest, while fish and invertebrates are more difficult to monitor because of the large temporal and spatial variations in the mortality rates, settlement and survival of many species.

2 Birds

2.1 Introduction

In this chapter we give an overview of the birds that, together with SOVON, were chosen to best represent the three marine ecosystems, North Sea, Wadden Sea and Delta Area. This is a minimum set of indicators due to the limited resources available within this study. Other birds can be added to make the whole set larger and increase the robustness of the nature quality. SOVON has indicated that the list can easily be extended to include many more species.

For birds a distinction is made between breeding and non-breeding birds. For breeders the yearly number is given over the period 2000-2004. For non-breeders a 3-yearly moving average is given, based on the fact that numbers may vary considerably as a consequence of the winter situation. The recent period is given as a 3-yearly moving average of the counting seasons from 1999-2000 till 2001-2002. The present situation as a 3-yearly moving average of the counting seasons from 2001-2002 till 2003-2004.

Units: Especially for non-breeders the collection method may have a strong effect on the way that yearly indices are expressed. In some cases a monthly mean based on the values from July – June of the selected period. For other species the mid winter counts (January) are more appropriate.

Table 1. Overview of the selected birds (English and Dutch names) and the area for which they will be used. Abbreviations: NB, non-breeders; B, breeders; MM, monthly mean; BP, number of breeding pairs per year; I, index; MW, mid-winter counts.

Species	North Sea	Wadden Sea	Delta Area	Type
Pied Avocet - Kluut (B)		x	x	BP
Little Tern - Dwergstern (B)	x		x	BP
Kentish Plover - Strandplevier (B)	x	x	x	BP
Common Tern - Visdief (B)	x	x	x	BP
Common Eider breeding - Eidereend (B)		x		BP
Sandwich Tern - Grote stern (B)	x	x	x	BP
Eurasian Oystercatcher - Scholekster (B)		x		I
Great Cormorant - Aalscholver (NB)		x	x	MM
Sanderling- Drieteenstrandloper (NB)	x	x	x	MM
Great Knot – Kanoet (NB)		x	x	MM
Grey Plover - Zilverplevier (NB)		x	x	MM
Eurasian Oystercatcher - Scholekster (NB)		x	x	MM
Bar-tailed Godwit - Rosse Grutto (NB)		x	x	MM
Dunlin - Bonte strandloper (NB)		x	x	MM
Dark-bellied Brent Goose - Zwartbuikrotgans (NB)		x	x	MM
Common Eider, non breeding - Eidereend (NB)		x		MW

An extensive explanation of the chosen birds, units and reference values is given in Appendix 1.

2.2 Calidris alba (Sanderling / Drieteenstrandloper)

Species common name	Sanderling
Scientific name **Dutch name**	*Calidris alba* Drieteenstrandloper

Ecological data

Guild ○ herbivore ○ piscivore ○ omnivore ● *scavenger* ○ detritivore ○ planktivore ● *molluscivore* ● *other: mainly feeds on small molluscs, crustaceans and polychaete worms*	**Max. Body weight (adults)** male: 0.058 kg (average) female: 0.060 kg (average) **Max. Length:** between 20 and 21 cm (average) **Maturity age:** between 1 and 2 years/months (average) **Reproduction:** *irrelevant* **Age:** 13 years (maximum) **Density/biomass (in optimal habitat):** *irrelevant* **Home range:** *irrelevant* **Dispersal distance:** *irrelevant* **For populations: estimate of minimal viable population size per area:** *irrelevant*

Geografical	**Habitat**	**Fysical/chemical**
Distribution ● *Coastal* ● *Wadden Sea* ● *Delta Zeeland (saline)*	**Position in the water column** ○ pelagic; average depth between…and…m ○ demersal ○ planktonic; average depth between…and…m ○ benthic ● *irrelevant*	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ● eutrophic
Migratory behavior ○ sedentary ● *migratory* ○ variable/dependent on geographical location	**Seabed/bottom preferences** ● *sand* ○ gravel ○ mud ○ rock	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ● *irrelevant*
	Intertidal ○ preferred height (relative to MHT) ● *other preferences: sandy beaches and emersed sandbanks, in particular forages along water line*	**Salinity** ● *saline* ○ brackish ○ freshwater

General description non-breeding habitat

Foraging habitat: prefers open beaches and edges of sand banks for foraging, avoids sediments with high lutum content; forages in small groups along waterline.

Roosts: near foraging areas, in same habitat and also other coastal locations with stony or muddy substrate, usually occurs less often in mixed species high tide roosts than other stilts.

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation	○ Invasive species	○ Food	○ Building material
○ Habitat destruction	○ Disease	○ Medicine	○ Energy
○ Overfishing/overharvesting	○ Poisoning	○ Recreation	○ Other:….
○ Bycatch	○ Sea surface temp. incr.		
● *Human disturbance, however seems less shy to humans than other stints*	○ Sea level change		
○ Natural disturbance	○ Oil/gass extraction		
○ Pollution	○ Ship traffic		
○ Eutrophication	○ Other…..		
○ Wind farms			

Data set information

Waterfowl non-breeding

- **Name of data set or monitoring programme**
  Waterbird census scheme in The Netherlands (part of NEM (Network Ecological Monitoring))
- **Measurement unit**
  Number of individuals
- **Brief description of contents data set and/or monitoring programme or hyperlink**
  The waterbird scheme aims to assess (1) national and regional (site-based) trends, and (2) national wintering or migratory populations during international counts in September (Greylag Goose), November (Anser geese), January (all waterbird species), March (Barnacle Goose) and May (Dark-bellied Brent Goose). These international surveys are co-ordinated by Wetlands International. Monitoring in the Wadden Sea is part of a trilateral cooperation between The Netherlands, Germany and Denmark (Trilateral Monitoring and Assessment Program, TMAP). The waterbird scheme is based on monthly counts of monitoring areas and goose/swan staging sites, that are carried out on high tide). Census effort focuses on September-April, when highest numbers are present in most species. In January many additional sites are counted whereas in national freshwater bodies, Delta Area and Wadden Sea counts are also covered in (part of) the period May-August. Due to its size, the Wadden Sea can not be covered monthly. Here, counts refer to a combination of 4 complete counts and bi-weekly or monthly counts at 10 sample sites, together allowing a reliable trend assessment for the entire season.
- **Brief description/reference/hyperlink of sampling method**
  Complete counts of all present individuals in a census area
- **Begin date of data set**
  1975/1976
- **Are other data sets available (give dates)**
  See Appendix 1 by SOVON.

Numbers and distribution

Distribution is concentrated in coastal zone of North Sea, and sand banks in Westerschelde and Oosterschelde. Numbers have increased since early nineties.

- **Mean values**

Sanderling - Drieteenstrandloper	North Sea	Wadden Sea	Delta Area
Present (01/02-03/04)	2383	6946	1526
Recent (99/00-01/02)	1804	4952	1094
Reference value	1700	1300	600

Measurement Unit: 3 yearly moving average of monthly mean (Juli-June) of each year.

Reference values: No numbers are available of the wintering populations from the first half of the previous century. Reliable numbers are only available from the mid seventies for the Wadden Sea and from the end of the eighties for the Delta Area. Reference values are based on a detailed study by Van Turnhout & Van Roomen (2005).

Distribution data if available (preferably send digital maps otherwise description)

See Appendix 1 by SOVON. Updates of its distribution are published in the annual SOVON-waterbird census reports (e.g. Van Roomen *et al*. 2004). The monthly distribution 1979-1985 has been published in SOVON (1987). Additional historical information on distribution and numbers is summarized in Bijlsma *et al*. (2001).

Monitoring network information

- Name of monitoring network
  NEM
- Brief description of network/hyperlink
  http://www.siliconmeadow.nl/~nemweb/index.html
- Other variables measured in network
  Trends and distributions of populations of other taxonomic groups
- Contact for network
  http://www.siliconmeadow.nl/~nemweb/index.html
- Starting date network
  1995
- Guaranteed continuation of network till what date/year
  Formally till 2006/2007 (agreements for a year), however long term continuation is probable
- Name/map of area covered by network
  The Netherlands
- Reference of last network progress report
  Van Strien A. 2005. Landelijke natuurmeetnetten van het NEM in 2004. Kwaliteitsrapportage NEM. Kengetal J-67, Centraal Bureau voor de Statistiek, Voorburg, The Netherlands.
- Restrictions on availability of data
  Availability original census data not (always) free of charge

2.3 Calidris canutus canutus/islandica (Great Knot / Kanoet)

Species common name	**Great Knot**
Scientific name	**Calidris canutus canutus/islandica**
Dutch name	**Kanoet**

Ecological data non-breeding

Guild ○ herbivore ○ piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ● *molluscivore* ○ other: ….	**Max. Body weight (adults)** male: 0.176 kg (average) female: 0.176 kg (average) **Max. Length:** between 23 and 25 cm (average) **Maturity age:** between 2 and 3 years (average) **Reproduction:** irrelevant **Age:** 16 years (maximum) **Density/biomass (in optimal habitat):** irrelevant **Home range:** irrelevant **Dispersal distance:** irrelevant **For populations**: **estimate of minimal viable population size per area:** irrelevant

Geografical	**Habitat**	**Fysical/chemical**
Distribution ● *Wadden Sea* ● *Delta Zeeland (saline*)	**Position in the water column** ○ pelagic; average depth between…and…m ○ demersal ○ planktonic; average depth between…and…m ○ benthic ● *irrelevant*	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ● *eutrophic*
Migratory behavior ○ sedentary ● *migratory* ○ variable/dependent on geographical location	**Seabed/bottom preferences** ○ *sand* ○ gravel ● *mud* ○ rock	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ● *irrelevant*
	Intertidal ○ preferred height (relative to MHT) ● *other preferences: foraging habitat: tidal flats*.	**Salinity** ● *saline* ○ brackish ○ freshwater

General description non-breeding habitat

Foraging habitat: tidal areas with sandy or muddy sediment; forages in large compact group over large areas. They can use 800 km^2 tidal area during one tidal-cycle.

Roosts: Collective high tide roosts are located on bare, undisturbed sand banks

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
• *Habitat degradation, dredging could result in geomorphological changes of tidal areas and thus the quality of tidal flats* • *Habitat destruction: root up of sediment by mechanical cockle fishery leads to changes in composition of prey species and leads to decrease of numbers* • *Human disturbance, species aggregates in few large flocks, thus is sensitive to recreation and disturbance by air traffic*	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. • *Sea level change could result in geomorphological changes of tidal areas and thus the quality of tidal flats* ○ Oil/gass extraction ○ Ship traffic	○ Food ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other:….

Data set information

Waterfowl non-breeding

- **Name of data set or monitoring programme**
  Waterbird census scheme in The Netherlands (part of NEM (Network Ecological Monitoring))
- **Measurement unit**
  Number of individuals
- **Brief description of contents data set and/or monitoring programme or hyperlink**
  The waterbird scheme aims to assess (1) national and regional (site-based) trends, and (2) national wintering or migratory populations during international counts in September (Greylag Goose), November (Anser geese), January (all waterbird species), March (Barnacle Goose) and May (Dark-bellied Brent Goose). These international surveys are co-ordinated by Wetlands International. Monitoring in the Wadden Sea is part of a trilateral cooperation between The Netherlands, Germany and Denmark (Trilateral Monitoring and Assessment Program, TMAP). The waterbird scheme is based on monthly counts of monitoring areas and goose/swan staging sites, that are carried out on high tide). Census effort focuses on September-April, when highest numbers are present in most species. In January many additional sites are counted whereas in national freshwater bodies, Delta Area and Wadden Sea counts are also covered in (part of) the period May-August. Due to its size, the Wadden Sea can not be covered monthly. Here, counts refer to a combination of 4 complete counts and bi-weekly or monthly counts at 10 sample sites, together allowing a reliable trend assessment for the entire season.
- **Brief description/reference/hyperlink of sampling method**
  Complete counts of all present individuals in a census area
- **Begin date of data set**
  1975/1976
- **Are other data sets available (give dates)**
  See appendices SOVON
- **Frequency of monitoring and next monitoring date**
  Census effort monthly at least September-April, many additional sites once a year in January

Numbers and distribution

Distribution is limited to extensive tidal areas in Wadden Sea, Oosterschelde and Westerschelde. Numbers in the Wadden Sea increased between 1975 and 1993, but have decreased since 1993. However numbers in the Delta Area have increased since 1988.

- **Mean values**

Great Knot - Kanoet	North Sea	Wadden Sea	Delta Area
Present (01/02-03/04)	-	36555	8884
Recent (99/00-01/02)	-	48568	8842
Reference value	-	40000	6000

Measurement Unit: 3 yearly moving average of monthly mean (July-June) of each year.

Reference values: No numbers are available of the wintering populations from the first half of the previous century. Trustworthy numbers are only available from the mid seventies for the Wadden Sea and from the end of the eighties for the Delta Area. For the Wadden Sea 1975-1990 has been chosen as a reference period because of the large availability of wild mussel beds for the birds in that period. The disappearance of these mussel banks in later years was followed by large changes in the numbers of birds (Van Roomen *et al.* 2005). For the Delta Area such impacts are absent and the average of the first 10 years of 1987-2004 has been chosen.

Distribution data if available (preferably send digital maps otherwise description)

See Appendix 1. Updates of its distribution are published in the annual SOVON- waterbird census reports (e.g. Van Roomen *et al.* 2004). The monthly distribution 1979-1985 has been published in SOVON (1987). Additional historical information on distribution and numbers is summarized in Bijlsma *et al.* (2001).

Monitoring network information

- Name of monitoring network
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  Formally till 2006/2007 (agreements for a year), however long term continuation is probable
- Name/map of area covered by network
  The Netherlands
- Reference of last network progress report
  Van Strien A. 2005. Landelijke natuurmeetnetten van het NEM in 2004. Kwaliteitsrapportage NEM. Kengetal J-67, Centraal Bureau voor de Statistiek, Voorburg, The Netherlands.
- Restrictions on availability of data
  Availability original census data not (always) free of charge

2.4 Recurvirostra avosetta (Pied Avocet / Kluut)

Species common name	Pied Avocet
Scientific name	*Recurvirostra avosetta*
Dutch name	Kluut

Ecological data

Guild ○ herbivore ○ piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ○ molluscivore ● *other: feeds on waterinsects, crustaceans and polychaete worms*	**Max. Body weight (adults)** male: 0.327 kg (average) female: 0.308 kg (average) **Max. Length:** between 42 and 45 cm (average) **Maturity age:** between 2 and 3 years (average) **Reproduction:** between :<0.1and 1.4 young per female (fledge) (several areas in The Netherlands; Arts & Meininger 1997) **Age:** 24 years (maximum) **Density/biomass (in optimal habitat):** Between 8.3 and 42 breeding pairs/100 ha (large areas), 2-25 nests/ 100 m^2 (colony) (Arts & Meininger 1997) **Home range:** between 2 and 5 ha (average) **Dispersal distance:** irrelevant **For populations: estimate of minimal viable population size per area:** Minimum viable Metapopulation: 120 pairs (with key-population of at least40 pairs) and 200 pairs (without key-population) (Verboom *et al.* 2001)

Geografical	Habitat	Fysical/chemical
Distribution ● *Wadden Sea* ● *Delta Zeeland (saline, brackish and fresh water)*	**Position in the water column** ● *prefers shallow water <15cm*	Nutrient conc. ● *eutrophic*
Migratory behavior ○ sedentary ● *migratory* ○ variable/dependent on geographical location	**Seabed/bottom preferences** ○ sand ○ gravel ● *mud* ○ rock	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ● *irrelevant*
	Intertidal ● *other preferences: gullies and shallow pools at low tide, follows tide line, where it forages in shallow water >15 cm .*	**Salinity** ● *saline* ● *brackish* ● *freshwater*

General description breeding habitat

The breeding biotope consists of open landscape with sparsely grown or almost barren soils (pioneer situation) close to open water. The nest is mostly made on bare ground or on spots with little vegetation. The nearness of vegetation, shoulders, edges, etc. are important as shelter for the young.

Breeding season: April – end of July

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
• *Habitat degradation ecological succession of nesting habitat, at present lack of coastal dynamic situations; species is increasingly dependent on man-made nesting sites* ○ Habitat destruction ○ Overfishing/overharvesting ○ Bycatch ○ Human disturbance • *Natural disturbance, predation by Red fox* ○ Pollution ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic ○ Other…..	○ Food ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other:….

Data set information

- **Name of data set or monitoring programme**
  National census of rare and colonial breeding birds
- **Measurement unit**
  Number of breeding pairs
- **Brief description of contents data set and/or monitoring programme or hyperlink**
  Yearly nationwide censuses of all breeding colonies; http://www.sovon.nl
- **Brief description/reference/hyperlink of sampling method**
  Census of breeding colonies: number of pairs, nests: http://www.sovon.nl/pdf/Handleiding-LSB.pdf
- **Begin date of data set**
  1992 (start of current monitoring program, older data available)
- **Are other data sets available (give dates)**
  1950-1992, data series may be incomplete
- **Frequency of monitoring and next monitoring date**
  Once a year, 2006
  - Range/variation of available data in space and time
  - Estimate of percentage inaccuracy of measurements

Numbers and distribution

Present distribution in the Netherlands: Central distibution areas are within the Wadden Sea (mostly outside of the dikes of northern Friesland, the north coast of Groningen, and the Dollard), the top of the province of North-Holland (Balgzand) and the Delta Area (biggest colonies at lake Volkerak and Haringvliet). In other areas the species is spread over smaller settlements in the area of Lake IJsel, the inland area of North and South Holland and along the larger rivers. The natural distribution is restricted to the coastal areas (Wadden Sea, western coast, and Delta Area). In other areas the distribution is almost completely related to human created pioneer situations. Outside of the breeding time the distribution is mainly restricted to the saline waters of Wadden and Delta Area.

Trends in the Netherlands: the breeding population has increased strongly within the 20th century: 1940-65 3500, 1975-77 4600, 1982-83 8000, 1992 9000-9200 breeding pairs. After 1992 the population has decreased to about 7100-7600 pairs in the mid nineties; the decrease was mainly due to birds from the coast of Friesland and Groningen. In the Delta Area

numbers were more stable. From 1990-2002 the trend is decreasing (< 25%, but significant). Recent numbers vary from 9000 pairs (1999-2000) to 7900 (2002).

The season high, which is reached in the late summer, is approximately 10.000 individuals. The number of overwintering birds (mainly Delta area) is mostly not more than 1000 animals. The number of staging birds have been slightly declining significantly since 1987/88.
From 1993 to 1997 the breeding population included on average 7200 pairs, of which 83% within areas that had been assigned through the European Habitats and Birds directive. The largest part of the staging birds (estimate >90%) are also concentrated in these areas.

- **Mean values**

Pied Avocet /Kluut	2000	2001	2002	2003	2004	Reference value
n. breeding pairs Wadden Sea	4367	3197	3854	2977	2438	5300
n. breeding pairs Delta area	2088	1874	1833	2145	1775	960
n. breeding pairs North Sea coast	0	0	0	0	0	

Measurement Unit: the number of breeding pairs of each year.

Reference values: Breeding numbers from the beginning of the previous century are low (Arts & Meininger (1997) as a consequence of the higher protection of the species nowadays. Therefore, these estimates are not usable as a reference value for today. The reference values used here are based on breeding numbers of the start of the nineteen nineties.

Distribution data if available (preferably send digital maps otherwise description)

See Appendix 1. Updates on distribution and numbers are published in the annual SOVON breeding bird reports (e.g. Van Dijk *et al.* 2004). Besides complete distribution maps have been published in the national Breeding bird atlases, covering the periods 1998-2000 (SOVON Vogelonderzoek Nederland 2002) and 1973-1977 (Texeira 1979). Additional historical information on distribution and numbers is summarized in Bijlsma *et al.* (2001).

Monitoring network information

- Name of monitoring network
  NEM (Network Ecological Monitoring)
- Brief description of network/hyperlink
  http://www.siliconmeadow.nl/~nemweb/index.html
- Other variables measured in network
  Trends and distributions of populations of other taxonomic groups
- Contact for network
  http://www.siliconmeadow.nl/~nemweb/index.html
- Starting date network
  1995
- Guaranteed continuation of network till what date/year
  Formally till 2006/2007 (agreements for a year), however long term continuation is probable
- Name/map of area covered by network
  The Netherlands
- Reference of last network progress report
  Van Strien A. 2005. Landelijke natuurmeetnetten van het NEM in 2004. Kwaliteitsrapportage NEM. Kengetal J-67, Centraal Bureau voor de Statistiek, Voorburg, The Netherlands.
- Restrictions on availability of data
  Availability original census data not (always) free of charge

2.5 Sterna albifrons albifrons (Little Tern / Dwergstern)

Species common name	Little Tern
Scientific name	*Sterna albifrons albifrons*
Dutch name	Dwergstern

Ecological data Breeding

Guild ○ Herbivore ● *piscivore* ○ omnivore ○ scavenger ○ detritivore ○ planktivore ○ molluscivore ● *other: also forages on crustaceans*	**Max. Body weight (adults)** male: 0.051 kg (average) female: 0.045 kg (average) **Max. Length:** between 22 and 28 cm (average) **Maturity age:** between 2 and 3 years/months (average) **Reproduction:** between 1,4 and 1,6 young per female (fledge) (England, fledging success fluctuates strongly) **Age:** 21 years (maximum) **Density/biomass (in optimal habitat):** Breeds in small to medium sized colonies (<100 breeding pairs); distance between nests usually over 2 m **Home range:** <3 km (average) **Dispersal distance:** adult birds usually stay within 10 km of the nesting area (Den Boer *et al.* 1993) **For populations: estimate of minimal viable population size per area:** Minimum viable Metapopulation: 120 pairs (with key-population of at least 40 pairs) and 200 pairs (without key-population) Verboom *et al.* (2001)

Geografical	Habitat	Fysical/chemical
Distribution ○ North Sea ● *coastal* (20 km or use other distance…) ○ offshore ○ deep sea ○ Wadden Sea ● *Delta Zeeland (saline, brackish or fresh)*	**Position in the water column** ○ pelagic ○ demersal ○ planktonic ○ benthic ● *other: optimal depth: 25-100cm*	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ● *eutrophic*
Migratory behavior ○ sedentary ● *migratory* ○ variable/dependent on geographical location	**Seabed/bottom preferences** ○ sand ○ gravel ○ mud ○ rock	**Light conditions** ○ tolerant for turbidity ● *intolerant for turbidity*
	Intertidal ○ preferred height (relative to MHT) ● *other preferences: Forages in intertidal area in shallow water: 25-100 cm*	**Salinity** ● *saline* ○ brackish ○ freshwater

General description breeding habitat

The breeding biotope is mainly restricted to pioneer biotopes within the saline coastal areas. The nesting place is situated on banks of sand, gravel, or shells and on areas that have been created by sand suppletion. The nests are mostly within 150 m from open water and seldom more than 450 m. Empty sand areas without shells are less preferred. For chicks there needs to be some cover (e.g. short vegetation) which should be within 50m of the nest. The species nests preferably in small colonies of 10-20 pairs and has little location fidelity.
Breeding season: *middle of April – end of July*

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
• *Habitat degradation, ecological succession of nesting habitat, at present lack of coastal dynamic situations; species is increasingly dependent on man-made nesting sites* ○ Habitat destruction ○ Overfishing/overharvesting ○ Bycatch • *Human disturbance* ○ Natural disturbance ○ Pollution ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic ○ Other…..	○ Food ○ Medicine • *Recreation in particular beach recreation*	○ Building material ○ Energy ○ Other:….

Data set information

- **Name of data set or monitoring programme**
  National census of rare and colonial breeding birds
- **Measurement unit**
  Number of breeding pairs
- **Brief description of contents data set and/or monitoring programme or hyperlink**
  Yearly nationwide censuses of all breeding colonies; http://www.sovon.nl
- **Brief description/reference/hyperlink of sampling method**
  Census of breeding colonies: number of pairs, nests: http://www.sovon.nl/pdf/Handleiding-LSB.pdf
- **Begin date of data set**
  1992 (start of current monitoring program, older data available)
- **Are other data sets available (give dates)**
  1950-1992, data series may be incomplete
- **Frequency of monitoring and next monitoring date**
  Once a year, 2006

Numbers and distribution

Current distribution is limited to some 30 breeding places (app. half with less than 11 nests) within the Wadden Sea and Delta area (mainly Texel, Haringvliet, and Westerscheldt). Natural distribution concerns mainly Wadden Sea and Delta area.

Trends in the Netherlands: the countries breeding population is characterised by large fluctuations related to the availability of proper nesting areas, but numbers appear to have increased since the mid seventies: 1973-77 250-300 pairs, 1985-90 380-450, 1991-95 250-410 and 1996-2000 460-510. Compared to the fifties (800-900 pairs) the numbers are lower nowadays.The distribution has decreased since the mid seventies (occupation -40%). Breeding areas have disappeared along the coast of Groningen, Lauwersmeer, the Frisian Lake IJsel coast, locally on the islands of the Wadden Sea and in the Delta area (disappeard from 31 blocks). This is counterbalanced by 15 new settlements in the Delta area and on the Noorderhaaks, a sand bar in the Marsdiep. The dutch breeding population accounted for 512,

485 and 463 pairs from 1998-2000 (450 in 2002). Approximately 65% of these were situated in the Delta area with important coloies in the Haringvliet (Ventjagersplaten) and the Westerschelde. From 1993-97 the dutch breeding population amounted on average to 420 pairs, with more than 80% settling in areas assigned by the Bird and Habitat directive.

- **Mean values**

Little Tern/Dwergstern	2000	2001	2002	2003	2004	Reference value
n. breeding pairs Wadden Sea	127	113	196	212	167	300
n. breeding pairs Delta area	277	306	263	276	299	300
n. breeding pairs North Sea coast	0	0	0	0	0	

Measurement Unit: the number of breeding pairs of each year.

Reference values: Based on Den Boer *et al.* (1993). In this report old counting results are described which are used to determine goals for the little tern. These values are used as a reference value.

Distribution data if available (preferably send digital maps otherwise description)

See Appendix 1. Updates on distribution and numbers are published in the annual SOVON breeding bird reports (e.g. Van Dijk *et al.* 2004). Besides complete distribution maps have been published in the national Breeding bird atlases, covering the periods 1998-2000 (SOVON Vogelonderzoek Nederland 2002) and 1973-1977 (Texeira 1979). Additional historical information on distribution and numbers is summarized in Bijlsma *et al.* (2001).

Monitoring network information

- Name of monitoring network
  NEM (Network Ecological Monitoring)
- Brief description of network/hyperlink
  http://www.siliconmeadow.nl/~nemweb/index.html
- Other variables measured in network
  Trends and distributions of populations of other taxonomic groups
- Contact for network
  http://www.siliconmeadow.nl/~nemweb/index.html
- Starting date network
  1995
- Guaranteed continuation of network till what date/year
  Formally till 2006/2007 (agreements for a year), however long term continuation is probable
- Name/map of area covered by network
  The Netherlands
- Reference of last network progress report
  Van Strien A. 2005. Landelijke natuurmeetnetten van het NEM in 2004. Kwaliteitsrapportage NEM. Kengetal J-67, Centraal Bureau voor de Statistiek, Voorburg, The Netherlands.
- Restrictions on availability of data
  Availability original census data not (always) free of charge

2.6 Charadrius alexandrinus alexandrinus (Kentish Plover / Strandplevier)

Species common name	Kentish Plover
Scientific name	*Charadrius alexandrinus alexandrinus*
Dutch name	Strandplevier

Ecological data breeding

Guild ○ herbivore ○ piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ○ molluscivore ● *other: feeds mainly on polychaete worms, small molluscs, crustaceans, insects and spiders*	**Max. Body weight (adults)** male: 0.048 kg (average) female: 0.047 kg (average) **Max. Length:** between 15 and 17.5 cm (average) **Maturity age:** after 1 years(average) **Reproduction:** 0.55 young per successful brood (average) **Age:** at least 18 years (maximum) **Density/biomass (in optimal habitat):** *nowadays a rare breeding bird, locations with at least 10 breeding pairs are scarce* **Home range:** between 2 and 5 ha (average) **Dispersal distance:***?* **For populations: estimate of minimal viable population size per area:** Minimum viable Metapopulation: 120 pairs (with key-population of at least40 pairs) and 200 pairs (without key-population) (Verboom *et al.* 2001)

Geografical	Habitat	Fysical/chemical
Distribution ● North Sea ○ coastal ○ offshore ○ deep sea ● *Wadden Sea* ● *Delta Zeeland*	**Position in the water column** ○ pelagic ○ demersal ○ planktonic ○ benthic ● *irrelevant*	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic ● *not directly relevant*
Migratory behavior ○ sedentary ● *migratory* ○ variable/dependent on geographical location	**Seabed/bottom preferences** ● *sand* ○ gravel ○ mud ○ rock	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ● *irrelevant*
	Intertidal ○ preferred height (relative to MHT) ● *other preferences: feeds in intertidal area on sand flats*	**Salinity** ● *saline* ○ brackish ○ freshwater

General description breeding habitat

The primary breeding biotope can be found in dynamic (saline) coastal environments and consists of small dunes, flat beach areas, heights rich in shells within saltmarshes, and permanently dry areas of sea dikes. The nesting place consists of bare or sparsely vegetated open, often with many shells, areas close to salt or brakisch water where the species breeds solitarily or semi-colonial, often close to terns. Incidentally, breeding takes place on inland locations on artificial sand suppleted terrain.

Breeding season: *middle of April – middle of July*

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
• *Habitat degradation: ecological succession of nesting habitat, at present lack of coastal dynamic situations; species is increasingly dependent on man-made nesting sites* • *Habitat destruction, possibly geomorphological changes in intertidal areas as a consequence of human activities: for instance dredging, construction of dams*, ○ Overfishing/overharvesting ○ Bycatch • *Human disturbance: very sensitive to recreation pressure* ○ Natural disturbance ○ Pollution ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. • *Sea level change* ○ Oil/gass extraction ○ Ship traffic ○ Other…..	○ Food ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other:….

Data set information

- **Name of data set or monitoring programme**
  National census of rare and colonial breeding birds
- **Measurement unit**
  Number of breeding pairs
- **Brief description of contents data set and/or monitoring programme or hyperlink**
  Yearly nationwide censuses of all breeding colonies; http://www.sovon.nl
- **Brief description/reference/hyperlink of sampling method**
  Census of breeding colonies: number of pairs, nests: http://www.sovon.nl/pdf/Handleiding-LSB.pdf
- **Begin date of data set**
  1992 (start of current monitoring program, older data available)
- **Are other data sets available (give dates)**
  1950-1992, data series may be incomplete
- **Frequency of monitoring and next monitoring date**
  Once a year, 2006

Numbers and distribution

Present distribution and occurence in the Netherlands: the distribution is mostly restricted to the Delta area and Wadden Sea areas with more in the Delta area (in the survey period mainly lake Grevelingen, the Westerscheldt and the Krammer-Volkerak. Elsewhere, the species is breeding incidentally in the Lake IJssel area. The natural distribution is limited to the coast (Wadden area, west coast, and Delta area. In other areas the plover is bound to pioneer situations that have been created by man.

Outside the breeding time the species is almost completely restricted to the saline waters of the Wadden and Delta area and inland it is a rarely seen.
Trends in the Netherlands: During the last 25 years the national breeding population has decreased with more than 50%, from 700-900 pairs (1973-77) to 500-700 (1979-85) and 330-370 (1993-97). This decrease is still continuing: in 1998-2000 the population was estimated at 270-320 pairs, in 2002 at 240-260 pairs. Outside the Wadden and Delta area,

numbers are neglegible. The distribution has also decreased (-54%). In the Wadden Sea area many breeding places have disappeared; around Lake IJsel most have gone, but also in the Delta area, thé Dutch stronghold, the distribution has shrunken.

Since the mid 80's, parallel with the decline of the breeding population, the number of staging birds in the saline Delta area has decreased to about half (mean index values for the periods 1987-91 and 1997-2001 are respectively 149 and 57). The larger part of the national population is breeding within or close to areas that have been designated under the EC Birds and Habitats Directive. The same is true for the staging birds.

- **Mean values**

Kentish Plover/Strandplevier	2000	2001	2002	2003	2004	Reference value
n. breeding pairs Wadden Sea	14	8	10	17	10	215
n. breeding pairs Delta area	166	150	151	176	157	250
n. breeding pairs North Sea coast	13	10	12	8	0	455

Measurement Unit: the number of breeding pairs of each year.

Reference values: Available reference values are from Arts & Meininger (1997) and Baptist & Jagtman (1997) who used the numbers of the first two authors. Arts & Meininger (1997) give estimates for the start of the previous century which were estimated to lie around 900 and 1000 pair for the whole of the Netherlands. The reference has been deducted from this number.

Distribution data if available (preferably send digital maps otherwise description)

See Appendix 1. Updates on distribution and numbers are published in the annual SOVON breeding bird reports (e.g. Van Dijk *et al.* 2004). Besides complete distribution maps have been published in the national Breeding bird atlases, covering the periods 1998-2000 (SOVON Vogelonderzoek Nederland 2002) and 1973-1977 (Texeira 1979). Additional historical information on distribution and numbers is summarized in Bijlsma *et al.* (2001).

Monitoring network information

- Name of monitoring network
  NEM (Network Ecological Monitoring)
- Brief description of network/hyperlink
  http://www.siliconmeadow.nl/~nemweb/index.html
- Other variables measured in network
  Trends and distributions of populations of other taxonomic groups
- Contact for network
  http://www.siliconmeadow.nl/~nemweb/index.html
- Starting date network
  1995
- Guaranteed continuation of network till what date/year
  Formally till 2006/2007 (agreements for a year), however long term continuation is probable
- Name/map of area covered by network
  The Netherlands
- Reference of last network progress report
  Van Strien A. 2005. Landelijke natuurmeetnetten van het NEM in 2004. Kwaliteitsrapportage NEM. Kengetal J-67, Centraal Bureau voor de Statistiek, Voorburg, The Netherlands.
- Restrictions on availability of data
  Availability original census data not (always) free of charge

2.7 Pluvialis squaterola (Grey Plover / Zilverplevier)

Species common name	Grey Plover
Scientific name	*Pluvialis squaterola*
Dutch name	Zilverplevier

Ecological data non-breeding

Guild ○ herbivore ○ piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ○ molluscivore ● *other: feeds on polychaete worms and small molluscs*.	**Max. Body weight (adults)** male: 0.129 kg (average) female: 0.114 kg (average) **Max. Length:** between 27 and 31 cm (average) **Maturity age:** between 2 and 3 years (average) **Reproduction:** irrelevant **Age:** 20 years (maximum) **Density/biomass (in optimal habitat):** irrelevant **Home range:** irrelevant **Dispersal distance:** irrelevant **For populations: estimate of minimal viable population size per area:** irrelevant

Geografical	Habitat	Fysical/chemical
Distribution ● *Wadden Sea* ● *Delta Zeeland (saline)*	**Position in the water column** ○ pelagic ○ demersal ○ planktonic ○ benthic ● *irrelevant*	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ● *eutrophic*
Migratory behavior ○ sedentary ● *migratory* ○ variable/dependent on geographical location	**Seabed/bottom preferences** ● *sand* ○ gravel ● *mud* ○ rock	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ● *irrelevant*
	Intertidal ○ preferred height (relative to MHT) ● *other preferences: foraging habitat: intertidal mud-sand flats, in particular recently emersed parts*	**Salinity** ● *saline* ○ brackish ○ freshwater

General description non-breeding habitat

Foraging habitat: tidal areas with sandy or muddy sediment; During unfavorable weather conditions (long lasting high tides) forages inland on farmland.
roosts: Collective high tide roosts are situated in open flat areas close to tidal flats, like salt marshes, sand banks and inland wetlands.

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation ● *Habitat destruction, possibly geomorphological changes in intertidal areas as a consequence of human activities: for instance dredging, construction of dams* ○ Overfishing/overharvesting ○ Bycatch ● *Human disturbance: recreation, air-traffic in foraging and areas especially on high tide roosts* ○ Natural disturbance ○ Pollution ○ Eutrophication ● *Wind farms: when situated between foraging areas and high tide roosts*	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ● *Sea level change could lead to geomorphological changes in tidal areas: loss of feeding habitat* ○ Oil/gass extraction ○ Ship traffic ○ Other…..	○ Food ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other:….

Data set information

Waterfowl non-breeding

- **Name of data set or monitoring programme**
  Waterbird census scheme in The Netherlands (part of NEM (Network Ecological Monitoring))
- **Measurement unit**
  Number of individuals
- **Brief description of contents data set and/or monitoring programme or hyperlink**
  The waterbird scheme aims to assess (1) national and regional (site-based) trends, and (2) national wintering or migratory populations during international counts in September (Greylag Goose), November (Anser geese), January (all waterbird species), March (Barnacle Goose) and May (Dark-bellied Brent Goose). These international surveys are co-ordinated by Wetlands International. Monitoring in the Wadden Sea is part of a trilateral cooperation between The Netherlands, Germany and Denmark (Trilateral Monitoring and Assessment Program, TMAP). The waterbird scheme is based on monthly counts of monitoring areas and goose/swan staging sites, that are carried out on high tide). Census effort focuses on September-April, when highest numbers are present in most species. In January many additional sites are counted whereas in national freshwater bodies, Delta area and Wadden Sea counts are also covered in (part of) the period May-August. Due to its size, the Wadden Sea can not be covered monthly. Here, counts refer to a combination of 4 complete counts and bi-weekly or monthly counts at 10 sample sites, together allowing a reliable trend assessment for the entire season.
- **Brief description/reference/hyperlink of sampling method**
  Complete counts of all present individuals in a census area
- **Begin date of data set**
  1975/1976
- **Are other data sets available (give dates)**
- **Frequency of monitoring and next monitoring date**
  Census effort monthly at least September-April, many additional sites once a year in January

Numbers and distribution

Distribution is concentrated in tidal areas of Wadden Sea and Delta area. During migration small numbers are recorded in inland wetlands. The numbers of the wintering population are stable, both in Wadden Sea and Delta area, totaling 19.000 birds.

- **Mean values**

Grey Plover/Zilverplevier	North Sea	Wadden Sea	Delta area
Present (01/02-03/04)	-	23220	6064
Recent (99/00-01/02)	-	20253	6009
Reference value	-	12000	7000

Measurement Unit: 3 yearly moving average of monthly mean (Juli-June) of each year.

Reference values: There are no known reference values of wintering populations from the first half of the previous century. Reasonably estimates start to be collected from the mid seventies for the Wadden Sea and the end of the eighties for the Delta area. For the Wadden Sea 1975-1990 has been chosen as a reference period because of the large availability of wild mussel beds for the birds in that period. The disappearance of these mussel banks in later years was followed by large changes in the numbers of birds (Van Roomen *et al.* 2005). For the Delta area such impacts are absent and the average of the first 10 years of 1987-2004 has been chosen.

Distribution data if available (preferably send digital maps otherwise description)

See Appendix 1. Updates of its distribution are published in the annual SOVON- waterbird census reports (e.g. Van Roomen *et al.* 2004). The monthly distribution 1979-1985 has been published in SOVON (1987). Additional historical information on distribution and numbers is summarized in Bijlsma *et al.* (2001).

Monitoring network information

- Name of monitoring network
  NEM
- Brief description of network/hyperlink
  http://www.siliconmeadow.nl/~nemweb/index.html
- Other variables measured in network
  Trends and distributions of populations of other taxonomic groups
- Contact for network
  http://www.siliconmeadow.nl/~nemweb/index.html
- Starting date network
  1995
- Guaranteed continuation of network till what date/year
  Formally till 2006/2007 (agreements for a year), however long term continuation is probable
- Name/map of area covered by network
  The Netherlands
- Reference of last network progress report
  Van Strien A. 2005. Landelijke natuurmeetnetten van het NEM in 2004. Kwaliteitsrapportage NEM. Kengetal J-67, Centraal Bureau voor de Statistiek, Voorburg, The Netherlands.
- Restrictions on availability of data
  Availability original census data not (always) free of charge

2.8 Phalacrocorax carbo sinensis (Great Cormorant / Aalscholver)

Species common name	Great Cormorant
Scientific name	*Phalacrocorax carbo sinensis*
Dutch name	Aalscholver

Ecological data non-breeding

Guild ○ herbivore ● *piscivore* ○ omnivore ○ scavenger ○ detritivore ○ planktivore ○ molluscivore ○ other: ….	**Max. Body weight (adults)** male: 2.423 kg (average) female: 2.085 kg (average) **Max. Length:** between 80 and 100 cm (average) **Maturity age:** between 3 and 5 years (average) **Reproduction:** irrelevant **Age:** 20 years (maximum) **Density/biomass (in optimal habitat):** irrelevant for non-breeding birds **Home range:** irrelevant **Dispersal distance:** irrelevant **For populations: estimate of minimal viable population size per area:** irrelevant

Geografical	Habitat	Fysical/chemical
Distribution ○ *North Sea* ● coastal (20 km or use other distance…) ○ offshore ○ deep sea ● *Wadden Sea* ● *Delta Zeeland (both saline, brackish and freshwater bodies)*	**Position in the water column** ○ pelagic ○ demersal ○ planktonic ○ benthic ● *other preferences: preferred depth: 1-3m, maximum: 9m*	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ● *eutrophic* *note: key-factor is availability and quality of fish, that can be correlated with nutrient concentrations*
Migratory behavior ○ sedentary ● *migratory* ○ variable/dependent on geographical location	**Seabed/bottom preferences** ○ sand ○ gravel ○ mud ○ rock	**Light conditions** ○ tolerant for turbidity ● *intolerant for turbidity*
	Intertidal ○ preferred height (relative to MHT) ○ other preferences….	**Salinity** ○ saline ○ brackish ○ freshwater

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation ○ Habitat destruction ● *Overfishing /overharvesting* ○ Bycatch ○ Human disturbance ○ Natural disturbance ● *Pollution* ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic ● *Other: Human persecution*	○ Food ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other:

Data set information

Waterfowl non-breeding

- **Name of data set or monitoring programme**
  Waterbird census scheme in The Netherlands (part of NEM (Network Ecological Monitoring))
- **Measurement unit**
  Number of individuals
- **Brief description of contents data set and/or monitoring programme or hyperlink**
  The waterbird scheme aims to assess (1) national and regional (site-based) trends, and (2) national wintering or migratory populations during international counts in September (Greylag Goose), November (Anser geese), January (all waterbird species), March (Barnacle Goose) and May (Dark-bellied Brent Goose). These international surveys are co-ordinated by Wetlands International. Monitoring in the Wadden Sea is part of a trilateral cooperation between The Netherlands, Germany and Denmark (Trilateral Monitoring and Assessment Program, TMAP). The waterbird scheme is based on monthly counts of monitoring areas and goose/swan staging sites, that are carried out on high tide). Census effort focuses on September-April, when highest numbers are present in most species. In January many additional sites are counted whereas in national freshwater bodies, Delta area and Wadden Sea counts are also covered in (part of) the period May-August. Due to its size, the Wadden Sea can not be covered monthly. Here, counts refer to a combination of 4 complete counts and bi-weekly or monthly counts at 10 sample sites, together allowing a reliable trend assessment for the entire season.
- **Brief description/reference/hyperlink of sampling method**
  Complete counts of all present individuals in a census area
- **Begin date of data set**
  1975/1976
- **Are other data sets available (give dates)**
- **Frequency of monitoring and next monitoring date**
  Census effort monthly at least September-April, many additional sites once a year in January

Numbers and distribution

Distribution in winter: Laag-Nederland, concentrations in IJsselmeer-area and along the main rivers. Numbers have increased significantly.

- **Mean values**

Great Cormorant /Aalscholver	North Sea	Wadden Sea	Delta area
Present (01/02-03/04)	-	4846	687
Recent (99/00-01/02)	-	3880	821
Reference value	-	5000	1500

Measurement Unit: 3 yearly moving average of monthly mean (Juli-June) of each year.

Reference values: No reference is availble. No numbers available from the first half of the previous century. Good counts for the Waddden Sea are available from the mid 70's and for the Delta area only since the mid 80's. In the Wadden Sea the species has increased strongly as a result of the ban on hunting. This limits the use of historic data as a reference. Based on present monthly means the reference values for the Wadden Sea are determined to lie around 5000. For the Delta area the numbers are quite stable and the reference is based on the years 1987-1996.

Distribution data if available (preferably send digital maps otherwise description)

See Appendix 1. Updates of its distribution are published in the annual SOVON- waterbird census reports (e.g. Van Roomen *et al*. 2004). The monthly distribution 1979-1985 has been published in SOVON (1987). Additional historical information on distribution and numbers is summarized in Bijlsma *et al*. (2001).

Monitoring network information

- Name of monitoring network
  NEM
- Brief description of network/hyperlink
  http://www.siliconmeadow.nl/~nemweb/index.html
- Other variables measured in network
  Trends and distributions of populations of other taxonomic groups
- Contact for network
  http://www.siliconmeadow.nl/~nemweb/index.html
- Starting date network
  1995
- Guaranteed continuation of network till what date/year
  Formally till 2006/2007 (agreements for a year), however long term continuation is probable
- Name/map of area covered by network
  The Netherlands
- Reference of last network progress report
  Van Strien A. 2005. Landelijke natuurmeetnetten van het NEM in 2004. Kwaliteitsrapportage NEM. Kengetal J-67, Centraal Bureau voor de Statistiek, Voorburg, The Netherlands.
- Restrictions on availability of data
  Availability original census data not (always) free of charge

2.9 Haematopus ostralegus ostralegus (Eurasian Oystercatcher / Scholekster) Non-breeding

Species common name	Eurasian Oystercatcher
Scientific name	*Haematopus ostralegus ostralegus*
Dutch name	Scholekster

Ecological data non-breeding

Guild ○ herbivore ○ piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ● *molluscivore* ● *other: also feeds on polychaete worms and crustaceans*.	**Max. Body weight (adults)** male: 0.488 kg (average) female: 0.594 kg (average) **Max. Length:** between 40 and 47,5 cm (average) **Maturity age:** between 3 and 4 years (average) **Reproduction:** irrelevant **Density/biomass (in optimal habitat):** irrelevant **Home range:** irrelevant **Dispersal distance:** irrelevant **For populations: estimate of minimal viable population size per area:** irrelevant

Geografical	Habitat	Fysical/chemical
Distribution ○ North Sea ○ coastal ○ offshore ○ deep sea ● *Wadden Sea* ● *Delta Zeeland (saline)*	**Position in the water column** ○ pelagic; average depth between…and…m ○ demersal ○ planktonic; average depth between…and…m ○ benthic ● *irrelevant*	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ● *eutrophic*
Migratory behavior ○ sedentary ○ migratory ● *variable/dependent on geographical location*	**Seabed/bottom preferences** ● *sand* ○ gravel ○ mud ● *rock*	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ● *irrelevant*
	Intertidal ○ preferred height (relative to MHT) ● *other preferences: foraging habitat: intertidal mud-sand flats, in particular recently emersed parts.*	**Salinity** ● *saline* ○ brackish ○ freshwater

General description non-breeding habitat

Foraging habitat:sandy-muddy tidal flats, avoids extremely muddy soil, highest densities occur on mussel and cockle beds. During unfavorable weather conditions (long lasting high tides) forages inland in meadows.

Roosts: High tide roosts are located in salt marshes, on sand banks and in polders bordering the tidal areas. They prefer short vegetation.

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation ● *Habitat destruction, possibly geomorphological changes in intertidal areas as a consequence of human activities: for instance dredging, construction of dams*, ○ Overfishing/overharvesting by shell fishery ○ Bycatch ● *Human disturbance: high tide roosts are especially sensitive to disturbance by recreation* ○ Natural disturbance ○ Pollution ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ● *Sea level change could lead to a decrease* feeding habitat ○ Oil/gass extraction ○ Ship traffic ● *Other: climatic change could lead to changes in the composition of prey species and energy content of preys*.	○ Food ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other:….

Data set information

Waterfowl non-breeding

- **Name of data set or monitoring programme**
  Waterbird census scheme in The Netherlands (part of NEM (Network Ecological Monitoring))

- **Measurement unit**
  Number of individuals

- **Brief description of contents data set and/or monitoring programme or hyperlink**
  The waterbird scheme aims to assess (1) national and regional (site-based) trends, and (2) national wintering or migratory populations during international counts in September (Greylag Goose), November (Anser geese), January (all waterbird species), March (Barnacle Goose) and May (Dark-bellied Brent Goose). These international surveys are co-ordinated by Wetlands International. Monitoring in the Wadden Sea is part of a trilateral cooperation between The Netherlands, Germany and Denmark (Trilateral Monitoring and Assessment Program, TMAP). The waterbird scheme is based on monthly counts of monitoring areas and goose/swan staging sites, that are carried out on high tide). Census effort focuses on September-April, when highest numbers are present in most species. In January many additional sites are counted whereas in national freshwater bodies, Delta area and Wadden Sea counts are also covered in (part of) the period May-August. Due to its size, the Wadden Sea can not be covered monthly. Here, counts refer to a combination of 4 complete counts and bi-weekly or monthly counts at 10 sample sites, together allowing a reliable trend assessment for the entire season.

- **Brief description/reference/hyperlink of sampling method**
  Complete counts of all present individuals in a census area

- **Begin date of data set**
  1975/1976

- **Are other data sets available (give dates)**
- **Frequency of monitoring and next monitoring date**
  Census effort monthly at least September-April, many additional sites once a year in January

Numbers and disribution

Distribution concentrates in tidal areas of Wadden Sea and Delta area;
numbers of wintering population have decreased strongly since eightie both in Wadden Sea and Delta area: 350.000 in mid-eighties and 190.000 in 2002.

- **Mean values**

Eur. Oystercatcher/Scholekster	North Sea coast	Wadden Sea	Delta area
Present (01/02-03/04)	-	120990	35481
Recent (99/00-01/02)	-	130052	35849
Reference value	low	160000	64000

Measurement Unit: 3 yearly moving average of monthly mean (Juli-June) of each year.

Reference values: There are no known reference values of wintering populations from the first half of the previous century. Reasonably estimates start to be collected from the mid seventies. The numbers mentioned in Baptist & Jagtman (1997) based on a summary in Arts *et al.* (1997) have been transformed into a monthly mean by dividing by 0.8 (present numbers based only on the months September – March).

Distribution data if available (preferably send digital maps otherwise description)

See Appendix 1. Updates of its distribution are published in the annual SOVON- waterbird census reports (e.g. Van Roomen *et al.* 2004). The monthly distribution 1979-1985 has been published in SOVON (1987). Additional historical information on distribution and numbers is summarized in Bijlsma *et al.* (2001).

Monitoring network information

- Name of monitoring network
  NEM
- Brief description of network/hyperlink
  http://www.siliconmeadow.nl/~nemweb/index.html
- Other variables measured in network
  Trends and distributions of populations of other taxonomic groups
- Contact for network
  http://www.siliconmeadow.nl/~nemweb/index.html
- Starting date network
  1995
- Guaranteed continuation of network till what date/year
  Formally till 2006/2007 (agreements for a year), however long term continuation is probable
- Name/map of area covered by network
  The Netherlands
- Reference of last network progress report
  Van Strien A. 2005. Landelijke natuurmeetnetten van het NEM in 2004. Kwaliteitsrapportage NEM. Kengetal J-67, Centraal Bureau voor de Statistiek, Voorburg, The Netherlands.
- Restrictions on availability of data
  Availability original census data not (always) free of charge

2.10 Haematopus ostralegus ostralegus (Eurasian Oystercatcher / Scholekster) Breeding

Species common name	Eurasian Oystercatcher
Scientific name	*Haematopus ostralegus ostralegus*
Dutch name	Scholekster

Ecological data breeding

Guild ○ herbivore ○ piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ● *molluscivore* ● *other: also feeds on polychaete worms and crustaceans and insect larvae*	**Max. Body weight (adults)** male: 0.488 kg (average) female: 0.594 kg (average) **Max. Length:** between 40 and 47,5 cm (average) **Maturity age:** between 3 and 4 years (average) **Reproduction:** fledging success: 55,5% (Atlantic region; Arts *et al.* 1997) **Age:** >40 years (maximum) **Density/biomass (in optimal habitat):** Between 250 and 300 breeding pairs/100ha in salt marshes, and between 15 and 20 breeding pairs/100 ha on inland meadows **Home range:** between 5 and 25 ha (average): forages in intertidal areas maximal 13 km from de coast **Dispersal distance:** irrelevant **For populations: estimate of minimal viable population size per area:** Minimum viable Metapopulation: 120 pairs (with key-population of at least40 pairs) and 200 pairs (without key-population) (Verboom *et al.* 2001)

Geografical	Habitat	Fysical/chemical
Distribution ● *Wadden Sea* ● *Delta Zeeland (saline)* ● *Inland on arable land and meadows*	**Position in the water column** ○ pelagic ○ demersal ○ planktonic ○ benthic ● *irrelevant*	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ● *eutrophic*
Migratory behavior ○ sedentary ○ migratory ● *variable/dependent on geographical location*	**Seabed/bottom preferences** ● *sand* ○ gravel ○ mud ● *rock*	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ● *irrelevant*
	Intertidal ○ preferred height (relative to MHT) ● *other preferences: forages on intertidal mud-sand flats, in particular recently emersed parts; Inland populations forage mainly on meadows*	**Salinity** ● *saline* ○ brackish ○ freshwater

General description breeding habitat

Breeds coastal, on salt-marshes, sand and shingle beaches. Breeds also inland on farmland and meadows

Breeding season: April – June

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
• *Habitat degradation as a consequence of intensification of farming: draining of the land, early and frequent cutting of the grass* • *Habitat destruction, possibly geomorphological changes in intertidal areas as a consequence of human activities: for instance dredging, construction of dams* ○ Overfishing/overharvesting by shell fishery ○ Bycatch • *Human disturbance: high tide roosts are especially sensitive to disturbance by recreation* ○ Natural disturbance ○ Pollution ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. • *Sea level change could lead to a decrease in feeding habitat* ○ Oil/gass extraction ○ Ship traffic • *Other: climatic change could lead to changes in the composition of prey species and energy content of preys.*	○ Food ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other:….

Data set information

- **Name of data set or monitoring programme**
  Common breeding bird census
- **Measurement unit**
  Number of breeding pairs
- **Brief description of contents data set and/or monitoring programme or hyperlink**
  number of breeding pairs in census plots; data can be used to calculate trends: http://www.sovon.nl
- **Brief description/reference/hyperlink of sampling method**
  Complete counts of breeding pairs in census plots; by mapping the observed birds during the field visits: http://www.sovon.nl/pdf/Handleiding-BMP.pdf
- **Begin date of data set**
  BMP is started in 1984, however from some census plots older data back to about 1950 are available
- **Are other data sets available (give dates)**
- **Frequency of monitoring and next monitoring date**
  yearly

Numbers and distribution

Species is only absent from forested areas like Veluwe, Utrechtse Heuvelrug, parts of eastern Noord-Brabant and Limburg. Highest densities are reached in coastal areas and open meadows and farmland. Between 1973-1977 and 1998-2000 the species expanded its range in particular in Noord-Brabant and along the river Meuse in Limburg.

The species increased from 43.000-50.000 breeding pairs in 1973-1977 to 80.000-100.000 breeding pairs in 1979-1985 and 80.000-130.000 breeding pairs in 1998-2000. However between 1985-90 de trend gradually changed negative.

- **Mean values**

Eur. Oystercatcher/Scholekster	2000	2001	2002	2003	2004	Reference index
Index of breeding pairs Wadden Sea	72	72	59	59	60	100

Measurement Unit: Index value relative to reference value of 100.

Reference values: Available data are population indices according to the BMP network for the Wadden Sea only. The reference value should be expressed as a value relative to the index numbers that are being measured by the monitoring network. Historical indices are absent but estimates are available from Smit & Wolf (1983) for the 70s. it was decided to use data from 1990-1995 because the population was stable during that period. At the beginning of the nineties the influence of the disappeared mussel beds was not yet visible in the counts (Van Roomen *et al.* 2005). The mean index over that period has been set to 100. For the Delta area data are not available in sufficient numbers. In the North Sea coastal zone the numbers are very low and deemed irrelevant.

Distribution data if available (preferably send digital maps otherwise description)

See Appendix 1. Updates on distribution and numbers are published in the annual SOVON breeding bird reports (e.g. Van Dijk *et al.* 2004). Besides complete distribution maps have been published in the national Breeding bird atlases, covering the periods 1998-2000 (SOVON Vogelonderzoek Nederland 2002) and 1973-1977 (Texeira 1979). Additional historical information on distribution and numbers is summarized in Bijlsma *et al.* (2001).

Monitoring network information

- Name of monitoring network
  NEM (Network Ecological Monitoring)
- Brief description of network/hyperlink
  http://www.siliconmeadow.nl/~nemweb/index.html
- Other variables measured in network
  Trends and distributions of populations of other taxonomic groups
- Contact for network
  http://www.siliconmeadow.nl/~nemweb/index.html
- Starting date network
  1995
- Guaranteed continuation of network till what date/year
  Formally till 2006/2007 (agreements for a year), however long term continuation is probable
- Name/map of area covered by network
  The Netherlands
- Reference of last network progress report
  Van Strien A. 2005. Landelijke natuurmeetnetten van het NEM in 2004. Kwaliteitsrapportage NEM. Kengetal J-67, Centraal Bureau voor de Statistiek, Voorburg, The Netherlands.
- Restrictions on availability of data
  Availability original census data not (always) free of charge

2.11 Sterna hirundo hirundo (Common Tern / Visdief)

Species common name	Common Tern
Scientific name	*Sterna hirundo hirundo*
Dutch name	Visdief

Ecological data

Guild ○ herbivore ● *piscivore* ○ omnivore ○ scavenger ○ detritivore ○ planktivore ○ molluscivore ● *other: also feeds on crustaceans.*	**Max. Body weight (adults)** male: 0.111 kg (average) female: 0.113 kg (average) **Max. Length:** between 32 and 39 cm (average) **Maturity age:** between 2 and 4 years (average) **Reproduction:** between 0 and 2 young per female (fledge) (average) **Age:** 25 years (average) **Density/biomass (in optimal habitat):** breeds in colonies with nest spacing ranging from 0.4-5 m **Home range:** between 100 and 1000 ha (average) Most forage 5-10 km from colony **Dispersal distance:** ? **For populations**: estimate of minimal viable population size per area Minimum viable Metapopulation: 120 pairs (with key-population of at least40 pairs) (V and 200 pairs (without key-population) (Verboom *et al.* (2001)

Geografical	Habitat	Fysical/chemical
Distribution ○ *North Sea* ● *coastal (20 km)* ○ offshore ○ deep sea ● *Wadden Sea* ● *Delta Zeeland*	**Position in the water column** ○ pelagic ○ demersal ○ planktonic ○ benthic ● *irrelevant*	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ● *eutrophic*
Migratory behavior ○ sedentary ● *migratory* ○ variable/dependent on geographical location	**Seabed/bottom preferences** ○ sand ○ gravel ○ mud ○ rock ● *irrelevant*	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity *?*
	Intertidal ○ preferred height (relative to MHT) ○ other preferences…. ● *irrelevant*	**Salinity** ● *saline* ○ brackish ○ freshwater

General description breeding habitat

Mainly in coastal areas on bare or sparsely covered terrain (preferably island or saltmarshes), often in association with Black-headed Gull or other terns. Inland nesting can occur in similar areas close to water, partly in artificially constructed areas such as harbour or industrial terrain or sand suppletions).

Breeding season: *middle of April – end of July*

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
• *Habitat degradation, ecological succession of nesting habitat, at present lack of coastal dynamic situations; species is increasingly dependent on man-made nesting sites* ○ Habitat destruction • *Overfishing / overharvesting* ○ Bycatch • *Human disturbance* • *Natural disturbance: nest-predation* • *Pollution: species proved sensitive to pollution in sixties* ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic ○ Other…..	○ Food ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other:….

Data set information

- **Name of data set or monitoring programme**
  National census of rare and colonial breeding birds
- **Measurement unit**
  Number of breeding pairs
- **Brief description of contents data set and/or monitoring programme or hyperlink**
  Yearly nationwide censuses of all breeding colonies; http://www.sovon.nl
- **Brief description/reference/hyperlink of sampling method**
  Census of breeding colonies: number of pairs, nests: http://www.sovon.nl/pdf/Handleiding-LSB.pdf
- **Begin date of data set**
  1992 (start of current monitoring program, older data available)
- **Are other data sets available (give dates)**
  1950-1992, data series may be incomplete
- **Frequency of monitoring and next monitoring date**
  Once a year, 2006

Numbers and distribution

Present distribution and occurence in the Netherlands: the distribution center lies clearly in lower part of the Netherlands, mainly the Delta area, Wadden Sea areas, and the Lake IJssel area. Along the greater rivers and within the wetland in the northern and western areas abundances are much smaller (large colonies only present in Wadden and Delta areas, and on the Frisian part of the shore of Lake IJsel. Breeding deep in the inland is hardly ever seen anymore.

Trends in the Netherlands: The national breeding population has almost doubled since 1973-1977, however, the distribution has decreased somewhat (occupation -8%), mainly as a result of the disappearance of most breeding places in the upper Netherlands; this has however been compensated to a certain degree by new settlements in the west and north of the country and in the western river basin area. The national trend over the period 1990-2002 shows a small (significant) increase, but the numbers of the fifties (30.000-40.000 pairs),

from before the poisoning catastrophe of the sixties, will probably never be reached again. The Dutch breeding population amounted to 18.000-19.500 pairs during 1998-2000 and remained relatively stable around this value (20.000 in 2001, 17.700 in 2002). The largest colonies can be found in the Wadden Sea (Griend and Balgzand) and in the Delta area (Scheelhoek islands and Slijkplaat in the Haringvliet, Hooge Platen in the Westerscheldt). Elsewhere, the only place where colonies with at least 100 pairs can be found on a regular basis is the Lake IJsel area. Outside this area, colonies of this size are rare. In 1993-97 the counted breeding population was on average 17.200 pairs of 77% in designated (Habitats directive) areas.

- **Mean values**

Common Tern/Visdief	2000	2001	2002	2003	2004	Reference value
n breeding pairs Wadden Sea	5338	5201	5354	4796	3130	8450
n breeding pairs Delta area	3471	4171	2699	4348	4207	3500
n breeding pairs North Sea coast	3045	2587	2482	2878	1987	20000

Measurement Unit: the number of breeding pairs of each year.

Reference values: Available reference values are from Stienen & Brenninkmeijer (1992), Baptist & Jagtman (1997) and RIKZ reports (e.g. Strucker *et al.* 2005). Breeding numbers from 1900 are unavailable. The reference values are deduced from breeding numbers from the fifties. Based on expert judgement from RIKZ the terns of the Delta area are separated into colonies with birds fouraging in the coastal zone and other birds (see also Meininger & Strucker 2001).

Distribution data if available (preferably send digital maps otherwise description)

See Appendix 1. Updates on distribution and numbers are published in the annual SOVON breeding bird reports (e.g. Van Dijk *et al.* 2004). Besides complete distribution maps have been published in the national Breeding bird atlases, covering the periods 1998-2000 (SOVON Vogelonderzoek Nederland 2002) and 1973-1977 (Texeira 1979). Additional historical information on distribution and numbers is summarized in Bijlsma *et al.* (2001).

Monitoring network information

- Name of monitoring network
  NEM (Network Ecological Monitoring)
- Brief description of network/hyperlink
  http://www.siliconmeadow.nl/~nemweb/index.html
- Other variables measured in network
  Trends and distributions of populations of other taxonomic groups
- Contact for network
  http://www.siliconmeadow.nl/~nemweb/index.html
- Starting date network
  1995
- Guaranteed continuation of network till what date/year
  Formally till 2006/2007 (agreements for a year), however long term continuation is probable
- Name/map of area covered by network
  The Netherlands
- Reference of last network progress report
  Van Strien A. 2005. Landelijke natuurmeetnetten van het NEM in 2004. Kwaliteitsrapportage NEM. Kengetal J-67, Centraal Bureau voor de Statistiek, Voorburg, The Netherlands.
- Restrictions on availability of data
  Availability original census data not (always) free of charge

2.12 Somateria mollisima mollisima (Common Eider / Eidereend) non-breeding

Species common name	Common Eider
Scientific name	*Somateria mollisima mollisima*
Dutch name	Eider

Ecological data non-breeding

Guild	**Max. Body weight (adults)**
○ herbivore ○ piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ● *molluscivore* ○ other: ….	male: 2.218 kg (average) female: 1.915 kg (average) **Max. Length:** between 50 and 71 cm (average) **Maturity age:** between 2 and 3 years (average) **Reproduction:** irrelevant (non-breeding) **Age:** 23 years (maximum) **Density/biomass (in optimal habitat):** irrelevant **Home range:** between 100 and 1000 ha(average) **Dispersal distance***:* irrelevant **For populations**: irrelevant

Geografical	**Habitat**	**Fysical/chemical**
Distribution ● North Sea ● *coastal* (20 km) ○ offshore ○ deep sea ● *Wadden Sea* ● *Delta Zeeland* (saline)	**Position in the water column** ○ pelagic ○ demersal ○ planktonic ○ benthic ● *other: preferred foraging depth: 0-5m, maximum: 15-20m*	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ● *eutrophic*
Migratory behavior ○ sedentary ○ migratory ● *variable/dependent on geographical location: Dutch breeding population is principally sedentary. Also birds from Scandinavian origin winter in Dutch waters*	**Seabed/bottom preferences** ○ sand ○ gravel ○ mud ○ rock ● *other: mussel and cockle bed: feeding habitat*	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity *?*
	Intertidal ○ preferred height (relative to MHT) ○ other preferences…. ● *irrelevant*	**Salinity** ● *saline* ○ brackish ○ freshwater

General description non-breeding habitat

foraging habitat: littoral and sublittoral mussel and cockle beds in shallow waters.

roosts: along the edges of tidal flats.

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation ○ Habitat destruction ● *Overfishing / overharvesting by shell fish fishery* ○ Bycatch ● *Human disturbance on commercial mussel beds; disturbance in resting and moulting areas by water recreation* ○ Natural disturbance ● *Pollution,: chlorinated carbohydrates and oil spills* ○ Eutrophication ● *Wind farms: when built in staging areas of species*	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic ● *Other: climate change could result in changed food availability: decrease molluscs*	○ Food ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other:….

Data set information

Waterfowl non-breeding

- **Name of data set or monitoring programme**
  Waterbird census scheme in The Netherlands (part of NEM (Network Ecological Monitoring))
- **Measurement unit**
  Number of individuals
- **Brief description of contents data set and/or monitoring programme or hyperlink**
  The waterbird scheme aims to assess (1) national and regional (site-based) trends, and (2) national wintering or migratory populations during international counts in September (Greylag Goose), November (Anser geese), January (all waterbird species), March (Barnacle Goose) and May (Dark-bellied Brent Goose). These international surveys are co-ordinated by Wetlands International. Monitoring in the Wadden Sea is part of a trilateral cooperation between The Netherlands, Germany and Denmark (Trilateral Monitoring and Assessment Program, TMAP). The waterbird scheme is based on monthly counts of monitoring areas and goose/swan staging sites, that are carried out on high tide). Census effort focuses on September-April, when highest numbers are present in most species. In January many additional sites are counted whereas in national freshwater bodies, Delta area and Wadden Sea counts are also covered in (part of) the period May-August. Due to its size, the Wadden Sea can not be covered monthly. Here, counts refer to a combination of 4 complete counts and bi-weekly or monthly counts at 10 sample sites, together allowing a reliable trend assessment for the entire season.
- **Brief description/reference/hyperlink of sampling method**
  Complete counts of all present individuals in a census area
- **Begin date of data set**
  1975/1976
- **Are other data sets available (give dates)**
- **Frequency of monitoring and next monitoring date**
  Census effort monthly at least September-April, many additional sites once a year in January
  See Appendix 1.

Numbers and distribution

The main wintering grounds are situated in the Wadden Sea (Dutch and Scandinavian breeding birds). In case of food shortage birds move to bordering North Sea coastal area. Winterpopulation was estimated at 160.000 in 1995/96 and less than 90.000 in 2002/03. Numbers have decreased in the Wadden Sea and have increased in the bordering North Sea coastal area. Between 1993 and 2003 the total number of wintering birds decreased significantly.

- **Mean values for North Sea, Wadden Sea, Delta area and/or Coastal zone for:**

Common Eider/Eidereend	North Sea coast	Wadden Sea	Delta area
Present (01/02-03/04)	Unknown	110.075	-
Recent (99/00-01/02)	Unknown	83.938	-
Reference value	5.000	120.000	-

Measurement Unit: 3 yearly moving average of midwinter counts of each year.

Reference values: There are no known reference values of wintering populations from the first half of the previous century. Reasonably estimates start to be collected from the mid seventies. The numbers mentioned in Baptist & Jagtman (1997) are problematic because depending on winter conditions and food availability a strong exchange between Wadden Sea and North Sea coast may occur. Numbers are based on RIKZ plain counts. Reference values were set on the basis of Baptist & Jagtman (1997), Camphuysen (1996) and consultation with R. Kats. Because of the exchange between Wadden Sea and North Sea one may argue that the separation between the two regions should not be made. From an ecological point of view high numbers in the North Sea coastal zone should be interpreted as unwanted.

Distribution data if available (preferably send digital maps otherwise description)

See Appendix 1. Updates of its distribution are published in the annual SOVON- waterbird census reports (e.g. Van Roomen *et al.* 2004). The monthly distribution 1979-1985 has been published in SOVON (1987). Additional historical information on distribution and numbers is summarized in Bijlsma *et al.* (2001).

Monitoring network information

- Name of monitoring network
  NEM
- Brief description of network/hyperlink
  http://www.siliconmeadow.nl/~nemweb/index.html
- Other variables measured in network
  Trends and distributions of populations of other taxonomic groups
- Contact for network
  http://www.siliconmeadow.nl/~nemweb/index.html
- Starting date network
  1995
- Guaranteed continuation of network till what date/year
  Formally till 2006/2007 (agreements for a year), however long term continuation is probable
- Name/map of area covered by network
  The Netherlands
- Reference of last network progress report
  Van Strien A. 2005. Landelijke natuurmeetnetten van het NEM in 2004. Kwaliteitsrapportage NEM. Kengetal J-67, Centraal Bureau voor de Statistiek, Voorburg, The Netherlands.
- Restrictions on availability of data
  Availability original census data not (always) free of charge

2.13 Somateria mollisima mollisima (Common Eider / Eidereend) breeding

Species common name	Common Eider
Scientific name	*Somateria mollisima mollisima*
Dutch name	Eider

Ecological data breeding

Guild ○ herbivore ○ piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ● *molluscivore* ○ other: ….	**Max. Body weight (adults)** male: 2.218 kg (average) female: 1.915 kg (average) **Max. Length:** between 50 and 71 cm (average) **Maturity age:** between 2 and 3 years (average) **Reproduction:** 0.25±0,38 young per female per year (Vlieland, The Netherlands (Camphuysen 1996) **Age:** 23 years (maximum) **Density/biomass (in optimal habitat):** irrelevant, usually forms breeding colonies **Home range:** between 100 and 1000 ha(average) **Dispersal distance:** irrelevant **For populations: estimate of minimal viable population size per area:** Minimum viable Metapopulation: 120 pairs (with key-population of at least40 pairs) and 200 pairs (without key-population) (Verboom *et al.* 2001)

Geografical	Habitat	Fysical/chemical
Distribution ● North Sea ● *coastal* (20 km) ○ offshore ○ deep sea ● *Wadden Sea* ● *Delta Zeeland* (saline)	**Position in the water column** ○ pelagic ○ demersal ○ planktonic ○ benthic ● *other: preferred depth: 0-5m, maximum: 15-20m*	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic
Migratory behavior ○ sedentary ○ migratory ● *variable / dependent on geographical location: Dutch breeding population is principally sedentary. Also birds from Scandinavian origin winter in Dutch waters*	**Seabed/bottom preferences** ○ sand ○ gravel ○ mud ○ rock ● *other: mussel and cockle bed: feeding habitat*	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity *?*
	Intertidal ○ preferred height (relative to MHT) ○ other preferences…. ● *irrelevant*	**Salinity** ● *saline* ○ brackish ○ freshwater

General description breeding habitat

The breeding biotope lies in the coastal areas. Nesting places are close to salt water (within 600m) in open dune areas, on salt marshes and, less often, on dikes, piers and pastures. The nest is made in a small depression in the ground or within the cover of stones, grass, bushes (50-150 high, mainly Sea Buckthorn and Creeping Willow), just above mean high tide, in reed, between ferns or bare branches or on bare ground. Breeding takes generally place within colonies, often close to other colony breeders such as gulls and terns (protection is preferred even though there is a risk of predation on the young). After hatching, the ducks and their young come together in crèches where a few females take care of many young.

Breeding season: *April-September*

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation ○ Habitat destruction ● *Overfishing / overharvesting by shell fish fishery* ○ Bycatch ● *Human disturbance on commercial mussel beds; disturbance in resting and moulting areas by water recreation* ○ Natural disturbance ● *Pollution: chlorinated carbohydrates and oil spills* ○ Eutrophication ● *Wind farms: when built in staging areas of species*	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic ● *Other: climate change could result in changed food availability: decrease molluscs*	○ Food ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other:….

Data set information

- **Name of data set or monitoring programme**
  National census of rare and colonial breeding birds
- **Measurement unit**
  Number of breeding pairs
- **Brief description of contents data set and/or monitoring programme or hyperlink**
  Yearly nationwide censuses of all breeding colonies; http://www.sovon.nl
- **Brief description/reference/hyperlink of sampling method**
  Census of breeding colonies: number of pairs, nests: http://www.sovon.nl/pdf/Handleiding-LSB.pdf
- **Begin date of data set**
  1992 (start of current monitoring program, older data available)
- **Are other data sets available (give dates)**
  1950-1992, data series may be incomplete

Numbers and distribution

Present distribution and occurence in the Netherlands: Almost the complete Dutch breeding population is nesting on the Wadden Sea islands (mainly Vlieland, Terschelling, and Schiermonnikoog). Very low numbers breed along Wadden Sea coast of the provinces of Friesland and Groningen and in the Delta area (Neeltje Jans, Easterscheldt). The natural distribution is soley restricted to the coastal Wadden Sea regions and, marginally, the west coast and the Delta area. Outside the breeding season the species is mainly present in the Wadden Sea where part of the Ducth breeders and large numbers of Scandinavian birds remain during the winter. Since the beginning of the nineties massive numbers of birds have been observed migrating to the bordering North Sea coastal zone because of food shortages in the Wadden Sea.

Trends in the Netherlands: Since 1973-77 the distribution has increased (+62), even though this has been restricted to marginal new breeding areas (from the end of the eighties on Neeltje jans and since the nineties on the saltmarshes of Friesland and Groningen). Since the mid seventies (4000 pairs) the breeding population has more than doubled, but after 1997 there appears to be a strong decrease. In 1988-2000 the dutch breeding population has been estimated at 8.000-10.000 pairs and till recently 100.000-170.000 wintering eiders could be counted, concentrating in the Wadden Sea till the mid eighties. Since then numbers in the

(western) Wadden Sea have decreased and increased in the bordering North Sea coastal zone. The number of wintering birds have not clearly changed when viewed since 1969 from a national perspective. Recently, in the period 1993-2003 however, the decrease was significant. Since the top year of 1995/96 with 160.000 birds numbers have decreased till less than 90.000 in the winter of 2002/03. Almost the complete national population nests and stages in areas that have been designated under the EC Birds and Habitats Directive.

- **Mean values**

Common Eider/Eidereend	2000	2001	2002	2003	2004	Reference value
Number of breeding pairs Wadden Sea	7257	8005	6883	5461	5835	9000

Measurement Unit: The number of breeding pairs of each year.
Reference values: Available data are population indices according to the BMP network for the Wadden Sea only. The reference value should be expressed as a value relative to the index numbers that are being measured by the monitoring network. The reference value is based on Camphuysen (1996) who gives an overview of all available data. His reference value of 9000 was reached during the first half of the nineties when the species had recovered from the previous over-exploitation and poisoning and the effects of the disappeared mussel beds has not yet become apparent (Van Roomen *et al.* 2005).
For the index value of the reference the mean BMP index for the period 1990-1995 has been calculated as 9000 pairs. Consequently, the BMP indices for the Wadden Sea per year have been expressed as an estimate for the yearly number of breeding pairs for the whole Wadden Sea. Because the eider is a rare breeding bird in other parts of the marine and coastal environment, no index/number are calculated for the other areas.

Distribution data if available (preferably send digital maps otherwise description)

See Appendix 1. Updates on distribution and numbers are published in the annual SOVON breeding bird reports (e.g. Van Dijk *et al.* 2004). Besides complete distribution maps have been published in the national Breeding bird atlases, covering the periods 1998-2000 (SOVON Vogelonderzoek Nederland 2002) and 1973-1977 (Texeira 1979). Additional historical information on distribution and numbers is summarized in Bijlsma *et al.* (2001).

Monitoring network information

- Name of monitoring network
  NEM (Network Ecological Monitoring)
- Brief description of network/hyperlink
  http://www.siliconmeadow.nl/~nemweb/index.html
- Other variables measured in network
  Trends and distributions of populations of other taxonomic groups
- Contact for network
  http://www.siliconmeadow.nl/~nemweb/index.html
- Starting date network
  1995
- Guaranteed continuation of network till what date/year
  Formally till 2006/2007 (agreements for a year), however long term continuation is probable
- Name/map of area covered by network
  The Netherlands
- Reference of last network progress report
  Van Strien A. 2005. Landelijke natuurmeetnetten van het NEM in 2004. Kwaliteitsrapportage NEM. Kengetal J-67, Centraal Bureau voor de Statistiek, Voorburg, The Netherlands.
- Restrictions on availability of data
  Availability original *census* data not (always) free of charge

2.14 Limosa lapponica/taymirensis (Bar-tailed Godwit / Rosse Grutto) non-breeding

Species common name	Bar-tailed Godwit
Scientific name	*Limosa lapponica/taymirensis*
Dutch name	Rosse Grutto

Ecological data non-breeding

Guild ○ herbivore ○ piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ○ molluscivore ● *other: feeds mainly on polychaete worms and to a lesser extent on crustaceans, molluscs and crane-fly larvae*	**Max. Body weight (adults)** male: 0.286 kg (average) female: 0.356 kg (average) **Max. Length:** between 37 and 41 cm (average) **Maturity age:** after 2 years (average) **Reproduction:** irrelevant **Age:** 18 years (maximum) **Density/biomass (in optimal habitat):** irrelevant **Home range:** irrelevant **Dispersal distance:** irrelevant **For populations: estimate of minimal viable population size per area:** irrelevant

Geografical	Habitat	Fysical/chemical
Distribution ○ North Sea ○ coastal (20 km or use other distance…) ○ offshore ○ deep sea ● *Wadden Sea* ● *Delta Zeeland (saline)*	**Position in the water column** ○ pelagic; average depth between…and…m ○ demersal ○ planktonic; average depth between…and…m ○ benthic ● *irrelevant*	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic
Migratory behavior ○ sedentary ● *migratory* ○ variable/dependent on geographical location	**Seabed/bottom preferences** ● *sand* ○ gravel ● *mud* ○ rock	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ● *irrelevant*
	Intertidal ○ preferred height (relative to MHT) ○ *other preferences: foraging habitat: intertidal mud-sand flats, in particular recently emersed parts*	**Salinity** ○ *saline* ○ brackish ○ freshwater

General description non-breeding habitat

Foraging-habitat: both sand and mud flats in tidal areas and on inland meadows, during spring migration

roosts: Mixed species high tide roosts are located outside the dikes on the higher parts of salt marshes and sand flats and inland in polders close to the foraging areas.

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation ○ Habitat destruction ○ Overfishing/overharvesting ○ Bycatch ● *Human disturbance: disturbance on high tide roosts by recreation* ○ Natural disturbance ○ Pollution ○ Eutrophication ● *Wind farms, could disturb species on inland roosts*	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ● *Sea level change could lead to geomorphological changes in tidal areas: loss of feeding habitat* ○ Oil/gass extraction ○ Ship traffic	○ Food ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other:….

Data set information

- **Name of data set or monitoring programme**
  Waterbird census scheme in The Netherlands (part of NEM (Network Ecological Monitoring))
- **Measurement unit**
  Number of individuals
- **Brief description of contents data set and/or monitoring programme or hyperlink**
  The waterbird scheme aims to assess (1) national and regional (site-based) trends, and (2) national wintering or migratory populations during international counts in September (Greylag Goose), November (Anser geese), January (all waterbird species), March (Barnacle Goose) and May (Dark-bellied Brent Goose). These international surveys are co-ordinated by Wetlands International. Monitoring in the Wadden Sea is part of a trilateral cooperation between The Netherlands, Germany and Denmark (Trilateral Monitoring and Assessment Program, TMAP). The waterbird scheme is based on monthly counts of monitoring areas and goose/swan staging sites, that are carried out on high tide). Census effort focuses on September-April, when highest numbers are present in most species. In January many additional sites are counted whereas in national freshwater bodies, Delta area and Wadden Sea counts are also covered in (part of) the period May-August. Due to its size, the Wadden Sea can not be covered monthly. Here, counts refer to a combination of 4 complete counts and bi-weekly or monthly counts at 10 sample sites, together allowing a reliable trend assessment for the entire season.
- **Brief description/reference/hyperlink of sampling method**
  Complete counts of all present individuals in a census area
- **Begin date of data set**
  1975/1976
- **Are other data sets available (give dates)**
- **Frequency of monitoring and next monitoring date**
  Census effort monthly at least September-April, many additional sites once a year in January

Numbers and distribution

Distribution is almost limited to tidal areas, in particular in Wadden Sea and Oosterschelde and to a lesser extent in Westerschelde and Voordelta. Wintering numbers (ssp. laponica) in the Wadden Sea have increased since 1988 and are stable in the Delta-area.

- **Mean values for North Sea, Wadden Sea, Delta area and/or Coastal zone for:**

Bar-tailed Godwit / Rosse Grutto	North Sea	Wadden Sea	Delta area
Present (01/02-03/04)	-	57625	6076
Recent (99/00-01/02)	-	50927	5786
Reference value	-	33000	6000

Measurement Unit: 3 yearly moving average of monthly mean (Juli-June) of each year.

Reference values: There are no known reference values of wintering populations from the first half of the previous century. Reasonably estimates start to be collected from the mid seventies for the Wadden Sea and the end of the eighties for the Delta area. In accordance with the reference period for other bivalve eating birds 1990-1995 has been taken. Large changes in the Wadden Sea ecosystem have occurred since then.

Distribution data if available (preferably send digital maps otherwise description)

See Appendix 1. Updates of its distribution are published in the annual SOVON- waterbird census reports (e.g. Van Roomen *et al.* 2004). The monthly distribution 1979-1985 has been published in SOVON (1987). Additional historical information on distribution and numbers is summarized in Bijlsma *et al.* (2001).

Monitoring network information

- Name of monitoring network
  NEM
- Brief description of network/hyperlink
  http://www.siliconmeadow.nl/~nemweb/index.html
- Other variables measured in network
  Trends and distributions of populations of other taxonomic groups
- Contact for network
  http://www.siliconmeadow.nl/~nemweb/index.html
- Starting date network
  1995
- Guaranteed continuation of network till what date/year
  Formally till 2006/2007 (agreements for a year), however long term continuation is probable
- Name/map of area covered by network
  The Netherlands
- Reference of last network progress report
  Van Strien A. 2005. Landelijke natuurmeetnetten van het NEM in 2004. Kwaliteitsrapportage NEM. Kengetal J-67, Centraal Bureau voor de Statistiek, Voorburg, The Netherlands.
- Restrictions on availability of data
  Original census data not (always) free of charge

2.15 Sterna sandvicensis sandvicensis (Sandwich Tern / Grote stern)

Species common name	Sandwich Tern
Scientific name	*Sterna sandvicensis sandvicensis*
Dutch name	Grote Stern

Ecological data

Guild ○ herbivore ● *piscivore* ○ omnivore ○ scavenger ○ detritivore ○ planktivore ○ molluscivore ○ other: ….	**Max. Body weight (adults)** male: 0.245 kg (average) female: 0.240 kg (average) **Max. Length:** between 36 and 46 cm (average) **Maturity age:** between 3 and 4 years/months (average) **Reproduction:** 0.6 young per female (fledge) (average) **Age:** 23 years (maximum) **Density/biomass (in optimal habitat):** breeds in large compact colonies: 2-10 nests/m^2 **Home range:** forages usually within 15 km from colony but occasionally up to 40 km. **Dispersal distance:** irrelevant **For populations: estimate of minimal viable population size per area:** Minimum viable Metapopulation: 120 pairs (with key-population of at least 40 pairs) and 200 pairs (without key-population) (Verboom *et al.* 2001)

Geografical	Habitat	Fysical/chemical
Distribution ● *North Sea* ○ coastal (20 km or use other distance…) ○ offshore ○ deep sea ● *Wadden Sea* ● *Delta Zeeland* (saline)	**Position in the water column** ○ pelagic; average depth between…and…m ○ demersal ○ planktonic; average depth between…and…m ○ benthic ● *forages to 1,5 m depth*	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic irrelevant
Migratory behavior ○ sedentary ● *migratory* ○ variable/dependent on geographical location	**Seabed/bottom preferences** ○ sand ○ gravel ○ mud ○ rock	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ● *probably best feeding conditions in clear water*
	Intertidal ○ preferred height (relative to MHT) ○ other preferences….	**Salinity** ● *saline* ○ brackish ○ freshwater

General description breeding habitat

The species breeds in dynamic coastal environments that are free from ground predators, mostly bare or sparsely vegetated islands (vegetation cover between 10-30%, height between 10-25cm). In these areas breeding is in compact colonies (up to 10 nests/m^2 in the center and 2 nests/m^2 at the border of the colony), preferably in association with Black-headed Gull or other terns. The border of the vegetated zone can often be found near the nest, so chicks can find cover.

Breeding season: *April - July*

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
• *Habitat degradation ecological succession of nesting habitat, at present lack of coastal dynamic situations; species is increasingly dependent on man-made nesting sites* ○ Habitat destruction ○ *Overfishing/overharvesting; could result in food shortage in both breeding and wintering areas* ○ Bycatch • *Human disturbance; especially sensitive to recreation pressure at the start of the nesting season* • *Natural disturbance; flooding of nesting colonies at spring-tide or being covered with sand after strong winds* • *Pollution; in sixties sensitive toxic effects of bio-accumulated chlorinated hydrocarbons* ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic • *Other: consequences of bird catching in wintering areas on population are unclear …..*	○ Food ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other:….

Data set information

- **Name of data set or monitoring programme**
  National census of rare and colonial breeding birds
- **Measurement unit**
  Number of breeding pairs
- **Brief description of contents data set and/or monitoring programme or hyperlink**
  Yearly nationwide censuses of all breeding colonies; http://www.sovon.nl
- **Brief description/reference/hyperlink of sampling method**
  Census of breeding colonies: number of pairs, nests: http://www.sovon.nl/pdf/Handleiding-LSB.pdf
- **Begin date of data set**
  1992 (start of current monitoring program, older data available)
- **Are other data sets available (give dates)**
  1950-1992, data series may be incomplete
- **Frequency of monitoring and next monitoring date**
  Once a year, 2006

Numbers and distribution

Present distribution and occurence in the Netherlands: distribution is limited to a small number of colonies in the Wadden Sea and Delta area. There are large colonies on Griend (Wadden Sea), Hompelvoet (Lake Grevelingen) and Hooge Platen (Westerscheldt). Incidentally, there have been settlements elsewhere, but these are generally unsuccessful. The natural distribution remains restricted to the Wadden area and the Delta area with some marginal colonies on the west coast.

Trends in the Netherlands: Since 1973-77 the national population has almost tripled. The numbers from before the poison disaster of the sixties (27.000-35.000) however, have not

yet been reached. The occupation has decreased since the seventies (-38%), but this is solely accountable to the marginal breeding places. Changes in the numbers of breeders in the national population are mainly due to numbers in the large colonies of the Wadden Sea (Griend, 1998-2002, 7000-10.970 pairs) and the Delta area (Hompelvoet and surroundings 1750-4100, Hooge Platen 2200-4600). Nationally, there is a small (significant) increase from 1990-2002 (33-100% over 10 years).

In the period 1998-2000 the Dutch breeding population was estimated at 14.500 pairs; in 2002 it had increased till more than 17.000 pairs, mostly because of a strong increase on Griend. In 1993-97 the counted breeding population was on average 11.700 pairs, all nesting in areas designated under the EC Habitats and Birds Directive.

- **Mean values for North Sea, Wadden Sea, Delta area and/or Coastal zone for:**

Sandwich Tern/Grote stern	2000	2001	2002	2003	2004	Reference value
n. breeding pairs Wadden Sea	8658	8223	11108	11810	11528	28.000 for whole area
n. breeding pairs Delta area	5800	6126	6200	6701	4200	
n. breed. pairs North Sea coast	14458	14349	17308	18511	15728	

Measurement Unit: The number of breeding pairs of each year.

Reference values: Available reference value in Baptist & Jagtman (1997) and described in Stienen (2006). Numbers are availble since 1900; the maximum during this period has been taken as the reference value, however, since this species forages mainly in the North Sea, Baptist & Jagtman (1997) use it as an indicator for the North Sea coast only.

Distribution data if available (preferably send digital maps otherwise description)

See Appendix 1. Updates on distribution and numbers are published in the annual SOVON breeding bird reports (e.g. Van Dijk *et al.* 2004). Besides complete distribution maps have been published in the national Breeding bird atlases, covering the periods 1998-2000 (SOVON Vogelonderzoek Nederland 2002) and 1973-1977 (Texeira 1979). Additional historical information on distribution and numbers is summarized in Bijlsma *et al.* (2001).

Monitoring network information

- Name of monitoring network
  NEM (Network Ecological Monitoring)
- Brief description of network/hyperlink
  http://www.siliconmeadow.nl/~nemweb/index.html
- Other variables measured in network
  Trends and distributions of populations of other taxonomic groups
- Contact for network
  http://www.siliconmeadow.nl/~nemweb/index.html
- Starting date network
  1995
- Guaranteed continuation of network till what date/year
  Formally till 2006/2007 (agreements for a year), however long term continuation is probable
- Name/map of area covered by network
  The Netherlands
- Reference of last network progress report
  Van Strien A. 2005. Landelijke natuurmeetnetten van het NEM in 2004. Kwaliteitsrapportage NEM. Kengetal J-67, Centraal Bureau voor de Statistiek, Voorburg, The Netherlands.
- Restrictions on availability of data
  Availability original census data not (always) free of charge

2.16 Calidris alpina spec. (mainly alpina; Dunlin / Bonte strandloper)

Species common name	Dunlin
Scientific name	*Calidris alpina* spec. (mainly alpina)
Dutch name	Bonte Strandloper

Ecological data

Guild ○ herbivore ○ piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ● *molluscivore* ● *other: mainly feeds on polychaete worms, and crustaceans*	**Max. Body weight (adults)** male: 0.051 kg (average) female: 0.055 kg (average) **Max. Length:** between 16 and 22 cm (average) **Maturity age:** after 1 year (average) **Reproduction:** irrelevant **Age:** 24 years (maximum) **Density/biomass (in optimal habitat):** irrelevant **Home range:** irrelevant **Dispersal distance:** irrelevant **For populations: estimate of minimal viable population size per area:** irrelevant

Geografical	Habitat	Fysical/chemical
Distribution ○ North Sea ● *coastal* (20 km or use other distance…) ○ offshore ○ deep sea ● *Wadden Sea* ● *Delta Zeeland* (saline)	**Position in the water column** ○ pelagic; average depth between…and…m ○ demersal ○ planktonic; average depth between…and…m ○ benthic ● *irrelevant*	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ● eutrophic
Migratory behavior ○ sedentary ● *migratory* ○ variable/dependent on geographical location	**Seabed/bottom preferences** ● *sand* ○ gravel ● *mud* ○ rock	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ● *irrelevant*
	Intertidal ○ preferred height (relative to MHT) ● *other preferences: forages on intertidal mud-sand flats, in particular recently emersed parts.*	**Salinity** ● *saline* ● *brackish* ● *freshwater*

General description non-breeding habitat

Foraging habitat: intertidal mud-sand flats, in particular recently emersed parts. Moreover occurs on mudflats in marshes, muddy river-/ lakeshores. After heavy rains forages on farmland and meadows.

roosts: uses mixed species high tide roosts in salt marshes, sand banks, beaches and inland wetlands close to the foraging areas.

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation ● *Habitat destruction, possibly geomorphological changes in intertidal areas as a consequence of human activities: for instance dredging, construction of dams*, ○ Overfishing/overharvesting ○ Bycatch ● *Human disturbance (recreation air traffic)* ○ Natural disturbance ○ Pollution ○ Eutrophication ● *Wind farms (collisions between foraging areas and high tide refuges*	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ● *Sea level change* ○ Oil/gass extraction ○ Ship traffic ○ Other…..	○ Food ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other:….

Data set information Waterfowl non-breeding

- **Name of data set or monitoring programme**
  Waterbird census scheme in The Netherlands (part of NEM (Network Ecological Monitoring))
- **Measurement unit**
  Number of individuals
- **Brief description of contents data set and/or monitoring programme or hyperlink**
  The waterbird scheme aims to assess (1) national and regional (site-based) trends, and (2) national wintering or migratory populations during international counts in September (Greylag Goose), November (Anser geese), January (all waterbird species), March (Barnacle Goose) and May (Dark-bellied Brent Goose). These international surveys are co-ordinated by Wetlands International. Monitoring in the Wadden Sea is part of a trilateral cooperation between The Netherlands, Germany and Denmark (Trilateral Monitoring and Assessment Program, TMAP). The waterbird scheme is based on monthly counts of monitoring areas and goose/swan staging sites, that are carried out on high tide). Census effort focuses on September-April, when highest numbers are present in most species. In January many additional sites are counted whereas in national freshwater bodies, Delta area and Wadden Sea counts are also covered in (part of) the period May-August. Due to its size, the Wadden Sea can not be covered monthly. Here, counts refer to a combination of 4 complete counts and bi-weekly or monthly counts at 10 sample sites, together allowing a reliable trend assessment for the entire season.
- **Brief description/reference/hyperlink of sampling method**
  Complete counts of all present individuals in a census area
- **Begin date of data set**
  1975/1976
- **Frequency of monitoring and next monitoring date (See Appendix 1)**
  Census effort monthly at least September-April, many additional sites once a year in January

Numbers and distribution

Distribution concentrates in tidal areas of Wadden Sea and Delta area. In particular during autumn and spring migration turns up in small numbers in Noord-Holland, along rivers, and IJsselmeer.
Average numbers in the Netherlands have increased to 170.000 in 1999-2001. Numbers have increased in the Wadden Sea since 1985. Numbers in the Delta area are stable.

- **Mean values for North Sea, Wadden Sea, Delta area and/or Coastal zone for:**

Dunlin/Bonte strandloper	North Sea	Wadden Sea	Delta area
Present (01/02-03/04)	-	211433	32053
Recent (99/00-01/02)	-	207839	32604
Reference value	-	130000	25000

Measurement Unit: 3 yearly moving average of monthly mean (Juli-June) of each year.

Reference values: There are no known reference values of wintering populations from the first half of the previous century. Reasonably estimates start to be collected from the mid seventies for the Wadden Sea and the end of the eighties for the Delta area. For the Wadden Sea 1975-1990 has been chosen as a reference period because of the large availability of wild mussel beds for the birds in that period. The disappearance of these mussel banks in later years was followed by large changes in the numbers of birds (Van Roomen *et al*. 2005). For the Delta area such impacts are absent and the average of the first 10 years of 1987-2004 has been chosen.

Distribution data if available (preferably send digital maps otherwise description)

See Appendix 1. Updates of its distribution are published in the annual SOVON- waterbird census reports (e.g. Van Roomen *et al*. 2004). The monthly distribution 1979-1985 has been published in SOVON (1987). Additional historical information on distribution and numbers is summarized in Bijlsma *et al*. (2001).

Monitoring network information

- Name of monitoring network
  NEM
- Brief description of network/hyperlink
  http://www.siliconmeadow.nl/~nemweb/index.html
- Other variables measured in network
  Trends and distributions of populations of other taxonomic groups
- Contact for network
  http://www.siliconmeadow.nl/~nemweb/index.html
- Starting date network
  1995
- Guaranteed continuation of network till what date/year
  Formally till 2006/2007 (agreements for a year), however long term continuation is probable
- Name/map of area covered by network
  The Netherlands
- Reference of last network progress report
  Van Strien A. 2005. Landelijke natuurmeetnetten van het NEM in 2004. Kwaliteitsrapportage NEM. Kengetal J-67, Centraal Bureau voor de Statistiek, Voorburg, The Netherlands.
- Restrictions on availability of data
  Availability original census data not (always) free of charge

2.17 Branta bernicla bernicla (Dark-bellied Brent Goose / Zwartbuikrotgans)

Species common name	Dark-bellied Brent Goose
Scientific name	*Branta bernicla bernicla*
Dutch name	Zwartbuikrotgans

Ecological data non-breeding

Guild ● *herbivore* ○ piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ○ molluscivore ○ other: ….	**Max. Body weight (adults)** both sexes: 1.411 kg (average) **Max. Length:** between 55 and 66 cm (average) **Maturity age:** between 2 and 3 years/months (average) **Reproduction:** irrelevant **Age:** 13 years (maximum) **Density/biomass (in optimal habitat):** irrelevant **Home range:** irrelevant **Dispersal distance:** irrelevant **For populations: estimate of minimal viable population size per area:** irrelevant

Geografical	Habitat	Fysical/chemical
Distribution ○ North Sea ○ coastal ○ offshore ○ deep sea ● *Wadden Sea* ● *Delta Zeeland (saline)*	**Position in the water column** ○ pelagic ○ demersal ○ planktonic ○ benthic ● *irrelevant*	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ● *eutrophic*
Migratory behavior ○ sedentary ● *migratory* ○ variable/dependent on geographical location	**Seabed/bottom preferences** ○ sand ○ gravel ○ mud ○ rock ● *irrelevant*	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ● *irrelevant*
	Intertidal ○ preferred height (relative to MHT) ● *other preferences: rests on intertidal waters or sand banks near feeding areas, forages on tidal flats on seaweeds*	**Salinity** ○ *saline* ○ brackish ○ freshwater

General description non-breeding habitat

In autumn initially forages in tidal area, from October changes over to meadows in the nearby polders and farmland (winter-wheat, grass), from May changes to salt marshes. Species does not specifically use high tide roosts, at night collects in groups on open tidal waters.

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
• *Habitat degradation: ecological succession of foraging areas on salt marshes when grazing is stopped*	○ Invasive species	○ Food	○ Building material
○ Habitat destruction	○ Disease	○ Medicine	○ Energy
○ Overfishing/overharvesting	○ Poisoning	○ Recreation	○ Other:….
○ Bycatch	○ Sea surface temp. incr.		
• *Human disturbance by recreation, farming activities, traffic and low-flying planes/helicopters*	○ Sea level change		
○ Natural disturbance	○ Oil/gass extraction		
○ Pollution	○ Ship traffic		
○ Eutrophication	○ Other…..		
• *Wind farms*			

Data set information Waterfowl non-breeding

- **Name of data set or monitoring programme**
  Waterbird census scheme in The Netherlands (part of NEM (Network Ecological Monitoring))
- **Measurement unit**
  Number of individuals
- **Brief description of contents data set and/or monitoring programme or hyperlink**
  The waterbird scheme aims to assess (1) national and regional (site-based) trends, and (2) national wintering or migratory populations during international counts in September (Greylag Goose), November (Anser geese), January (all waterbird species), March (Barnacle Goose) and May (Dark-bellied Brent Goose). These international surveys are co-ordinated by Wetlands International. Monitoring in the Wadden Sea is part of a trilateral cooperation between The Netherlands, Germany and Denmark (Trilateral Monitoring and Assessment Program, TMAP). The waterbird scheme is based on monthly counts of monitoring areas and goose/swan staging sites, that are carried out on high tide). Census effort focuses on September-April, when highest numbers are present in most species. In January many additional sites are counted whereas in national freshwater bodies, Delta area and Wadden Sea counts are also covered in (part of) the period May-August. Due to its size, the Wadden Sea can not be covered monthly. Here, counts refer to a combination of 4 complete counts and bi-weekly or monthly counts at 10 sample sites, together allowing a reliable trend assessment for the entire season.
- **Brief description/reference/hyperlink of sampling method**
  Complete counts of all present individuals in a census area
- **Begin date of data set**
  1975/1976
- **Are other data sets available (give dates)**
- **Frequency of monitoring and next monitoring date (See Appendix 1)**
  Census effort monthly at least September-April, many additional sites once a year in January

Numbers and distribution

Distribution encompasses Wadden and Delta area.
Numbers have decreased since early nineties of the 20th century.

- **Mean values for North Sea, Wadden Sea, Delta area and/or Coastal zone for:**

Dark-bellied Brent Goose/Zwartbuikrotgans	North Sea	Wadden Sea	Delta area
Present (01/02-03/04)	-	24759	7833
Recent (99/00-01/02)	-	28231	8484
Reference value	-	25000	10000

Measurement Unit: 3 yearly moving average of monthly mean (Juli-June) of each year.

Reference values: There are no known reference values of wintering populations from the first half of the previous century. Reasonably estimates start to be collected from the mid seventies for the Wadden Sea and the end of the eighties for the Delta area. After a reduction in hunting pressure the species increased in the seventies. Consequently, a reference period is hard to set. Because species numbers have stabilized since 1990 an average monthly mean based on 10 years since 1990 has been chosen as a reference value. For the Delta area the same period has been taken.

Distribution data if available (preferably send digital maps otherwise description)

See Appendix 1. Updates of its distribution are published in the annual SOVON- waterbird census reports (e.g. Van Roomen *et al.* 2004). The monthly distribution 1979-1985 has been published in SOVON (1987). Staging areas have been mapped and described in Koffijberg *et al* (1997): 1985-94, and Voslamber *et al.* (2005): 1994-03. Additional historical information on distribution and numbers is summarized in Bijlsma *et al.* (2001).

Monitoring network information

- Name of monitoring network
  NEM
- Brief description of network/hyperlink
  http://www.siliconmeadow.nl/~nemweb/index.html
- Other variables measured in network
  Trends and distributions of populations of other taxonomic groups
- Contact for network
  http://www.siliconmeadow.nl/~nemweb/index.html
- Starting date network
  1995
- Guaranteed continuation of network till what date/year
  Formally till 2006/2007 (agreements for a year), however long term continuation is probable
- Name/map of area covered by network
  The Netherlands
- Reference of last network progress report
  Van Strien A. 2005. Landelijke natuurmeetnetten van het NEM in 2004. Kwaliteitsrapportage NEM. Kengetal J-67, Centraal Bureau voor de Statistiek, Voorburg, The Netherlands.
- Restrictions on availability of data
  Availability original census data not (always) free of charge

2.18 Relevant publications or expert group meetings

Bijlsma R.G., F. Hustings & C.J. Camphuysen (2001). Algemene en schaarse vogels van Nederland (Avifauna van Nederland 2). GMB Uitgeverij/KNNV Uitgeverij, Haarlem/Utrecht.

Den Boer, T.E., F. Arts, R.B. Beijersbergen & P.L. Meininger (1993). Actieplan Dwergstern. Actie rapport 8, Vogelbescherming Nederland, Zeist.

Koffijberg K., B. Voslamber & E. van Winden (1997). Ganzen en zwanen in Nederland: overzicht van pleisterplaatsen in de periode 1985-94. SOVON Vogelonderzoek Nederland, Beek-Ubbergen.

SOVON 1987. Atlas van de Nederlandse Vogels.

SOVON Vogelonderzoek Nederland (2002). Atlas van de Nederlandse Broedvogels 1998-2000. – Nederlandse Fauna 5. Nationaal Natuurhistorisch Museum Naturalis, KNNV Uitgeverij & European Invertebrate Survey-Nederland, Leiden

Texeira R. (red, 1979). Atlas van de Nederlandse broedvogels. Natuurmonumenten, 's-Graveland.

Van Dijk A.J., L. Dijksen, F. Hustings, K. Koffijberg, J. Schoppers, W. Teunissen, C. van Turnhout, M.J.T. van der Weide, D. Zoetebier & C. Plate (2005). Broedvogels in Nederland in 2003. SOVON-monitoring-rapport 2005/01. SOVON Vogelonderzoek Nederland, Beek-Ubbergen (English summary)

Van Roomen M., E. van Winden, K. Koffijberg, A. Boele, F. Hustings, F. Kleefstra, J. Schoppers, C. van Turnhout & L. Soldaat (2004). Watervogels in Nederland in 2002/2003. SOVON-monitoringrapport 2004/02, RIZA-rapport BM04/09, SOVON Vogelonderzoek Nederland, Beek-Ubbergen (English summary)

Voslamber B., E. van Winden & K. Koffijberg (2004). Atlas van ganzen, zwanen en Smienten in Nederland. SOVON-onderzoeksrapport 2004/08. SOVON Vogelonderzoek Nederland, Beek-Ubbergen.

3 Fish

3.1 Introduction

The fish for which ecoprofiles have been made are given below. This is a selection because of limited resources within this study.

Other species for which data are available include snake pipefish (adderzeenaald), anchovy (ansjovis), flounder (bot), butterfish (botervis), Solenette (dwergtong), spotted ray (gevlekte rog), scad (horsmakreel), lesser weever (kleine pieterman), tub gurnard (rode poon), dab (schar), sea snail (slakdolf), turbot (tarbot), lemon sole (tongschar), five-bearded rockling (vijfdradige meun), angler (zeeduivel) and bass (zeebaars).

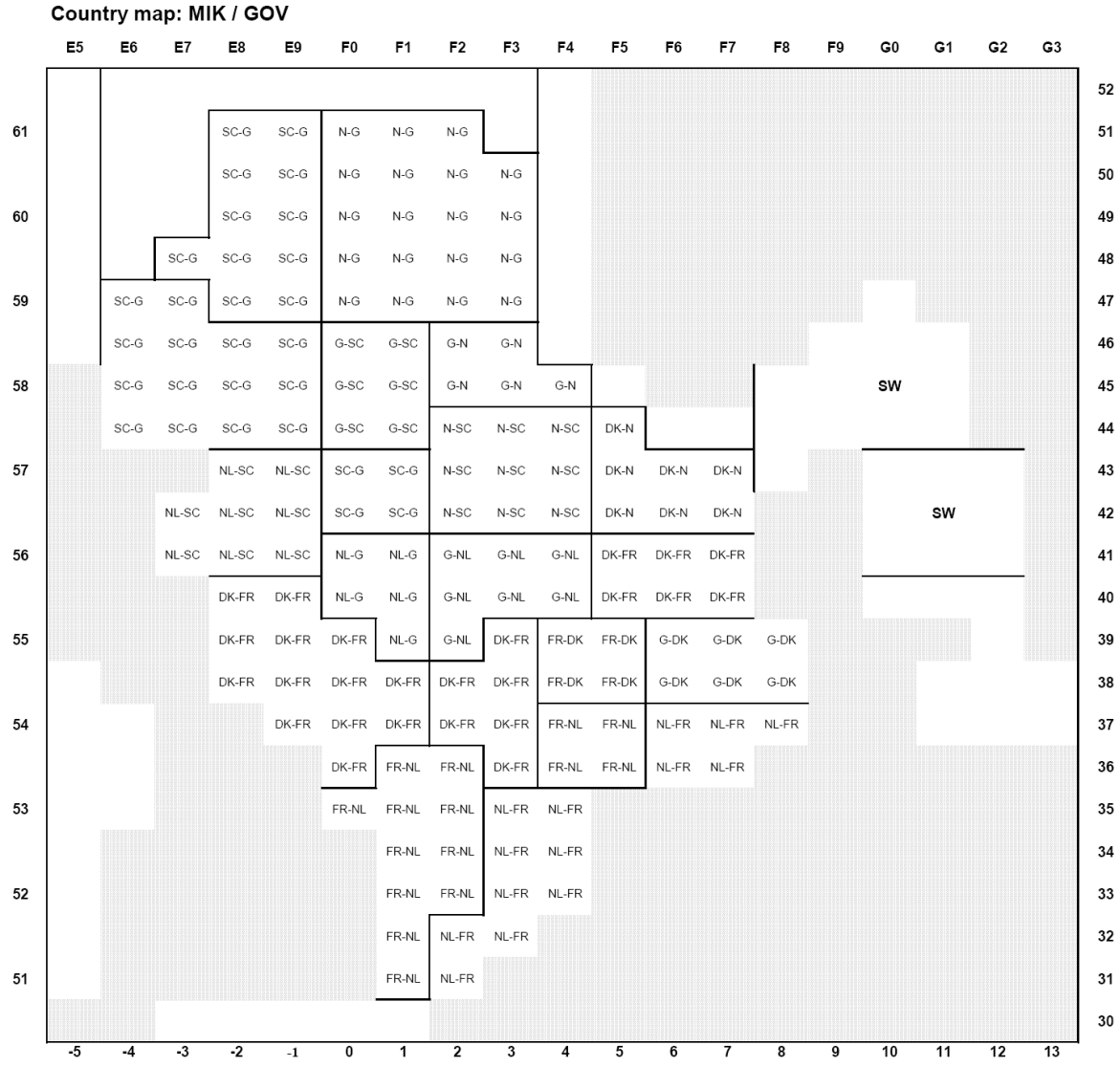
3.2 Surveys

Different surveys are used to assess the status of different fish populations in the Dutch continental waters. These are described below.

International Bottom Trawl Survey – IBTS

Name of data set or monitoring programme: IBTS (International Bottom Trawl Survey)
Measurement unit: Catch numbers per hour
Contents data set: Annual/quarterly survey catches, haul-based or raised to ICES-rectangle.

- **Brief description of network/hyperlink**
  The International Bottom Trawl Survey Working Group (IBTSWG) is the regular monitoring network for roundfish in the North Sea. The International Bottom Trawl Working Group (IBTSWG) has its origin in the North Sea, the Skagerrak and the Kattegat where coordinated surveys have occurred since 1965. Initially these surveys only took place during the first quarter of the year, but between 1991 and 1996 coordinated surveys took place in all four quarters of the year. Pressure on ship time caused the number of surveys to be reduced and currently coordinated surveys in the North Sea are only undertaken in the first and third quarters. The IBTSWG assumed responsibility for coordinating western and southern division surveys in 1994.
  - Other variables measured in network: Length-frequency distributions of all fish and some benthos, determination and counts of all benthos; Clupeid larval survey with MIK-net (Method Isaac Kitt); Hydrographical data such as conductivity, temperature and bottom depths.
  - Contact for network: R. ter Hofstede
  - Starting date network: 1965
  - Guaranteed continuation of network till what date/year: The IBTS is part of the EU data collection framework and therefore it is expected that the survey (as well as the working group) will continue.
  - Name/map of area covered by network: North Sea, Skagerrak, Kattegat.



DK – Denmark, FR – France, G – Germany, N – Norway, NL – Netherlands, SC – Scotland, SW – Sweden.

- Reference of last network progress report: ICES. 2005. Report of the International Bottom Trawl Survey Working Group (IBTSWG), 29 March – 1 April 2005, Hamburg, Germany. ICES CM 2005/D:05. 123 pp.
- Restrictions on availability of data: Data is available from the ICES-database (for restrictions see: http://www.ices.dk/datacentre/datras/public.asp)

- **Description/reference of monitoring programme and sampling method**
  International research vessel trawl surveys are organised under the auspices of ICES, to map the distribution of fish popualtions in the North Sea, Skagerrak and Kattegat and to estimate the recruitment of several roundfish species. The surveys are conducted annually during the first quarter (February) since 1965. From 1991 to 1995 surveys have been carried out on a quarterly basis, herewith providing a full description of the seasonal distribution of the stocks sampled. The following years (1996-present), the majority of vessels have only carried out surveys twice a year; a first quarter survey (Jan-Feb) and a third quarter survey (Aug-Sept). The stratification of the survey grid is based on ICES

statistical rectangles (one degree longitude x 0.5 degree latitude). Each rectangle is usually fished by two ships of two different countries, so that at least two hauls are normally made per rectangle. The sampling method consists of a 30 minute haul with fishing speed of 4 knots using a GOV trawl net during daytime. After sorting the catch into species, a length distribution needs to be obtained. Where the numbers of individuals are too large for them all to be measured, a representative sub-sample is selected of at least 50 fish. The otoliths are removed from target species and stored for age determinations in the laboratory. Catch data together with specific information like haul position, survey area etc. are reported to the ICES IBTS database annually. The data are combined from all surveys and expressed as number per hour per haul. (For further description see IBTS-manual, Van Damme *et al.*, 2005)

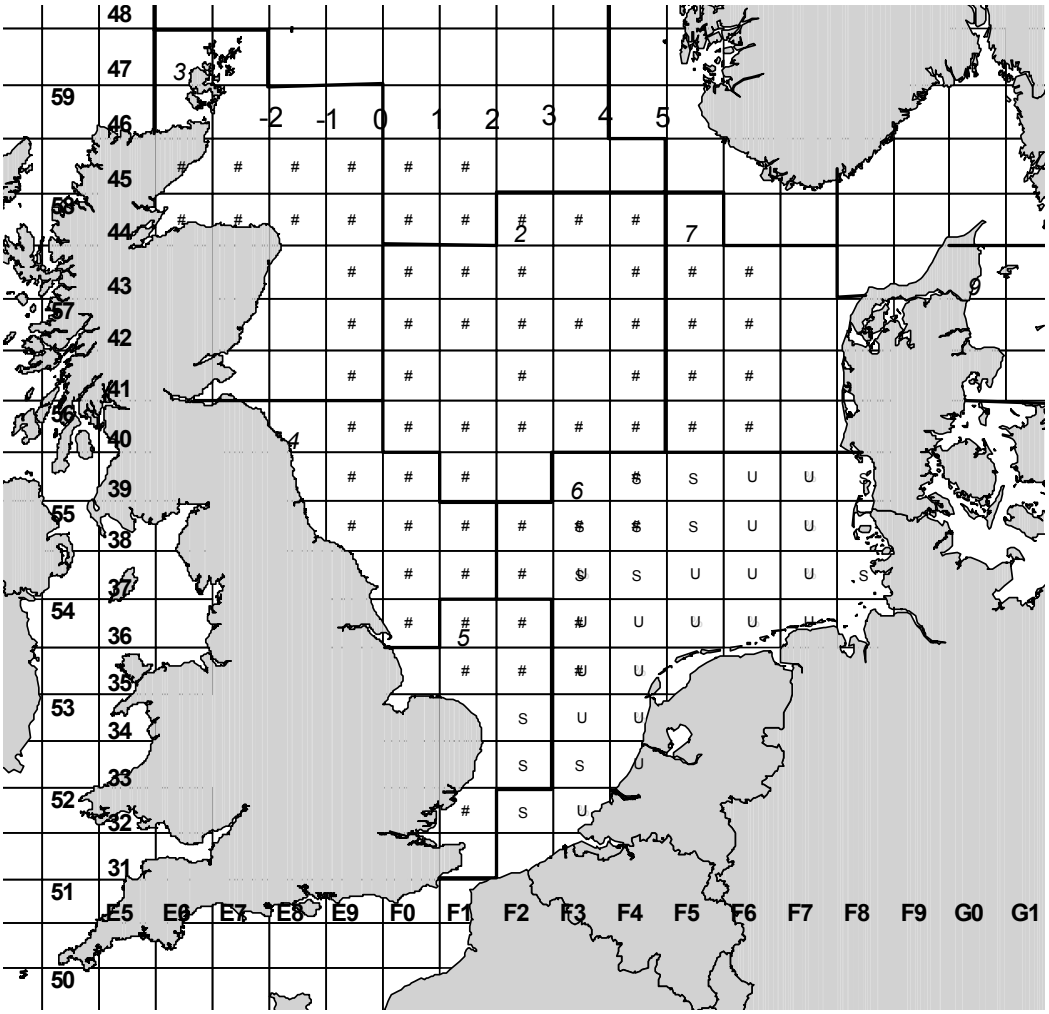
- Begin date of data set: Q1: 1965-present; Q2: 1991-1996; Q3: 1991-present; Q4: 1991-1996.
- Frequency of monitoring and next monitoring date: Annually, 2 times a year (Q1 and Q3). Next monitoring date: autumn 2006
- Range/variation of available data in space and time: entire North Sea, Skagerrak and Kattegat.
- Estimate of percentage inaccuracy of measurements: unknown
- Contact for dataset: IMARES, R. ter Hofstede.

Beam Trawl Survey - BTS

Name of data set or monitoring programme: BTS (Beam Trawl Survey)
Measurement unit: Catch numbers per haul
Contents data set: Annual survey catches in Q3 (haul based) □fish quantity; fish length data; trawl information; epifauna quantity

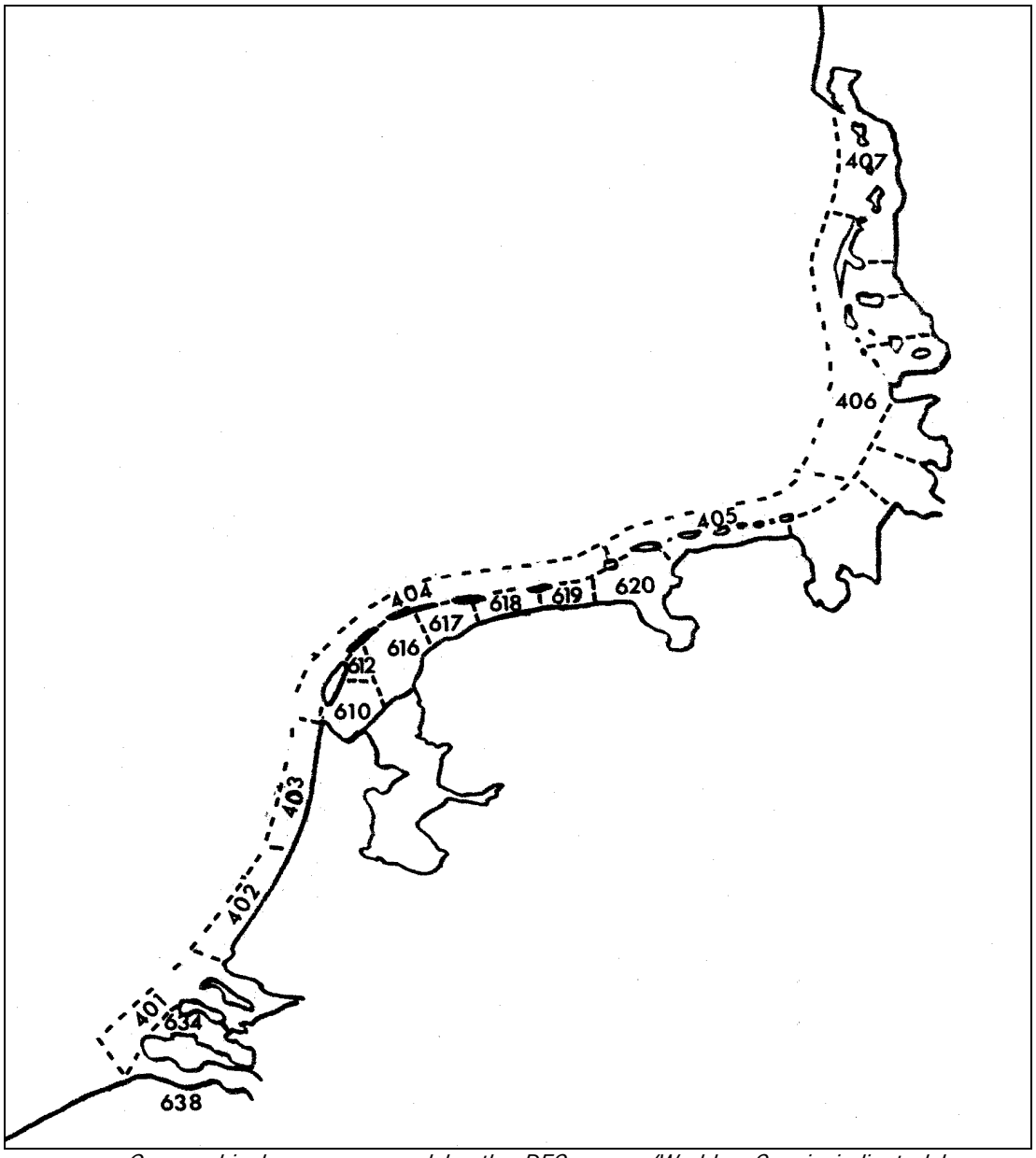
- **Brief description of network/hyperlink**
  The working group on Beam Trawl Surveys (WGBeam) is the regular monitoring network for flatfish in the North Sea and the inshore areas. Both the BTS and the DFS surveys are part of this network. The BTS survey aims at monitoring the adult population of plaice and sole. The DFS survey is originally designed to monitor the abundance 0 and 1-group plaice and sole.
  The Working Group on Beam Trawl Surveys (WGBEAM) is responsible for collating and summarising the results of beam trawl surveys carried out in the North Sea, English Channel, and Celtic Sea and in the Irish Sea. At its meetings, WGBEAM prepares and reports population abundance indices.
  (http://www.ices.dk/iceswork/wgdetailacfm.asp?wg=WGBEAM)
  - Other variables measured in network: other fish (length and quantity); epifauna (quantity); surface/bottom temperature (only BTS); salinity (only BTS)
  - Contact for network: I. de Boois
  - Starting date network: Fisheries independent beam trawl surveys using research vessels were established in the 1980s by countries bordering the North Sea to monitor stocks of plaice and sole. Collation and analysis of some of the data derived from these surveys was undertaken by the Beam Trawl Study Group, which in 1998 was re-established as the Working Group on Beam Trawl Surveys. Although the initial focus of its efforts was in the North Sea and Eastern Channel, the Working Group now evaluates all major surveys in Sub-area IV and VII (ICES 1991). The Working Group comprises regular participants from all countries involved in the surveys Belgium, Germany, Netherlands and the UK. An annual report describing the surveys and summarising the distribution and catch rate of fish species has been produced every year since 1990.

- Guaranteed continuation of network till what date/year: The Beam Trawl Surveys are part of European legislation and therefore it is expected that the surveys (as well as the working group) will continue.
- Name/map of area covered by network:



Area covered by BTS-survey, as in planning (● =1 haul per rectangle; ○ = 2 hauls per rectangle; □ =3 hauls per rectangle; ■ =4 hauls per rectangle

- Reference of last network progress report: ICES, 2005. Report of the working group on Beam Trawl surveys, 7-10 June 2005, Lowesoft, England. ICES CM 2005/G:12.
- Restrictions on availability of data: Data is available from the ICES-database (for restrictions see: http://www.ices.dk/datacentre/datras/public.asp)



Geographical areas covered by the DFS-survey (Wadden Sea is indicated by areas: 610,612,616,617,618,619 and 620. The Delta is indicated by areas: 634 and 638).

- **Description/reference of monitoring programme and sampling method**
  The Beam Trawl Survey (BTS) aims at sampling the adult population. From 1985 to 1995 only the south-eastern North Sea was sampled by the RV Isis. The geographical coverage was enlarged in 1996, since then the RV Tridens samples the western and central parts of the North Sea. The BTS is carried out annually in August–September. Sampling is stratified by ICES rectangle, 1-4 samples per rectangle in the area covered by the Isis and 1 sample per rectangle in the area covered by the Tridens. In principle the gear employed by both vessels is the same, but a flip-up rope is required in the areas sampled by the Tridens and this affects the relative catch efficiency. The catches are sorted out on board. For each haul, the catch numbers and length frequency distributions of all fish species are recorded. In the case of large catch numbers a random sub-sample consisting of at least 50

individuals is measured. Furthermore a sample is taken to establish age-length-keys (ALK's) and length-weight relationships. The fresh weight is determined on board. The otoliths are removed from the fish and stored for age determinations in the laboratory. Trawling details such as the position, date, time and depth are recorded for each haul. Sophisticated hydrographic data (temperature, salinity and visibility profiles) are collected with a real-time CTD during the Tridens cruises, and basic hydrographic measurements (surface water temperature) are taken during the Isis cruises. The catch, trawl and age data are transferred to the national database ("FRISBE") after the age determinations and quality controls have been completed. The data are then available for analysis and calculation of abundance indices. (For further description see BTS-manual: Van Damme *et al.*, 2005)

- Begin date of data set: 1985-present (Q3)
- Frequency of monitoring and next monitoring date: Annually, 1 time a year (Q3). Next monitoring date: autumn 2006
- Range/variation of available data in space and time: Southern and central North Sea
- Estimate of percentage inaccuracy of measurements: unknown
- Contact for dataset: IMARES, I. de Boois

Demersal Fish Survey - DFS

Name of data set or monitoring programme: DFS (Demersal Fish survey)
Measurement unit: DFS Catch numbers per haul
Contents data set: Annual survey catches in Q3 (haul based), fish quantity; fish length data; trawl information; epifauna quantity

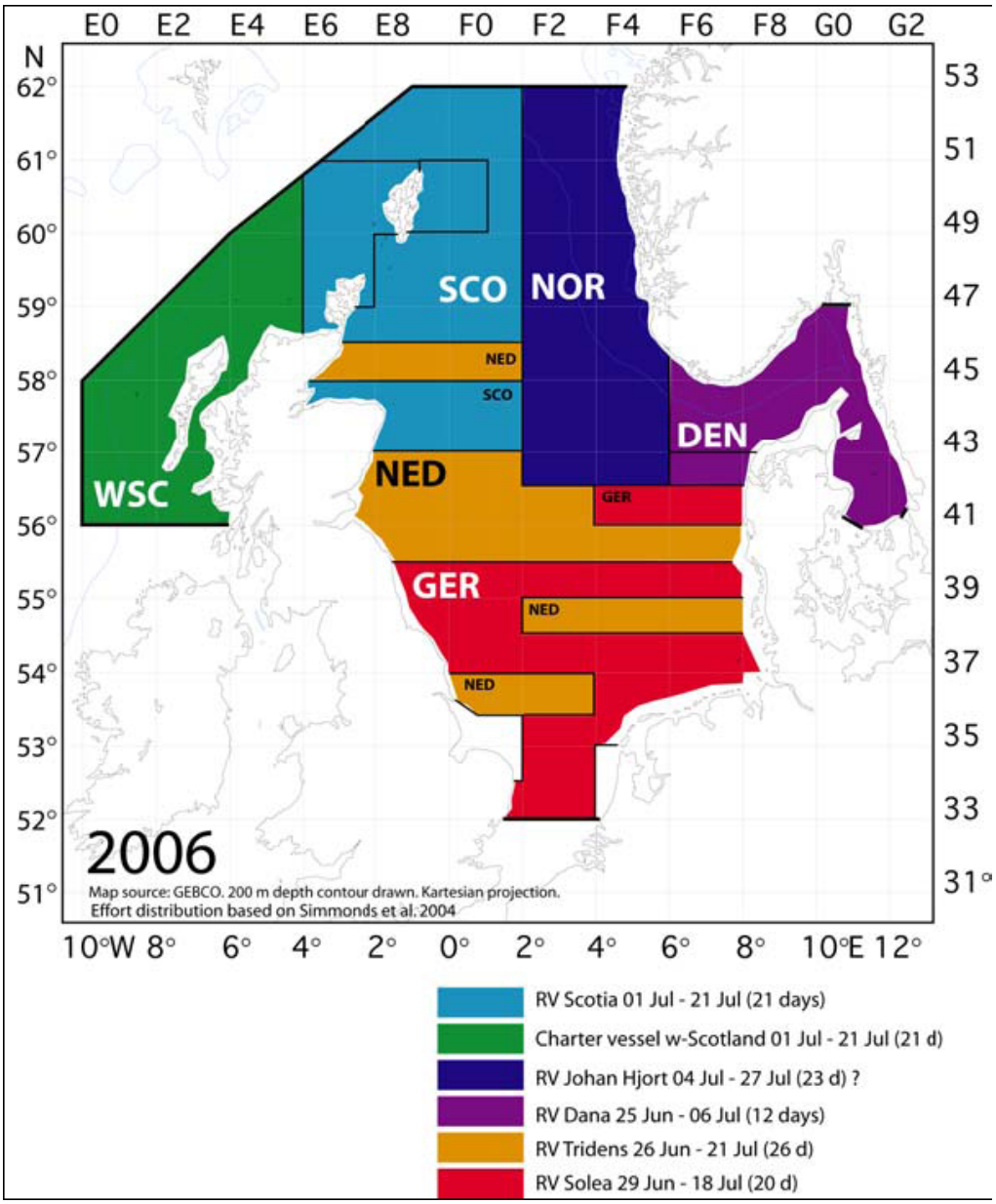
- **Description/reference of monitoring programme and sampling method**
  The Dutch Demersal Fish Survey (DFS) is part of an international inshore survey carried out by The Netherlands, England, Belgium and Germany. Internationally all coastal and estuarine areas of the southern North Sea are covered. The Dutch survey covers the coastal waters from Belgium to Esbjerg, the Wadden Sea and Eems-Dollard estuary and the Wester- and Oosterschelde. This survey was originally designed to monitor the abundance 0 and 1-group plaice and sole. The DFS is carried out once a year in September–October. Sampling is stratified by geographical area (see figure below) and depth (5m depth classes). Trawling details such as the position, date, time and depth are recorded for each haul. The catches are sorted out on board. For each haul, the catch numbers and length frequency distributions of all fish species are recorded. In the case of large catch numbers a random sub-sample consisting of at least 50 individuals is measured. Furthermore a length-stratified sample is taken by area to establish age-length-keys (ALK's). The catch, trawl and age data are transferred to the national database ("FRISBE") after age determinations and quality controls have been completed. The data are then available for analysis and calculation of abundance indices. (For further description see BTS-manual, Van Damme *et al.*, 2005)
  - Begin date of data set: Q1: 1969-1986; Q3: 1969-present.
  - Frequency of monitoring and next monitoring date: Annually, 1 time a year (Q3). Next monitoring date: autumn 2006
  - Range/variation of available data in space and time: the coastal waters from Belgium to Esbjerg, the Wadden Sea and Eems-Dollard estuary and the Wester- and Oosterschelde.
  - Estimate of percentage inaccuracy of measurements: unknown
  - Contact for dataset: DFS; IMARES, L. Bolle

Herring Acoustic Survey (HAS)

Name of data set or monitoring programme: International North Sea Hydro Acoustic Survey for herring (alias Herring Acoustic Survey, HAS).
Measurement unit: NASC-values (Nautical Acoustic Scattering Coefficient) are converted into an estimation of the biomass (tonnes).
Contents data set: Annual NASC-values along a transect; catch data for verification of the species and converting into biomass estimates.

- **Monitoring network information - PGHER**
  The ICES Planning Group for Herring Surveys (PGHERS) coordinates the International North Sea Hydro Acoustic Survey for herring.
  - Brief description of network/hyperlink: The International North Sea Hydro Acoustic Survey for herring has been executed annually since 1991, in general in June. Participating countries are The Netherlands, Scotland, Germany, Denmark and Norway. The purpose of the survey is to estimate the herring and sprat stocks of the North Sea.
  - Other variables measured in network: Herring Larvae Surveys; Baltic International Acoustic Survey; Hydrographical data such as conductivity, temperature and bottom depths.
  - Contact for network: B.C. Couperus.
  - Starting date network: 1991.
  - Guaranteed continuation of network till what date/year: The International North Sea Hydro Acoustic survey for herring is part of the EU data collection framework and therefore it is expected that the survey (as well as the working group) will continue.
  - Name/map of area covered by network: The surveyed area comprises the North Sea ICES Divisions IV, VIa, IIIa, and Western Baltic (see next page).
  - Reference of last network progress report: ICES. 2006. Report of the Planning Group on Herring Surveys (PGHERS), 24-27 January 2006, Rostock, Germany. ICES CM 2006/LRC:04. 239 pp.
  - Restrictions on availability of data: Restrictions on availability of data: Data is available from the ICES-database (for restrictions see:
  - http://www.ices.dk/datacentre/datras/public.asp)

- **Description/reference of monitoring programme and sampling method**
  The international North Sea hydro acoustic survey for herring is carried out with participation of Scotland, Norway, Germany, Denmark and the Netherlands. The survey is part of the EU data collection framework and is coordinated by the Planning Group fro Herring Surveys (PGHERS). The aim is to provide an abundance estimate of the whole North Sea herring population, which is used as a tuning index by the ICES Herring Assessment Working Group (HAWG) in its assessment of the population size. Along an interlaced transect each vessel collects acoustic data with scientific echo sounders at a speed of 10.5 knots per hour. The acoustic recordings are verified by occasional fishing with a 2000 mesh pelagic trawl with 20 mm meshes in the cod-end, also in order to obtain biological samples of herring and sprat. (For further description see IBTS-manual, Van Damme et al., 2005)
  - Begin date of data set: 1991.
  - Frequency of monitoring and next monitoring date: Annually, once a year (June). Next monitoring date: June 2006.
  - Range/variation of available data in space and time: North Sea.
  - Estimate of percentage inaccuracy of measurements: unknown.
  - Contact for dataset: IMARES, B.C. Couperus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2006
Map source: GEBCO. 200 m depth contour drawn. Kartesian projection.
Effort distribution based on Simmonds et al. 2004
10°W 8° 6° 4° 2° 0° 2° 4° 6° 8° 10°E 12°
RV Scotia 01 Jul - 21 Jul (21 days)
Charter vessel w-Scotland 01 Jul - 21 Jul (21 d)
RV Johan Hjort 04 Jul - 27 Jul (23 d) ?
RV Dana 25 Jun - 06 Jul (12 days)
RV Tridens 26 Jun - 21 Jul (26 d)
RV Solea 29 Jun - 18 Jul (20 d)

3.3 Merlangius merlangus (Whiting / Wijting)

Scientific name	*Merlangius merlangus*
Species common name	Whiting
Dutch name	Wijting
Species group	Fish

Ecological data

Guild ○ herbivore ● piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ● molluscivore ● other: benthivore	**Max. Body weight (adults):** both sexes: 3 kg **Max. Length:** 70 cm total length (rarely) **Maturity age:** between 2 and 3 years **Reproduction:** between 100.000 and 1.000.000 eggs per female per spawning period (Muus *et al.*, 1999); 400.000 (Knijn *et al.*, 1993) **Age:** 20 year **Distribution area:** From North Portugal to Iceland and the south-western Barents Sea, also in the Mediterranean and Black Sea. **Diet:** molluscs, crustaceans, fish

Geografical	Habitat	Fysical/chemical
Distribution ● North Sea ● coastal ● offshore ○ deep sea ● Wadden Sea ● Delta Zeeland (saline)	**Position in the water column** ○ pelagic ● demersal ○ planktonic ○ benthic ○ other….	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic ○ other….
Migratory behavior ○ sedentary ● migratory ○ variable/dependent on geographical location ○ other…	**Seabed/bottom preferences** ● sand ○ gravel ○ mud ○ rock ○ other….	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ○ other…
	Intertidal ○ preferred height (relative to MHT) ○ other preferences….	**Salinity** ● saline ○ brackish ○ freshwater

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation ○ Habitat destruction ● Overfishing / overharvesting ● Bycatch/discards ○ Human disturbance ○ Natural disturbance ○ Pollution ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic ○ Other…..	● Food ○ Medicine ○ Recreation	○ Building material ○ Energy ● Other: Industry 1) Fishmeal 2) Animal feed

Data set information

- Surveys: IBTS (North Sea) & DFS (Wadden Sea and Delta area)
- Other datasets available: BTS
- Mean values for North Sea (indicate whole/NCP), Wadden Sea, Delta and/or Coastal zone for:

Whiting/Wijting	North Sea (whole)	Wadden Sea	Delta area
Present (2004/2005)*	408	12.5	29.0
Recent (2000/2001/2003)*	1375	17.3	12.9
Reference value	616	77.1	23.9
*All values are based on good quantitative data; reference NS:1977-1979; reference WS/D: 1980-1982			

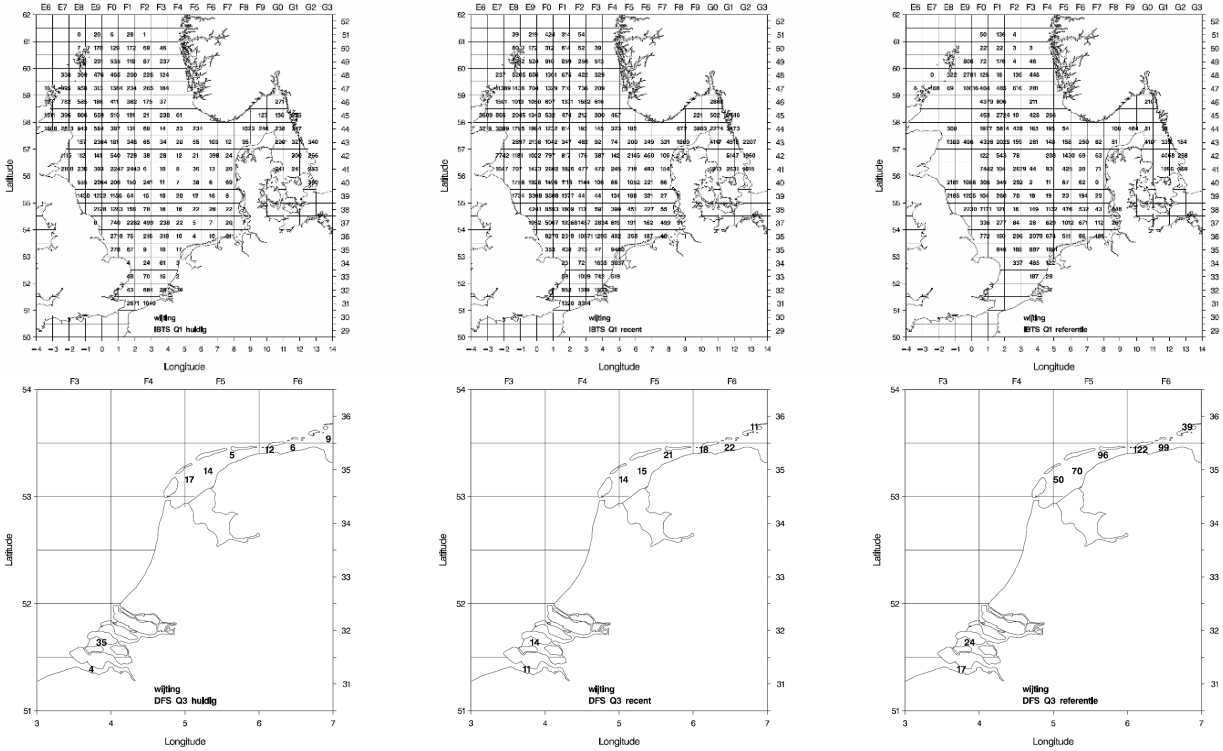
Note: for Wadden Sea and Delta area data are mainly reliable when looking at trends because the sampling gear is mainly directed at demersal fish and therefore is not optimally suited for sampling pelagic species.

- Long term trends
  North Sea: no trend; Wadden Sea: decreasing; Delta area: no trend.
- Other reference value: SSB (Spawning Stock Biomass) *1000 tonnes.

Whiting/Wijting	North Sea (whole)
Present (2004)	124
Recent (2000-2003)*	175
Reference*	315
* as described in report EC-LNV 2002/116.	

Distribution data

- 2 maps of present distribution (2004-2005),
- 2 maps of recent distribution (2000-2003),
- 2 maps of historic distribution (North Sea: 1977-1979; Wadden Sea and Delta area: 1980-1982).



Monitoring network information

The International Bottom Trawl Survey Working Group (ICES IBTSWG) is the regular monitoring network for whiting in the North Sea. See “Network information” sheet for more information.

3.4 Gadus Morhua (Cod / Kabeljauw)

Scientific name	*Gadus Morhua*
Species common name	Cod
Dutch name	Kabeljauw
Species group	Fish

Ecological data

Guild ○ herbivore ● piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ● molluscivore ○ other: ….	**Max. Body weight (adults):** both sexes: 40 kg **Max. Length:** 150 cm **Maturity age:** between 2 and 4 years for sedentary (coastal) cod; 6-15 years for migratory cod (Muus *et al.*, 1999) **Reproduction:** between 500.000 and 5.000.000 eggs per female per year **Max. Age:** up to 20 years (nowadays rarely) **Distribution area:** throughout the boreal region of the North Atlantic, in the east from the Bay of Biscay up to Svalbard (Spitsbergen) and Nova Zembla. **Diet:** molluscs, crustaceans, fish

Geografical	Habitat	Fysical/chemical
Distribution ● North Sea ● coastal ● offshore ○ deep sea ● Wadden Sea ● Delta Zeeland (saline)	**Position in the water column** ○ pelagic ● demersal ○ planktonic ○ benthic ○ other….	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic ○ other….
Migratory behavior ● sedentary ● migratory ○ variable/dependent on geographical location ○ other…	**Seabed/bottom preferences** ● sand ○ gravel ○ mud ○ rock ○ other….	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ○ other…
	Intertidal ○ preferred height (relative to MHT) ○ other preferences….	**Salinity** ● saline ○ brackish ○ freshwater

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation ○ Habitat destruction ● Overfishing/overharvesting ● Bycatch/discards ○ Human disturbance ○ Natural disturbance ○ Pollution ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic Other…..	● Food ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other:….

Data set information

- Surveys: IBTS (North Sea) & DFS (Wadden Sea and Delta area)
- Other datasets available: BTS
- Mean values for North Sea (indicate whole/NCP), Wadden Sea, Delta and/or Coastal zone for:

Cod/Kabeljauw	North Sea (whole)	Wadden Sea	Delta area
Present (2004-2005)*	5.6	7.4	16.0
Recent (2000-2003)*	12.1	11.0	4.5
Reference*	39.5	38.9	4.2
*All values are based on good quantitative data; reference NS:1977-1979; reference WS/D: 1980-1982			

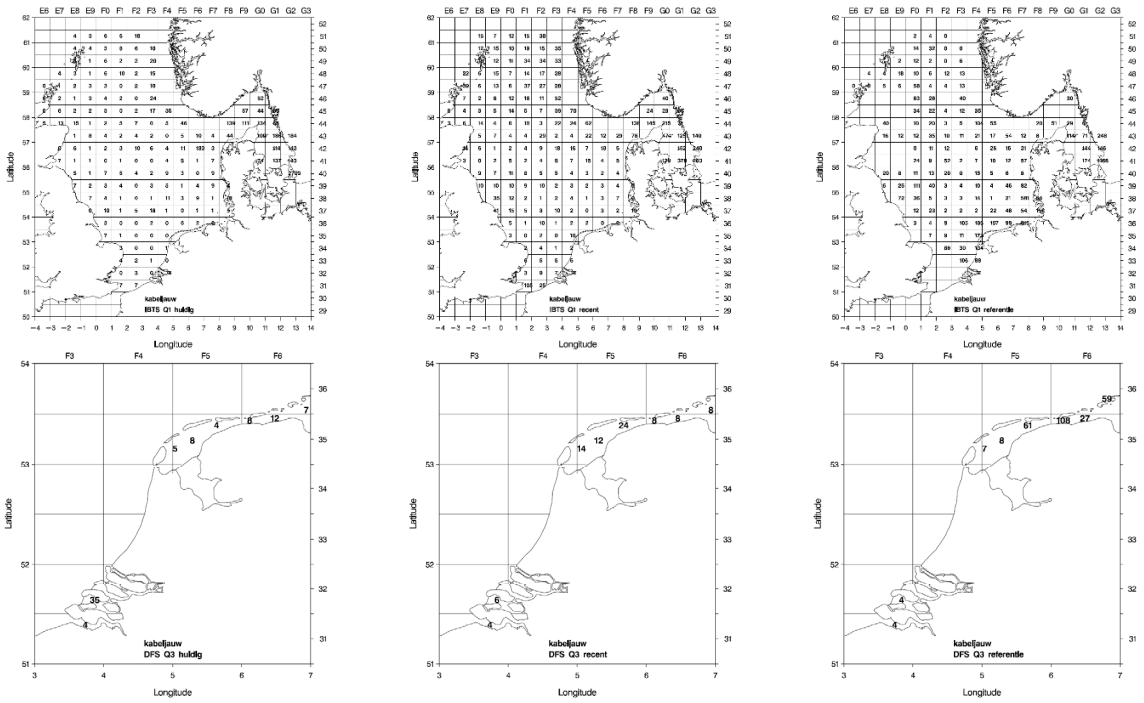
Note: for Wadden Sea and Delta area data are mainly reliable when looking at trends because the sampling gear is mainly directed at demersal fish and therefore is not optimally suited for sampling pelagic species.

- Long term trends: North Sea: decreasing; Wadden Sea: decreasing; Delta area: decreasing.
- Other reference value: SSB (Spawning Stock Biomass) *1000 tonnes.`

Cod/Kabeljauw	North Sea (whole)
Present (2004)	46
Recent (2000-2003)*	43
Reference*	200
* as described in report RIKZ-97.027	

Distribution data

- 2 maps of present distribution (2004-2005),
- 2 maps of recent distribution (2000-2003),
- 2 maps of historic distribution (North Sea: 1977-1979; Wadden Sea and Delta: 1980-1982).



Monitoring network information

The International Bottom Trawl Survey Working Group (ICES IBTSWG) is the regular monitoring network for cod in the North Sea. See “Network information” sheet for more information.
The Working Group on Beam Trawl surveys (ICES WGBeam) is the regular monitoring network for cod in the Wadden Sea and the Delta area. See “Network information” sheet for more information.

3.5 Zoarces viviparus (Eelpout / Puitaal)

Scientific name	*Zoarces viviparus*
Species common name	Eelpout
Dutch name	Puitaal
Species group	Fish

Ecological data

Guild ○ herbivore ● piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ● molluscivore ○ other: ….	**Max. Body weight (adults):** both sexes: 500 g **Max. Length:** 50 cm **Maturity age:** 2 years (16-18 cm) **Reproduction:** between 30 and 400 young per female (internal fertilization) **Max. Age:** 10 years **Distribution area:** From English Channel up to White Sea and Murman Coast, in North Sea in shallow waters. **Diet:** worms, crustaceans, echinoderms, insect larvae, small fish

Geografical	Habitat	Fysical/chemical
Distribution ○ North Sea ○ coastal ○ offshore ○ deep sea ● Wadden Sea ● Delta Zeeland (saline)	**Position in the water column** ○ pelagic ● demersal (2-20m) ○ planktonic ○ benthic ○ other….	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic ○ other….
Migratory behavior ● sedentary ○ migratory ○ variable/dependent on geographical location ○ other…	**Seabed/bottom preferences** ○ sand ○ gravel ○ mud ● rock ● other: seaweed	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ○ other…
	Intertidal ○ preferred height (relative to MHT) ○ other preferences….	**Salinity** ● saline ○ brackish ○ freshwater

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation ○ Habitat destruction ○ Overfishing/overharvesting ○ Bycatch ○ Human disturbance ○ Natural disturbance ○ Pollution ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic ● Unknown	○ Food ○ Medicine ● Recreation (aquaria)	○ Building material ○ Energy ○ Other:….

Data set information

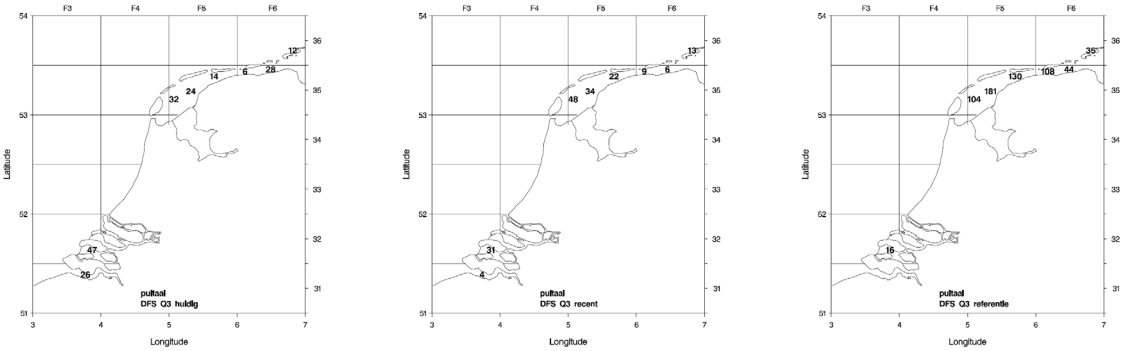
- Surveys: DFS
- Other datasets available: none
- Mean values for North Sea (indicate whole/NCP), Wadden Sea, Delta area and/or Coastal zone for:

Eelpout/Puitaal	North Sea (whole)	Wadden Sea	Delta area
Present (2004-2005)*	-	22.1	46.3
Recent (2000-2003)*	-	33.8	28.8
Reference value*	-	112.1	16.0
* All values are based on good quantitative data a; reference WS/D: 1980-1982.			

- Long term trends: Wadden Sea: decreasing; Delta area: no trend.

Distribution data if available (preferably send digital maps otherwise description)

- 1 map of present distribution (2004-2005),
- 1 map of recent distribution (2000-2003),
- 1 map of historic distribution (Wadden Sea and Delta area: 1980-1982).



Monitoring network information

The Working Group on Beam Trawl surveys (ICES WGBeam) is the regular monitoring network for eelpout in the Wadden Sea and the Delta area. See “Network information” sheet for more information.

3.6 Melanogrammus aeglefinus (Haddock / Schelvis)

Scientific name	*Melanogrammus aeglefinus*
Species common name	Haddock
Dutch name	Schelvis
Species group	Fish

Ecological data

Guild ○ herbivore ● piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ● molluscivore ○ other: ….	**Max. Body weight (adults):** both sexes:14 kg **Max. Length:** 100 cm **Maturity age:** between 3 and 4 years in the North Sea; between 6 and 10 years in Northern Norway **Reproduction:** between 100.000 and 2.000.000 eggs per female per year **Max. Age:** 20 years **Distribution area:** throughout the boreal region of the Northern Atlantic, in the east from the Celtic Sea up to Svalbard (Spitsbergen). **Diet:** worms, molluscs, echinoderms, fish

Geografical	Habitat	Fysical/chemical
Distribution ● North Sea ○ coastal (20 km/other…) ● offshore ○ deep sea ○ Wadden Sea ○ Delta Zeeland (saline)	**Position in the water column** ○ pelagic ● demersal (10-200 m) ○ planktonic ○ benthic ○ other….	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic ○ other….
Migratory behavior ○ sedentary ● migratory ○ variable/dependent on geographical location ○ other…	**Seabed/bottom preferences** ● sand ● gravel ○ mud ● rock ○ other….	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ○ other…
	Intertidal ○ preferred height (relative to MHT) ○ other preferences….	**Salinity** ● saline

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation ○ Habitat destruction ● Overfishing/overharvesting ○ Bycatch ○ Human disturbance ○ Natural disturbance ○ Pollution ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic Other…..	● Food ○ Medicine ○ Recreation	○ Building material ○ Energy ● Other: Industry 1) Fishmeal 2) Animal feed

Data set information

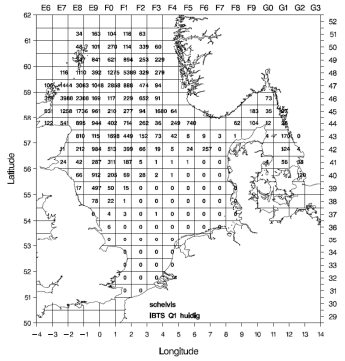
- Surveys: IBTS
- Other datasets available: BTS (chapter 3.2)
- Mean values for North Sea (indicate whole/NCP), Wadden Sea, Delta area and/or Coastal zone for:

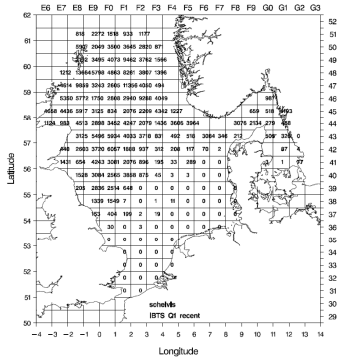
Haddock/Schelvis	North Sea (whole)	Wadden Sea	Delta area
Present (2004-2005)*	357.1	-	-
Recent (2000-2003)*	1822.6	-	-
Reference value*	519.3		
* All values are based on good quantitative data; reference NS:1977-1979			

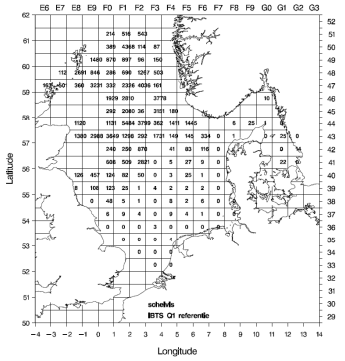
- Long term trend: North Sea: no trend.

Distribution data if available (preferably send digital maps otherwise description)

- 1 map of present distribution (2004-2005),
- 1 map of recent distribution (2000-2003),
- 1 map of historic distribution (North Sea: 1977-1979).







Monitoring network information

The International Bottom Trawl Survey Working Group (ICES IBTSWG) is the regular monitoring network for haddock in the North Sea. See “Network information” sheet for more information.
The Working Group on Beam Trawl surveys (ICES WGBeam) is an alternative regular monitoring network for haddock in the North Sea. See “Network information” sheet for more information.

3.7 Clupea harengus (Herring / Haring)

Scientific name	*Clupea harengus*
Species common name	Herring
Dutch name	Haring
Species group	Fish

Ecological data

Guild ○ herbivore ● piscivore ○ omnivore ○ scavenger ○ detritivore ● planktivore ○ molluscivore ○ other: ….	**Max. Body weight (adults):** both sexes: 1 kg **Max. Length: 56 c**m **Maturity age:** between 3 and 9 years **Reproduction:** between 20.000 and 50.000 eggs per female per year **Max. Age:** 20-25 year **Distribution area:** widely distributed in the North Atlantic, in the east from the Bay of Biscay to the Barents Sea. **Diet:** zooplankton, crustaceans, small fish.

Geografical	Habitat	Fysical/chemical
Distribution ● North Sea ● coastal ● offshore ○ deep sea ● Wadden Sea ● Delta Zeeland (saline)	**Position in the water column** ● pelagic ○ demersal ○ planktonic ○ benthic ○ other….	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic ○ other….
Migratory behavior ○ sedentary ● migratory ○ variable/dependent on geographical location ○ other…	**Seabed/bottom preferences** ● sand ○ gravel ○ mud ○ rock ○ other….	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ○ other…
	Intertidal ○ preferred height (relative to MHT) ○ other preferences….	**Salinity** ● saline ○ brackish ○ freshwater

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation ○ Habitat destruction ● Overfishing/overharvesting ○ Bycatch ○ Human disturbance ○ Natural disturbance ○ Pollution ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic Other…..	● Food ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other:….

Data set information

- Surveys: IBTS (North Sea) & DFS (Wadden Sea and Delta area)
- Other datasets available: The International North Sea Hydro Acoustic Survey for herring
- Mean values for North Sea (indicate whole/NCP), Wadden Sea, Delta and/or Coastal zone for:

Herring/Haring	North Sea (whole)	Wadden Sea	Delta area
Present (2004-2005)*	2283.3	155.8	82.4
Recent (2000-2003)*	3328.8	68.9	362.7
Reference*	157.2	139.2	19.4
*All values are based on good quantitative data; reference NS:1977-1979; reference WS/D: 1980-1982			

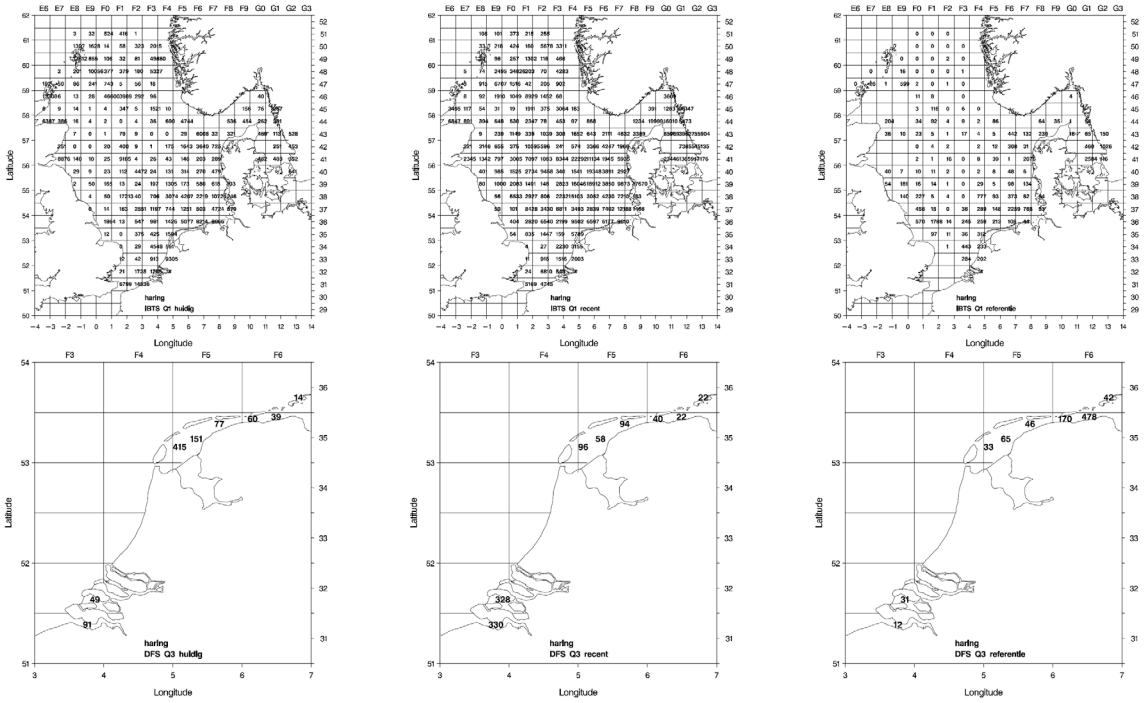
Note: for Wadden Sea and Delta area data are mainly reliable when looking at trends because the sampling gear is designed for estimating densities of demersal fish and therefore is not optimally suited for sampling pelagic species.

- Long term trends: North Sea: no clear trend; Wadden Sea: no clear trend; Delta area: increasing.
- Other reference value: SSB (Spawning Stock Biomass) *1,000,000 tonnes.

Herring/Haring	North Sea (whole)
Present (2004-2005)	1.9
Recent (2000-2003)*	1.3
Reference*	3.5
* as described in report RIKZ-97.027	

Distribution data if available (preferably send digital maps otherwise description)

- 2 maps of present distribution (2004-2005),
- 2 maps of recent distribution (2000-2003),
- 2 maps of historic distribution (North Sea: 1977-1979; Wadden Sea and Delta area: 1980-1982).



Monitoring network information

The ICES International Bottom Trawl Survey Working Group (IBTSWG) is the regular monitoring network for herring in the North Sea (see also chapter 3.2). The ICES Planning Group for Herring Surveys (PGHERS) coordinates the International North Sea Hydro Acoustic Survey for herring. See “Network information” sheet for more information.

3.8 Trisopterus esmarki (Norway pout / Kever)

Scientific name	*Trisopterus esmarki*
Species common name	Norway pout
Dutch name	Kever
Species group	Fish

Ecological data

Guild ○ herbivore ● piscivore ○ omnivore ○ scavenger ○ detritivore ● planktivore ○ molluscivore other: ….	**Max. Body weight (adults):** both sexes: 280 g **Max. Length:** 35 cm **Maturity age:** between 1 and 2 year **Reproduction:** 21.000 eggs for a 30-gram two-year-old fish (420-980 eggs per gram body weight. **Max. Age:** 4 years **Distribution area:** Northern and central North Sea (center of distribution lay midway between Shetland and the Norwegian coast) **Diet:** zooplankton, crustaceans, fish

Geografical	**Habitat**	**Fysical/chemical**
Distribution ● North Sea ● coastal ● offshore ○ deep sea ○ Wadden Sea	**Position in the water column** ● pelagic; average depth 80-200m ○ demersal ○ planktonic ○ benthic	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic ○ other….
Migratory behavior ○ sedentary ○ migratory ○ variable/dependent on geographical location ● slightly migratory towards spawning grounds	**Seabed/bottom preferences** ○ sand ○ gravel ● mud (Muus *et al.*, 1999) ○ rock ○ other….	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ○ other…
	Intertidal ○ preferred height (relative to MHT) ○ other preferences….	**Salinity** ● saline ○ brackish ○ freshwater

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		**Use of indicator (more options possible)**	
○ Habitat degradation ○ Habitat destruction ● Overfishing/overharvesting ○ Bycatch ○ Human disturbance ○ Natural disturbance ○ Pollution ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic Other…..	○ Food ○ Medicine ○ Recreation	○ Building material ○ Energy ● Other: Industry- 1) Fishmeal 2) Feed for animal husbandry

Data set information

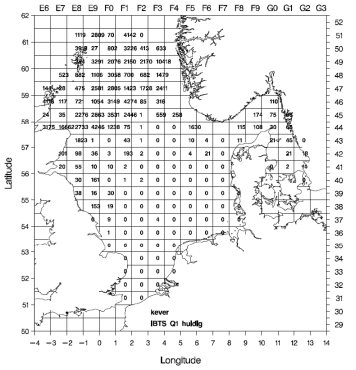
- Surveys: IBTS
- Other datasets available: BTS (Chapter 3.2))
- Mean values for North Sea (indicate whole/NCP), Wadden Sea, Delta area and/or Coastal zone for:

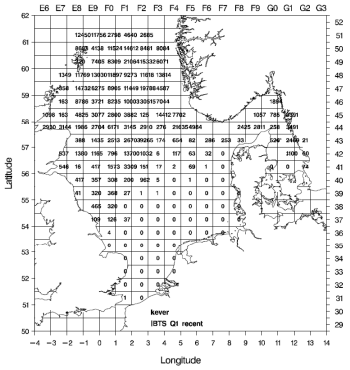
Norway pout/Kever	North Sea (whole)	Wadden Sea	Delta area
Present (2004-2005)*	687.6	-	-
Recent (2000-2003)*	3242.2	-	-
Reference*	3641.9	-	-
* All values are based on good quantitative data; reference NS:1977-1979.			

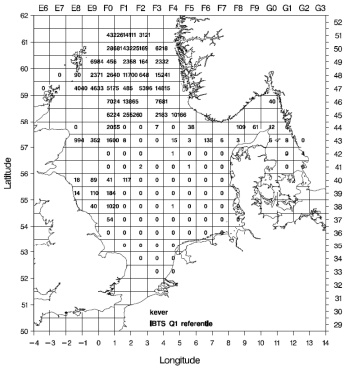
- Long term trends: North Sea: no trend.

Distribution data if available (preferably send digital maps otherwise description)

- 1 map of present distribution (2004-2005),
- 1 map of recent distribution (2000-2003),
- 1 map of historic distribution (North Sea: 1977-1979).







Monitoring network information

The International Bottom Trawl Survey Working Group (ICES IBTSWG) is the regular monitoring network for Norway pout in the North Sea (see chapter 3.2).

3.9 Pleuronectes platessa (Plaice / Schol)

Scientific name	*Pleuronectes platessa*
Species common name	Plaice
Dutch name	Schol
Species group	Fish

Ecological data

Guild ○ herbivore ○ piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ● molluscivore ○ other: ….	**Max. Body weight (adults):** both sexes: 7 kg **Max. Length:** between 90 and 100 cm **Maturity age:** between 2 and 4 years(18-26 cm) in the North Sea; between 3 and 7 year in Norway (Muus *et al.*, 1999) Males: 2-3 years and females: 4-5 years. Plaice from the northern areas mature at an older age and larger size than plaice from the south (Atlas) **Reproduction:** between 60.000 and 100.000 eggs per female per spawning period **Age:** 15 years **Distribution area:** Southern and eastern North Sea, Wadden Sea, Delta area **Diet:** worms, molluscs, crustaceans

Geografical	Habitat	Fysical/chemical
Distribution ● North Sea ● coastal ● offshore ○ deep sea ● Wadden Sea ● Delta Zeeland (saline)	**Position in the water column** ○ pelagic ● demersal ○ planktonic ○ benthic	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic ○ other….
Migratory behavior ○ sedentary ● migratory ○ variable/dependent on geographical location	**Seabed/bottom preferences** ● sand ○ gravel ○ mud ○ rock	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity
	Intertidal ○ preferred height (relative to MHT) ○ other preferences….	**Salinity** ● saline ● brackish ○ freshwater

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation	○ Invasive species	● Food	○ Building material
○ Habitat destruction	● Disease	○ Medicine	○ Energy
● Overfishing/overharvesting	○ Poisoning	○ Recreation	○ Other:….
● Bycatch/discards	○ Sea surface temp. incr.		
○ Human disturbance	○ Sea level change		
○ Natural disturbance	○ Oil/gass extraction		
● Pollution	○ Ship traffic		
○ Eutrophication	○ Other…..		
○ Wind farms			

Data set information

- Surveys: BTS & DFS
- Other datasets available: IBTS (see "survey information" sheet)
- Mean values for North Sea (indicate whole/NCP), Wadden Sea, Delta and/or Coastal zone for:

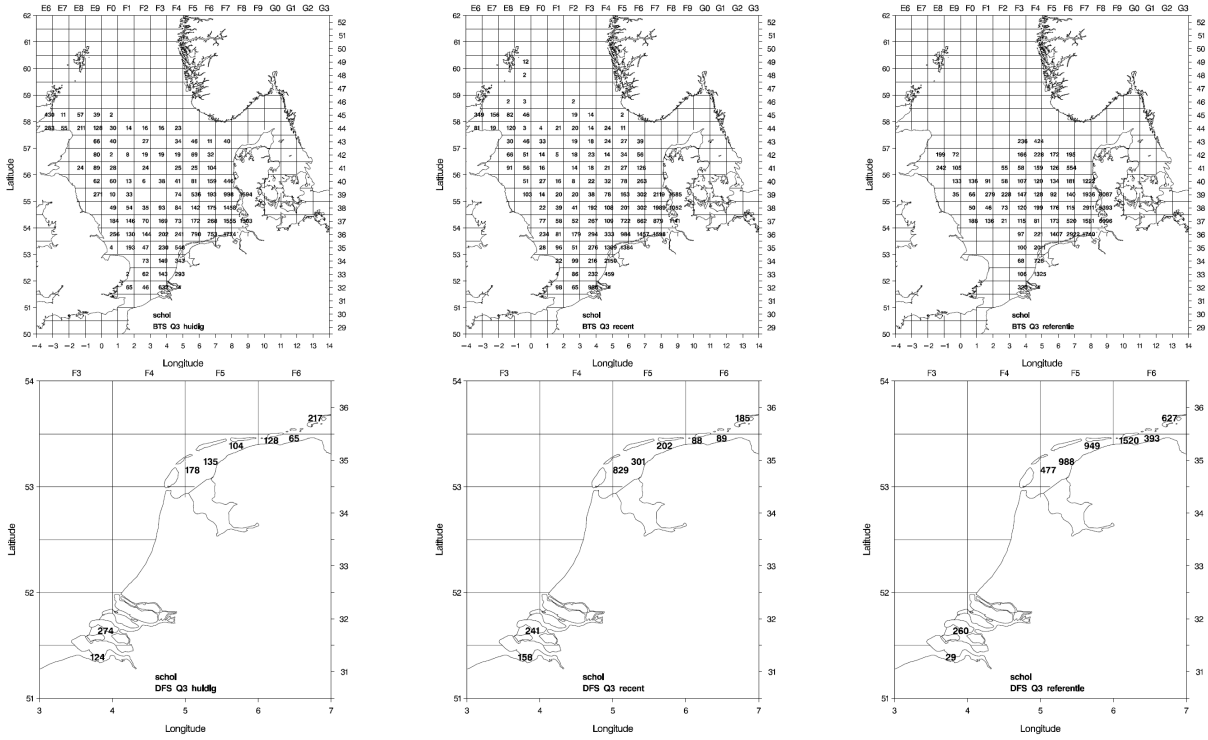
Plaice/Schol	North Sea (whole)	Wadden Sea	Delta area
Present (2004-2005)*	243.6	157.2	202.1
Recent (2000-2003)*	326.0	353.7	201.0
Reference*	578.8	810.1	159.6
* All values are based on good quantitative data: reference NS:1985-1987; reference WS/D: 1980-1982			

- Long term trends: North Sea: no trend; Wadden Sea: decreasing; Delta area: no trend.
- Other reference value: SSB (Spawning Stock Biomass) *1000 tonnes.

Plaice/Schol	North Sea (whole)
Present (2004-2005)	187
Recent (2000-2003)*	208
Reference*	400
* as described in report RIKZ-97.027	

Distribution data

- 2 maps of present distribution (2004-2005),
- 2 maps of recent distribution (2000-2003),
- 2 maps of historic distribution (North Sea: 1985-1987; Wadden Sea and Delta area: 1980-1982).



Monitoring network information

The Working Group on Beam Trawl surveys (ICES WGBeam) is the regular monitoring network for sole in the North Sea, Wadden Sea and the Delta area (see chapter 3.2).

3.10 Osmerus eperlanus (Smelt / Spiering)

Scientific name	*Osmerus eperlanus*
Species common name	Smelt
Dutch name	Spiering
Species group	Fish

Ecological data

Guild ○ herbivore ● piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ○ molluscivore ● other: benthivore	**Max. Body weight (adults):** 200 g **Max. Length:** 35 cm (marine); 20 cm (fresh water) **Maturity age:** between 3 and 4 years (marine); between 1 and 2 years (fresh water) **Reproduction:** between 8000 and 15.000 eggs per female per spawning period **Age:** 10 years (fishbase.org) **Distribution area:** From the English Channel, through the Baltic Sea to the White Sea; preference for coastal areas (The Netherlands / Germany / Denmark) **Diet:** crustaceans, fish

Geografical	Habitat	Fysical/chemical
Distribution ● North Sea ● coastal ○ offshore ○ deep sea ● Wadden Sea ● Delta Zeeland (saline)	**Position in the water column** ● pelagic; up to 50m ○ demersal ○ planktonic ○ benthic ○ other….	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic ○ other….
Migratory behavior ○ sedentary ○ migratory ○ variable/dependent on geographical location ● migratory (anadromous form) and sedentary (land-locked form)	**Seabed/bottom preferences** ● sand (during spawning) ● gravel (during spawning) ○ mud ○ rock ○ other….	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ○ other…
	Intertidal ○ preferred height (relative to MHT) ○ other preferences….	**Salinity** ● saline ● brackish ● freshwater

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation ○ Habitat destruction ○ Overfishing/overharvesting ○ Bycatch ● Human disturbance ○ Natural disturbance ○ Pollution ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic ○ Other….	● Food ○ Medicine ○ Recreation	○ Building material ○ Energy ● Other:Industry 1) Fishmeal 2) Animal feed

Data set information

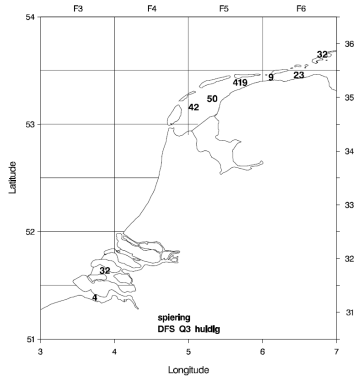
- Surveys: DFS
- Other datasets available: none
- Mean values for North Sea (indicate whole/NCP), Wadden Sea, Delta area and/or Coastal zone for:

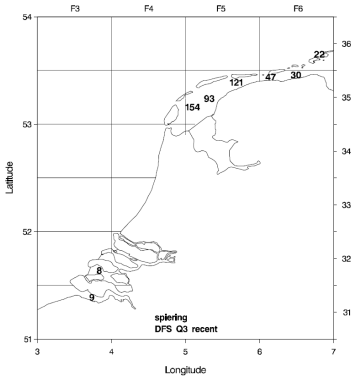
Smelt/Spiering	North Sea (whole)	Wadden Sea	Delta area
Present (2004-2005)*	-	62.3	18.0
Recent (2000-2003)*	-	69.8	8.8
Reference*	-	94.1	-
* All values are based on good quantitative data			

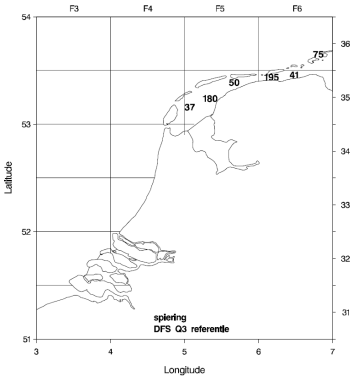
- Long term trends: Wadden Sea: no trend; Delta area: no trend.

Distribution data if available (preferably send digital maps otherwise description)

- 1 map of present distribution (2004-2005),
- 1 map of recent distribution (2000-2003),
- 1 map of historic distribution (Wadden Sea and Delta area: 1980-1982).







Monitoring network information

The Working Group on Beam Trawl surveys (ICES WGBeam) is the regular monitoring network for cod in the Wadden Sea and the Delta area (see chapter 3.2).

3.11 Solea solea (Sole / Tong)

Scientific name	*Solea solea*
Species common name	Sole
Dutch name	Tong
Species group	Fish

Ecological data

Guild ○ herbivore ○ piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ● molluscivore ● other: benthivore	**Max. Body weight (adults):** both sexes: 3 kg **Max. Length:** 60 cm **Maturity age:** between 3 and 5 years (25-30 cm) **Reproduction:** between 100.000 and 150.000 eggs per female per year (700-800 eggs per gram body weight) **Age:** 20 years **Distribution area:** From the Northwest African coast and Mediterranean to the Southern North Sea and Skagerrak/Kattegat. **Diet:** worms, molluscs, crustaceans

Geografical	Habitat	Fysical/chemical
Distribution ● North Sea ● coastal ● offshore ○ deep sea ● Wadden Sea ● Delta Zeeland (saline)	**Position in the water column** ○ pelagic ● demersal (up to 150 m) ○ planktonic ○ benthic	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic ○ other….
Migratory behavior ○ sedentary ● migratory ○ variable/dependent on geographical location ○ other…	**Seabed/bottom preferences** ● sand ○ gravel ● mud ○ rock ○ other….	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ○ other…
	Intertidal ○ preferred height (relative to MHT) ○ other preferences….	**Salinity** ● saline ● brackish ○ freshwater

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation	○ Invasive species	● Food	○ Building material
○ Habitat destruction	○ Disease	○ Medicine	○ Energy
● Overfishing / overharvesting	○ Poisoning	○ Recreation	○ Other:….
○ Bycatch/discards	○ Sea surface temp. incr.		
○ Human disturbance	○ Sea level change		
○ Natural disturbance	○ Oil/gass extraction		
○ Pollution	○ Ship traffic		
○ Eutrophication	○ Other…..		
○ Wind farms			

Data set information

- Surveys: BTS & DFS
- Other datasets available: IBTS (see "survey information" sheet)
- Mean values for North Sea (indicate whole/NCP), Wadden Sea, Delta and/or Coastal zone for:

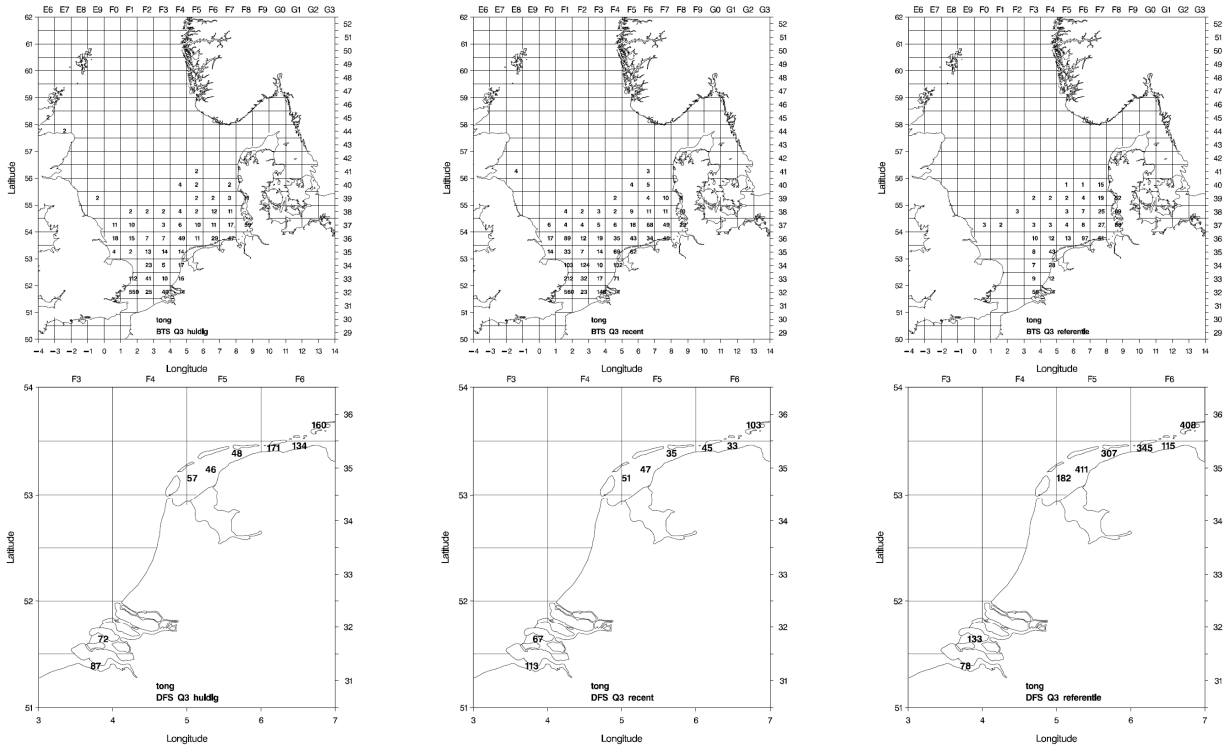
Sole/Tong	North Sea (whole)	Wadden Sea	Delta area
Present (2004-2005)*	25.3	129.3	80.8
Recent (2000-2003)*	51.0	61.0	96.0
Reference*	31.6	300.7	116.0
* All values are based on good quantitative data: reference NS:1985-1987; reference WS/D: 1980-1982			

- Long term trends: North Sea: no trend; Wadden Sea: decreasing; Delta area: no trend.
- Other reference value: SSB (Spawning Stock Biomass) *1000 tonnes.

Sole/Tong	North Sea (whole)
Present (2004)	45
Recent (2000-2003)*	35
Reference*	35
* as described in report EC-LNV 2002/116.	

Distribution data if available (preferably send digital maps otherwise description)

- 2 maps of present distribution (2004-2005),
- 2 maps of recent distribution (2000-2003),
- 2 maps of historic distribution (North Sea: 1985-1987; Wadden Sea and Delta area: 1980-1982).



Monitoring network information

The Working Group on Beam Trawl surveys (ICES WGBeam) is the regular monitoring network for sole in the North Sea, Wadden Sea and the Delta area (see chapter 3.2).

3.12 Sprattus sprattus (Sprat / Sprot)

Scientific name	*Sprattus sprattus*
Species common name	Sprat
Dutch name	Sprot
Species group	Fish

Ecological data

Guild ○ herbivore ○ piscivore ○ omnivore ○ scavenger ○ detritivore ● planktivore ○ molluscivore other: ….	**Max. Body weight (adults):** both sexes: 60 g **Max. Length:** 19 cm, but rarely above 16 cm **Maturity age:** between 1 and 2 years **Reproduction:** between 1500-6000 eggs per two-year-old female per batch. Sprat spawns repeatedly during the spawning season. **Max. Age:** between 5 and 6 years **Distribution area:** Along the shores from Morocco up to Norway, including the Mediterranean, Black Sea and Baltic Sea **Diet:** zooplankton

Geografical	Habitat	Fysical/chemical
Distribution ● North Sea ● coastal ● offshore ○ deep sea ● Wadden Sea ● Delta Zeeland (saline)	**Position in the water column** ● pelagic ○ demersal ○ planktonic ○ benthic ○ other….	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic ○ other….
Migratory behavior ○ sedentary ● migratory ○ variable/dependent on geographical location ○ other…	**Seabed/bottom preferences** ○ sand ○ gravel ○ mud ○ rock ○ other….	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity ○ other…
	Intertidal ○ preferred height (relative to MHT) ○ other preferences….	**Salinity** ● saline ● brackish ○ freshwater

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation	○ Invasive species	● Food	○ Building material
○ Habitat destruction	○ Disease	○ Medicine	○ Energy
○ Overfishing/overharvesting	○ Poisoning	○ Recreation	● Other:Industry
○ Bycatch	○ Sea surface temp. incr.		1) Fishmeal
○ Human disturbance	○ Sea level change		2) Animal feed
○ Natural disturbance	○ Oil/gass extraction		
○ Pollution	○ Ship traffic		
○ Eutrophication	○ Other…..		
○ Wind farms			

Data set information

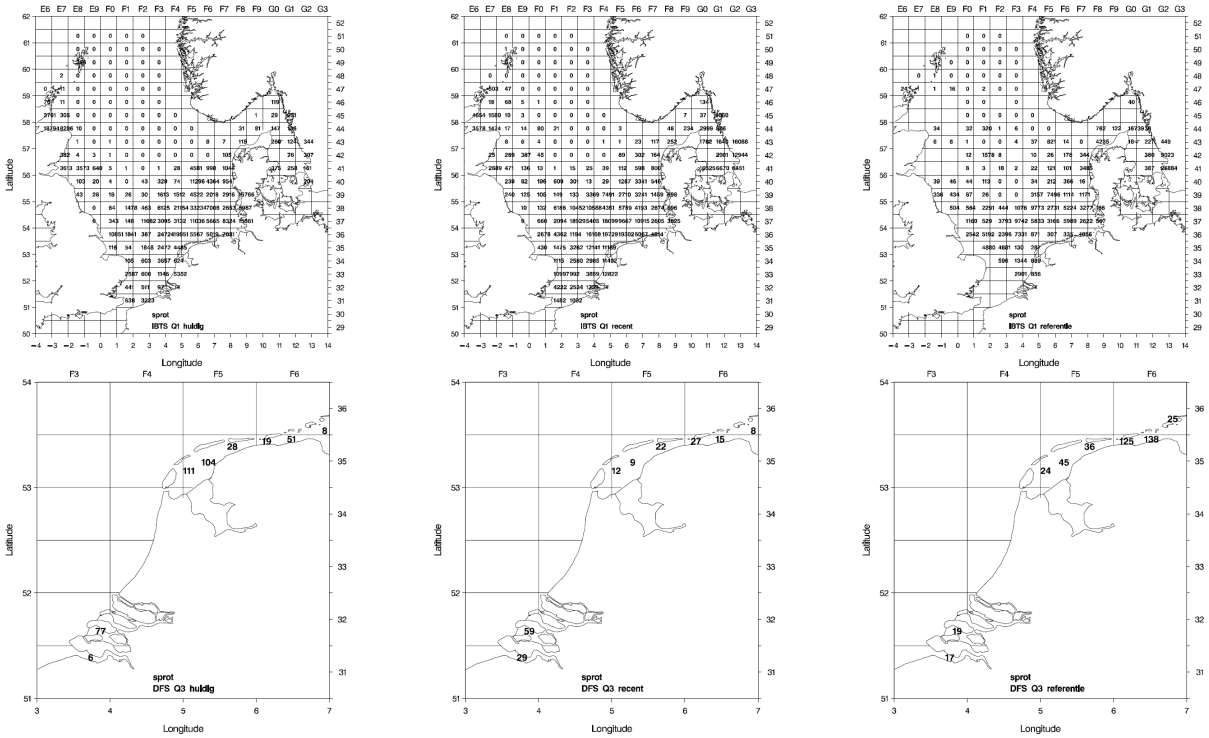
- Surveys: IBTS & DFS
- Other datasets available: The International North Sea Hydro Acoustic Survey for herring .
- Mean values for North Sea (indicate whole/NCP), Wadden Sea, Delta area and/or Coastal zone for:

Sprat/Sprot	North Sea (whole)	Wadden Sea	Delta area
Present (2004-2005)*	2207.3	63.8	16.8
Recent (2000-2003)*	2100.8	13.8	44.9
Reference*	974.3	74.0	22.3
* All values are based on good quantitative data; reference NS:1977-1979; reference WS/D: 1980-1982			

- Long term trends: North Sea: no trend; Wadden Sea: no trend; Delta area: no trend.

Distribution data if available (preferably send digital maps otherwise description)

- 2 maps of present distribution (2004-2005),
- 2 maps of recent distribution (2000-2003),
- 2 maps of historic distribution (North Sea: 1977-1979; Wadden Sea and Delta area: 1980-1982).



Monitoring network information

The ICES International Bottom Trawl Survey Working Group (IBTSWG) is the regular monitoring network for herring in the North Sea. See “Network information” sheet for more information. The ICES Planning Group for Herring Surveys (PGHERS) coordinates the International North Sea Hydro Acoustic Survey for herring (see chapter 3.2).

3.13 Relevant publications or expert group meetings

ICES HAWG: Herring Assessment Working Group for the Area South of 62ºN

ICES IBTSWG: International Bottom Trawl Survey Working Group

ICES PGHER: Planning Group on Herring Surveys

ICES WGBeam: Working Group for Beam Trawl Surveys.

ICES WGNSSK: Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak.

ICES. 2005. Report of the Herring Assessment Working Group for theArea South of 62ºN), 8-17 March 2005, ICES Headquarters. Diane. 595 pp.

ICES. 2005. Report of the International Bottom Trawl Survey Working Group (IBTSWG), 29 March – 1 April 2005, Hamburg, Germany. ICES CM 2005/D:05. 123 pp.

ICES. 2006. Report of the Planning Group on Herring Surveys (PGHERS), 24-27 January 2006, Rostock, Germany. ICES CM 2006/LRC:04. 239 pp.

ICES, 2005. Report of the working group on Beam Trawl surveys, 7-10 June 2005, Lowesoft, England. ICES CM 2005/G:12.

ICES. 2005. Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK), 6 - 15 September 2005, ICES Headquaters Copenhagen. ICES CM 2006/ACFM:09 . 971 pp.

ICES. 2006. Report of the Planning Group on Herring Surveys (PGHERS), 24-27 January 2006, Rostock, Germany. ICES CM 2006/LRC:04. 239 pp.

Muus, B.J. and J.G. Nielsen. 1999. Seafish. Blackwell Science, Oxford (UK). 340 pp.

Van Damme, C., H. Heessen, L. Bolle, I. de Boois, B. Couperus, W. Dekker, M. Dickey-Collas, G. Eltink, R. Grift, M.Pastoors, G. Piet, J. Poos, L. Schaap, H. Wiegerinck, J. van Willigen & S. Ybema, 2005. Handboek bestandsopnamen en routinematige bemonsteringen op het water, Versie 3. Intern CVO rapport

4 Sea mammals

4.1 Introduction

Sea mammals are monitored by areal surveys. In the Wadden Sea monitoring is carried out by IMARES and on the NCP (Dutch Continental Shelf) and in the Delta area by RIKZ and Delta ProjectManagement commissioned by Rijkswaterstaat. In the Wadden Sea IMARES is closely following the population dynamics of the grey and harbour seals as part of the Trilateral Wadden Sea Cooperation. Since 1978, The Netherlands, Denmark and Germany have been working together on the protection and conservation of the Wadden Sea covering management, monitoring and research, as well as political matters. In 1982, a Joint Declaration on the Protection of the Wadden Sea was agreed upon in which the countries declare their intention to coordinate their activities and measures for the protection of the Wadden Sea. Marine mammals regarded as indigenous species in the Wadden Sea are the harbour (or common) seal *Phoca vitulina*, grey seal *Halichoerus grypus*, and harbour porpoise *Phocoena phocoena*. In 1991 the Seal Agreement was enacted as the first agreement of the Convention on the Conservation of the Migratory Species of Wild Animals (Bonn Convention), concluded between the countries adjacent to the Wadden Sea – Denmark, Germany and the Netherlands. Only recently, the monitoring of the seals in the Dutch Waddensea has become an official legal task (*Wettelijke OnderzoeksTaak*). Funding is on a yearly basis.

The National Institute for Coastal and Marine Management (RIKZ, now Center of Water Management, *Waterdienst*) started in 1984 regular surveys of the NCP counting sea birds and sea mammals. Sea mammals in the Delta area are being counted by RIKZ since 1978.

4.2 Phoca vitulina (Harbour Seal / Gewone zeehond)

Scientific name	*Phoca vitulina*
Species common name	Harbour Seal
Dutch name	Gewone zeehond
Species group	Mammals

Ecological data

Guild ○ herbivore ● piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ○ molluscivore ○ other: ….	**Max. Body weight (adults)** male: between 55 and 130kg female: between 45 and 105kg **Max. Length:** adult female between 120 and 150cm Adult male 150-180 **Maturity age:** female: between 4 and 5 years/months Male: after 6 years **Fecundity:** between …and 0.85 young (per year) **Max Age:** female 40y and males 25y **Density/biomass (in optimal habitat):** irrelevant **Home range:** between 0 and 150 km **Dispersal distance:** irrelevant **For populations:** estimate of minimal viable population size per area: 5000 long term (incl. stochastic catastrophes) and 500 short term (no inbreeding) **Diet:** fish

Geografical	Habitat	Fysical/chemical
Distribution ● North Sea ● coastal (20 km/other…) ● offshore ○ deep sea ● Wadden Sea ● Delta Zeeland (saline)	**Position in the water column** ● pelagic ○ demersal ○ planktonic ○ benthic ○ other….	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic ○ other….
Migratory behavior ○ sedentary ● migratory ○ variable/dependent on geographical location	**Seabed/bottom preferences** ○ sand ○ gravel ○ mud ○ rock	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity
	Intertidal ○ preferred height (relative to MHT): ● other preferences: sand banks for haul out (whelping, suckling and moult).	**Salinity** ● saline ● brackish ○ freshwater

Pressures

Causes of change in population size and/or distribution		Use of indicator	
● Habitat degradation	○ Invasive species	○ Food	○ Building material
○ Habitat destruction	● Disease	○ Medicine	○ Energy
○ Overfishing/overharvesting	○ Poisoning	○ Recreation	● Other: Wadden Sea quality
○ Bycatch	○ Sea surface temp. increase		
● Human disturbance			
○ Natural disturbance	○ Sea level change		
● Pollution	○ Oil/gass extraction		
○ Eutrophication	○ Ship traffic		
○ Wind farms	○ Other…..		

Data set information

Name of data set or monitoring programme: MONITORING POPULATION DEVELOPMENT
Measurement unit: NUMBER
Brief description of contents data set and/or monitoring programme or hyperlink: www.tmap.de
Brief description/reference/hyperlink of sampling method: aerial surveys
Begin date of data set: 1960
Are other data sets available (give dates) : no
Frequency of monitoring and next monitoring date: 5 times annually
Range/variation of available data in space and time: Dutch part of Wadden Sea (summer)
Estimate of percentage inaccuracy of measurements: estimated at less than 5%
Mean values for North Sea (indicate whole/NCP), Wadden Sea, Delta area and/or Coastal zone for: see data (estimated population size/corrected counts)
Present (2004/2005) : average 3319 animals in Dutch part
Recent (2000/2001/2002/2003): average of 3318 animals in Dutch part
Reference value (and year, if applicable; minimal human influence or other deemed appropriate year; give justification based on incidental/anecdotic data and estimate relative state at start of monitoring programme) : 7000-16000, but more likely close to 16000 animals
Available data for other years: from 1960 for all years available
Contact for dataset: Prof. Dr. Ir. P.J.H. Reijnders or Drs S. Brasseur

Distribution data if available (preferably send digital maps otherwise description)

Maps of present haulout places in the Wadden Sea are available from IMARES.

Monitoring network information

Name of monitoring network: WOT-Natuur
Brief description of network/hyperlink: www.waddensea-secretariat.org
Other variables measured in network: pubs and distribution
Contact for network: Drs. S. Brasseur at IMARES.
Starting date network: WOT only recent
Guaranteed continuation of network till what date/year: 2008
Name/map of area covered by network: dutch Wadden Sea
Reference of last network progress report: year report 2005
Restrictions on availability of data: partly, but not for totals of young and adults

4.3 Halichoerus grypus (Grey Seal / Grijze zeehond)

Scientific name	*Halichoerus grypus*
Species common name	Grey Seal
Dutch name	Grijze zeehond
Species group	Mammals

Ecological data

Guild ○ herbivore ● piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ○ molluscivore ○ other: ….	**Max. Body weight (adults)** male: between 170 and 350 kg female: between 120 and 220 kg **Max. Length:** adult female between 165 and 210cm Adult male 195-250 **Maturity age:** female: between 4 and 5 years/months Male: after 8 years **Fecundity:** between …and app. 0.80 young for mature females (per year) **Max Age:** female 44 and males 30 **Density/biomass (in optimal habitat):** irrelevant **Home range:** irrelevant **Dispersal distance:** between 50 and 1200 km **For populations: estimate of minimal viable population size per area:** 5000 long term (incl. stochastic catastrophes) and 500 short term (no inbreeding) **Diet:** fish

Geografical	Habitat	Fysical/chemical
Distribution ● North Sea ● coastal (20 km/other…) ● offshore ○ deep sea ● Wadden Sea ● Delta Zeeland (saline)	**Position in the water column** ● pelagic ○ demersal ○ planktonic ○ benthic ○ other….	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic ○ other….
Migratory behavior ○ sedentary ● migratory ○ variable/dependent on geographical location	**Seabed/bottom preferences** ○ sand ○ gravel ○ mud ○ rock	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity
	Intertidal ○ preferred height (relative to MHT): ● other preferences: sand banks for haul out (whelping, suckling and moult).	**Salinity** ● saline ● brackish ○ freshwater

Pressures

Causes of change in population size and/or distribution		Use of indicator	
● Habitat degradation	○ Invasive species	○ Food	○ Building material
○ Habitat destruction	○ Disease	○ Medicine	○ Energy
○ Overfishing/overharvesting	○ Poisoning	○ Recreation	● Other: Wadden Sea quality
○ Bycatch	○ Sea surface temp. increase		
● Human disturbance	○ Sea level change		
○ Natural disturbance	○ Oil/gass extraction		
● Pollution	○ Ship traffic		
○ Eutrophication	○ Other…..		
○ Wind farms			

Data set information

Name of data set or monitoring programme: Monitoring population development
Measurement unit: number
Brief description of contents data set and/or monitoring programme or hyperlink: www.tmap.de
Brief description/reference/hyperlink of sampling method: boat and aerial surveys
Begin date of data set: 1980
Are other data sets available (give dates): no
Frequency of monitoring and next monitoring date: 7 times annually
Range/variation of available data in space and time: Dutch part of Wadden Sea (summer)
Estimate of percentage inaccuracy of measurements: unknown
Mean values for North Sea (indicate whole/NCP), Wadden Sea, Delta area and/or Coastal zone for: see data (only counted numbers, no population estimate)
Present (2004/2005) : average of 1305 counted in Dutch part of Wadden Sea
Recent (2000/2001/2002/2003): average of 731 animals
Reference value (and year, if applicable; minimal human influence or other deemed appropriate year; give justification based on incidental/anecdotic data and estimate relative state at start of monitoring programme): unknown
Available data for other years: from 1980 for all years available
Contact for dataset: Prof. Dr. Ir. P.J.H. Reijnders or Drs S. Brasseur

Distribution data if available (preferably send digital maps otherwise description)

Maps of present haulout places in the Wadden Sea are available from S. Brasseur.

Monitoring network information

Name of monitoring network: WOT-Natuur
Brief description of network/hyperlink: none
Other variables measured in network: pubs and distribution
Contact for network: see above
Starting date network: WOT only recent
Guaranteed continuation of network till what date/year: 2008
Name/map of area covered by network: dutch Wadden Sea
Reference of last network progress report: year report 2005
Restrictions on availability of data: partly, but not for totals of young and adults

4.4 Phocoena phocoena (Harbour porpoise / Bruinvis)

Scientific name	*Phocoena phocoena*
Species common name	Harbour porpoise
Dutch name	Bruinvis
Species group	Mammals

Ecological data

Guild ○ herbivore ● piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ○ molluscivore ○ other: ….	Max. Body weight (adults) male: app. 61 kg female: app. 76kg Max. Length: app. Males 1.6m, females 1.7m Maturity age: app. 5th year Reproduction: mostly 1 young per female (lifetime) Age: between 12 and max. 25 years Density/biomass (in optimal habitat): irrelevant Home range: unknown Dispersal distance: irrelevant For populations: estimate of minimal viable population size per area: unknown Diet: fish

Geografical	Habitat	Fysical/chemical
Distribution ● North Sea ● coastal ● offshore ○ deep sea ● Wadden Sea ● Delta Zeeland (saline)	**Position in the water column** ● pelagic ○ demersal ○ planktonic ○ benthic ○ other….	**Nutrient conc.** ● oligotrophic ● mesotrophic ○ eutrophic ○ other….
Migratory behavior ○ sedentary ● migratory ● variable/dependent on geographical location ○ other:	**Seabed/bottom preferences** ○ sand ○ gravel ○ mud ○ rock	**Light conditions** ● tolerant for turbidity ○ intolerant for turbidity
	Intertidal ○ preferred height (relative to MHT): ○ other preferences	**Salinity** ● saline ○ brackish ○ freshwater

Pressures

Causes of change in population size and/or distribution		Use of indicator	
● Habitat degradation ○ Habitat destruction ● Overfishing/overharvesting ● Bycatch ● Human disturbance ○ Natural disturbance ● Pollution ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ● Poisoning ○ Sea surface temp. increase ○ Sea level change ○ Oil/gass extraction ● Ship traffic ○ Other…..	○ Food ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other

Data set information

Name of data set or monitoring programme: MWTL
Measurement unit: estimated numbers per km^2
Brief description of contents data set and/or monitoring programme or hyperlink: unknown
Brief description/reference/hyperlink of sampling method: Arts & Berrevoets 2005
Begin date of data set: 1992
Are other data sets available (give dates): see
http://home.planet.nl/~camphuys/Cetacea.html
Frequency of monitoring and next monitoring date: monthly
Range/variation of available data in space and time: NCP, monthly
Estimate of percentage inaccuracy of measurements: unknown, but large
Mean values for North Sea (indicate whole/NCP), Wadden Sea, Delta area and/or Coastal zone for: NCP
Present (2004/2005): 0.43 n/km2 in april/may
Recent (2000/2001/2002/2003): 0.36 n/km2 in april/may
Reference value (and year, if applicable; minimal human influence or other deemed appropriate year; give justification based on incidental/anecdotic data and estimate relative state at start of monitoring programme): 1 n/km2 in april/may (conservative estimate)
Available data for other years: unknown
Contact for dataset: helpdesk@waterstat.nl
Monitoring network information
Name of monitoring network: MWTL
Brief description of network/hyperlink: Dutch Directorate for Public Works and Water Management (Rijkswaterstaat), http://www.rijkswaterstaat.nl
Other variables measured in network: Many (see http://www.waterstat.nl/)
Contact for network: helpdesk@waterstat.nl and Dr. M. Scheidat at IMARES.
Starting date network: 1984
Guaranteed continuation of network till what date/year: 2008
Name/map of area covered by network: NCP
Reference of last network progress report: Arts & Berrevoets 2006
Restrictions on availability of data: None

Other important information or remarks

None

4.5 Relevant publications or expert group meetings

Arts, F.A. and C. M. Berrevoets, 2005. Monitoring van zeevogels en zeezoogdieren op het Nederlands Continentaal Plat 1991 – 2005. Rapport RIKZ/2005.032, pp. 48.

Arts, F.A. and C. M. Berrevoets, 2006. Monitoring van zeevogels en zeezoogdieren op het Nederlands Continentaal Plat 1991 – 2006. Rapport RIKZ/2006.018, pp. 40.

Brasseur S. , P. Reijnders, O. Damsgaard Henriksen, J. Carstensen, J. Tougaard, J. Teilmann, M. Leopold, K. Camphuysen & J. Gordon, 2004. Baseline data on the harbour porpoise, Phocoena phocoena, in relation to the intended wind farm site NSW, in the Netherlands Wageningen, Alterra, Alterra- Profiel bruinvis.doc . 84 blz.; .32 figs.; 11 tables.; 50 refs.

Brasseur, S.M.J.M. & M.F. Fedak 2003. Habitat use of harbour seals in relation to recreation, fisheries and large infra-structural works. In: CWSS (eds), Management of North Sea harbour and grey seal populations. Proceedings of the International Symposium at EcoMare, Texel, The Netherlands, November 29-30, 2002. Wadden Sea Ecosystem No. 17, 27-31. Wadden Sea Secretariat, Wilhelmshaven, Germany.

Camphuysen, C.J, 1994. The Harbour porpoise Phocoena phocoena in the southern North Sea. II: A comeback in Dutch waters? Lutra 37: 54-61.

Camphuysen, Kees, 2004. The return of the harbour porpoise (Phocoena phocoena) in Dutch coastal waters. Lutra 47: 135-144.

Reijnders, P.J.H., 1992. Harbour porpoises Phocoena phocoena in the North Sea: numerical responses to changes in environmental conditions. Neth. J. Aquat. Ecol. 26: 75-86.

Reijnders, P.J.H. & S.M.J.M. Brasseur 2003. Veränderungen in Vorkommen und Status der Bestände von Seehunden und Kegelrobben in der Nordsee – Mit Anmerkungen zum Robbensterben 2002. In: J. Lozán, E. Rachor, K. Reise, J. Sündermann & H. von Westernhagen (Hrsg.), Warnsignale aus der Nordsee: Neue Folge. Vom Wattenmeer bis zur offenen See. Wissenschaftliche Auswertungen, Hamburg (ISSN 3-00-010166-7), in Kooperation mit GEO, 330-339.

Reijnders, P.J.H., S.M.J.M. Brasseur & A.G. Brinkman 2003. The phocine distemper virus outbreak of 2002 amongst harbour seals in the North Sea and Baltic Sea: spatial and temporal development, and predicted population consequences. In: CWSS (eds), Management of North Sea harbour and grey seal populations. Proceedings of the International Symposium at EcoMare, Texel, The Netherlands, November 29-30, 2002. Wadden Sea Ecosystem No. 17, 19-25. Wadden Sea Secretariat, Wilhelmshaven, Germany.

Reijnders, P.J.H., M.F. Leopold, C.J. Camphuysen, H.J.L. Heessen & R.A. Kastelein, 1996. The Status of the Harbour Porpoise Phocoena phocoena, in Dutch Waters and the State of Related research in the Netherlands: An Overview. Rep. Int. Whal. Commn. 46: 607-611.

Reijnders, P.J.H., B. Reineking, K.F. Abt, S.M.J.M. Brasseur, C.J. Camphuysen, M. Scheidat, U. Siebert, M. Stede, J. Tougaard & S. Tougaard 2005. Marine mammals. In: K. Essink. C. Dettman, H. Farke, K. Lauersen, G. Lüerssen, H. Marencic & W. Wiersinga (eds), QSR Wadden Sea 2004. Wadden Sea Ecosystem No. 19, 317-330.

Smeenk, C., 2003. Strandingen van Cetacea op de Nederlandse kust in 1993-1997. Cetacea stranded on the Dutch coast in 1993-1997. Lutra-. 2003; 46(1): 45-64.

5 Invertebrates

5.1 Introduction

In this report ecoprofiles are given for three species in the Wadden Sea and Delta area, one species in the coastal zone and one species on the Dutch Continental Shelf (NCP).

The development of exploited shellfish stocks (cockle beds, mussel beds, and spisula beds) is monitored through surveys in the Dutch coastal waters. The results are used to collect information that is used to manage the fisheries and to estimate ecosystem effects of shellfish exploitation. The data, including information on non commercial species collected during the surveys, is stored in a central database at Wageningen IMARES. The results are reported and communicated through reports and the media. Updated information on mussel banks is also submitted to the Wadden Sea Secretariat. Because of increasing dominance of the Pacific oyster in many areas in the Delta area and Wadden Sea, this species is becoming an important competitor for food and appears highly successful in replacing other invertebrates.

Monitoring further offshore has been carried out within the BIOMON programme, but those results will be discussed elsewhere. Results from research cruises are used to construct the ecoprofile for the ocean quahog. This is a long-lived (more than 300 years) species that can be used as an indicator of bottom trawl pressure.

5.2 Cerastoderma edule (Cockle beds / Kokkelbank)

Habitat name	Cockle bed
English name	Cockle bed
Dutch name	kokkelbank
Dominating species	*Cerastoderma edule* (Cockle, Kokkel)

Ecological data

Age: 1 to 6 years, individual cockles can be older
Density/biomass (in optimal habitat): Strong year to year changes in total area of beds. Population densities of 10,000 per m^2 for juveniles of year class 1 (1cm) have been recorded. In older beds (year class>2 years) average densities of more than 100/m^2 are common.
Estimate of minimal viable habitat size: In the Wadden Sea bed area of harvestable cockles varied from 150.000 ha to more than 133.000 ha between 2003 and 2006..

Geografical	Habitat	Fysical/chemical
Distribution ○ North Sea • coastal (20 km) ○ offshore ○ deep sea • Wadden Sea • Delta Zeeland	• preferred height (relative to MHT) middle to lower intertidal and shallow subtidal. Found at depths up to 20m. • Found on clean sand, muddy sand, mud or muddy gravel. Often abundant in estuaries and sheltered bays	**Salinity** • Saline. Usually live at salinities between 15 -35 psu but can tolerate salinities as low as 10 psu. ○ brackish ○ freshwater

Pressures

Causes of change in habitat size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation • Habitat destruction • Succession, older cockles in high densities may prevent larvae from settling? • Overfishing / overharvesting ○ By catch ○ Human disturbance • Natural disturbance (storms). ○ Pollution ○ Eutrophication ○ Wind farms	○ Invasive species • Disease: sometimes invested by trematod larvae ○ Poisoning ○ Sea surface temp. incr. • Sea level change? • Oil/gas extraction ○ Ship traffic ○ Other…..	• Food ○ Medicine ○ Recreation • Agriculture: chalk from shells ○ Coastal protection ○ Breeding area • Fouraging area	○ Resting area • Building material:chalk from shells ○ Energy • Other: pavement of walking paths • Substrate for macro-algae and subsequent spat fall of mussels.

Data set information

- **Name of data set or monitoring programme:**
  1. Yearly stock assessment in Spring
  2. Surveys for cockle beds by fishermen, until 2005 for the whole Wadden Sea, since 2005 only a limited area is being surveyd by hand cocklers.
  3: Assessment of population dynamics of cockle stocks in Oosterschelde and Westerschelde at fixed plots.
- **Measurement unit:**
  number and biomass per m^2
- **Brief description of contents data set and/or monitoring programme or hyperlink.**
  Ad 1: surface sampling on (fixed/grid) locations, method depending on location and time.
  Ad 2: qualitative sampling by walking and fishing to find harvestable cockle beds.
  Ad 3: sampling of fixed, approximately 1600 m2 plots 3 to 6 times a year.
- **Brief description/reference/hyperlink of sampling method:**
  Craeymeersch *et al* 2004
- **Begin date of data set:**
  Ad 1: Wadden Sea: Spring 1990, Oosterschelde: Spring 1990, Westerschelde: Spring 1992, and Voordelta: 1993 and less intenstive 1979/1980.(J. de Vlas)
  Ad 2: Wadden Sea, 1980.
  Ad 3: Cockle plots, 1991.
- **Are other data sets available (give dates)**
  Wadden Sea, winter 1990
  Wadden Sea, Autumn 1990, 1995-1998 (1998 only eastern part) and 2000-2003 (2003 focussed on places where cockle seed was expected)
  Oosterschelde, Winter 1990/1991
  Oosterschelde, Autumn 1997
  Oosterschelde, Autumn 1990
  Westerschelde, Autumn 1996-2002
- **Frequency of monitoring and next monitoring date:**
  1: Yearly, next survey in Spring 2007.
  2: Yearly in period 1980 - 2004
  3: In 1991 2 times, in 92 and 93 6x, in 94 5x, in 95 and 96 3x, in 97 4x and since 1998 3 times a year.
- **Range/variation of available data in space and time:**
  Yearly variation in stocks reported by Kesteloo *et al* (2005).
- **Estimate of percentage inaccuracy of measurements**
  95% confidence interval of stock assessments (Bult 2004)
  Biomass Cockles Oosterschelde, Spring, ±20%
  Biomass Cockles Westerschelde, Spring, ±40%
  Biomass Cockles Wadden Sea, Spring, ±15-30%

- **Mean values not calculated. Totals of stocks for North Sea (indicate whole/NCP), Wadden Sea, Delta area and/or Coastal zone for:**
  Present (2004 / 2005, 10^6 kg freshweight)

Data quality[1]: 1	**2004**	**2005**
Wadden Sea	209.42	198.03
Oosterschelde	26.61	30.54
Westerschelde	10.69	13.66
Voordelta	2.90	0.91 (buitendelta Haringvliet)

  Recent (2001 / 2002 / 2003, 106 kg freshweight)

Data quality1: 1	**2001**	**2002**	**2003**
Wadden Sea	238.24	180.68	90.05
Oosterschelde	33.24	16.46	24.14
Westerschelde	4.21	3.55	4.35
Voordelta (2001, 2002 not calculated)			0.03 (buitendelta Haringvliet)

- **Reference Value & year[2]**
  Estimate based on recent data (Baptist en Jagtman (1997), ha=hectare with cockle density >50 individuals m^{-2})

Netherlands	21000
Delta area	8500
Westerschelde	2500
Oosterschelde	6000
Wadden Sea	12500
Western Wadden Sea	6000
Eastern Wadden Sea	5000
Eems Dollard	1500

  Other references
  Estimates based on recent data: 1990-2005 (Biomass *106 kg freshweight)
  Cockles stocks are highly dynamic by nature. Influence of fisheries: average 10% per year (Wadden Sea, Ens *et al*, 2004). Total influence may be considerable after several years with limited spatfall.

	Average	**minimum**	**maximum**
Wadden Sea	192	17	422.10^6 kg
Voordelta	0.9	0	5.10^6 kg
Oosterschelde	26	9	44.10^6 kg
Westerschelde	7	1.5	14.10^6 kg

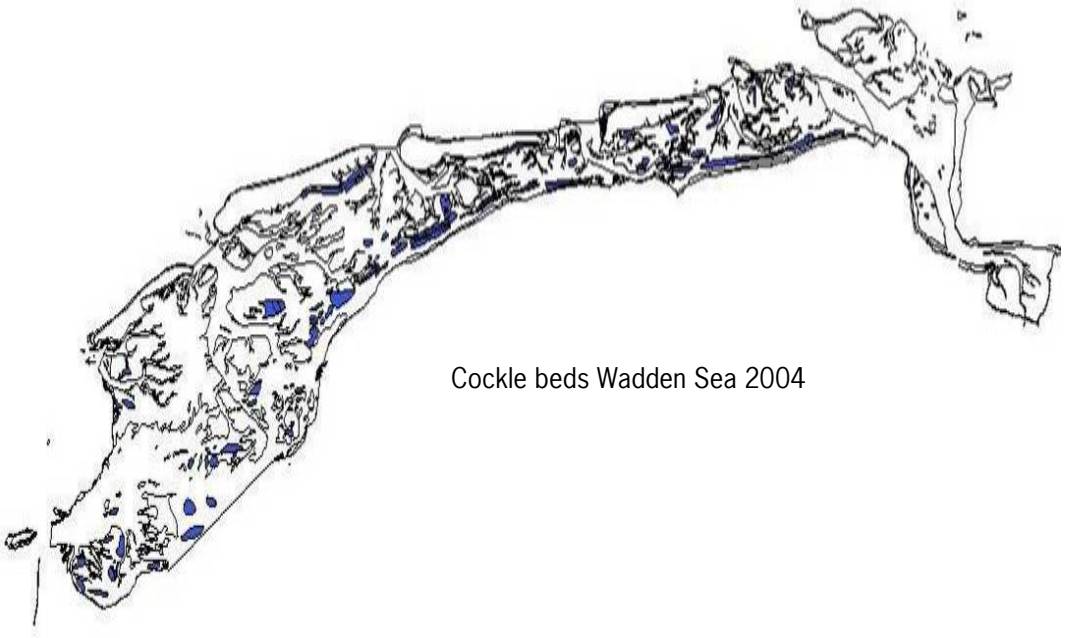
- **Available data for other years:**
  Total stocks for Wadden Sea and Oosterschelde 1990-2000, Westerschelde 1992-2000.

[1] estimate of data quality: 1. based on good quantitative/empirical data
2. poor/no quantitative data, lim. expert judgement
3. intermediate

[2] (minimal human influence or other deemed appropriate year; give justification based on incidental/anecdotic data and estimate relative state at start of monitoring programme)

Distribution data

- 1 map of historic distribution (preferably reference year), not available
- 1 map of present distribution (2004-2005)



Cockle beds Wadden Sea 2004

- 1 map of recent distribution (2000/2001/2003).

Cockle beds Wadden Sea 2003

Monitoring network information

Surveys are not part of a monitoring network

- **Other variables measured:**
  Some fauna elements (infauna; epifauna): Macoma cover reasonable, Ensis and Mya poor.

5.3 Spisula subtruncata (Spisula bed / Spisulabank)

Habitat name	Spisula bed
English name	Spisula / Cut trough shell bed
Dutch name	Spisulabank, nonnenbank
Dominating species	*Spisula subtruncata* (Spisula, Afgeknotte strandschelp)

Ecological data

Age: between 1 and 5 years
Density/biomass (in optimal habitat): Maxima per bed, may be calculated with existing data
Estimate of minimal viable habitat size: no data

Geografical	Habitat	Fysical/chemical
Distribution ● North Sea ● coastal ○ Offshore: Dogger Bank ○ deep sea ● Wadden Sea ● Delta Zeeland	● preferred height (relative to MHT): subtidal, up to 20m depth ● sediment preferences: sand and muddy fine sand	**Salinity** ● saline ○ brackish ○ freshwater

Pressures

Causes of change in habitat size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
● Habitat degradation ● Habitat destruction ○ Succession ● Overfishing/ overharvesting ? ○ Bycatch ○ Human disturbance ● Natural disturbance ○ Pollution ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic ● Naturally, there are strong spatial and temporal fluctuations in densities and biomass.	● Food ○ Medicine ○ Recreation ○ Agriculture ○ Coastal protection ○ Breeding area ○ Fouraging area	○ Resting area ● Building material ○ Energy ○ Other:

Data set information

- **Name of data set or monitoring programme:**
  stock assessment of spisula in the coastal area in Spring
- **Measurement unit:**
  number and biomass per m^2
- **Brief description of contents data set and/or monitoring program or hyperlink.**
  Systematic sampling design: the surveyed area is divided into a number of strata according to prior knowledge of or expectation on the distribution and density of trough shells

- **Brief description/reference/hyperlink of sampling method:**
  Craeymeersch *et al*, 2004
- **Begin date of data set:**
  Start 1995
- **Are other data sets available (give dates):**
  stock assessment of Spisula in the Voordelta in Spring 1993 and 1994.
- **Frequency of monitoring and next monitoring date:**
  Yearly up to 2005.
- **Range/variation of available data in space and time:**
  see yearly reports, Craeymeersch (1999) and Craeymeersch *et al* (2001)
  After spat fall densities as high as 150.000 individuals/m^2 can be found, however, mortality is high and 1.5 year later densities were lower than 1.000 individuals/m^2 (Degraer 1999).
- **Estimate of percentage inaccuracy of measurements:**
  95% confidence interval of estimates ±40-50%. (Bult, 2004)
- **Mean values of stocks not calculated. Totals for North Sea (indicate whole/NCP), Wadden Sea, Delta area and/or Coastal zone for:**
- **Coastal zone:**
  Present (2004, 2005)

Data quality[3]: 1	**number**	**biomass**
2004	$4884.6.10^6$	$13.5.10^6$kg freshweight
2005	$1529.7.10^6$	$3.6.10^6$kg freshweight

  Recent(2001, 2002, 2003)

Data quality[1]: 1	**number**	**biomass**
2001	$160519.3.10^6$	$425.8.10^6$kg freshweight
2002	$30751.9.10^6$	$117.4.10^6$kg freshweight
2003	$10765.5.10^6$	$24.2.10^6$ kg fresh weight

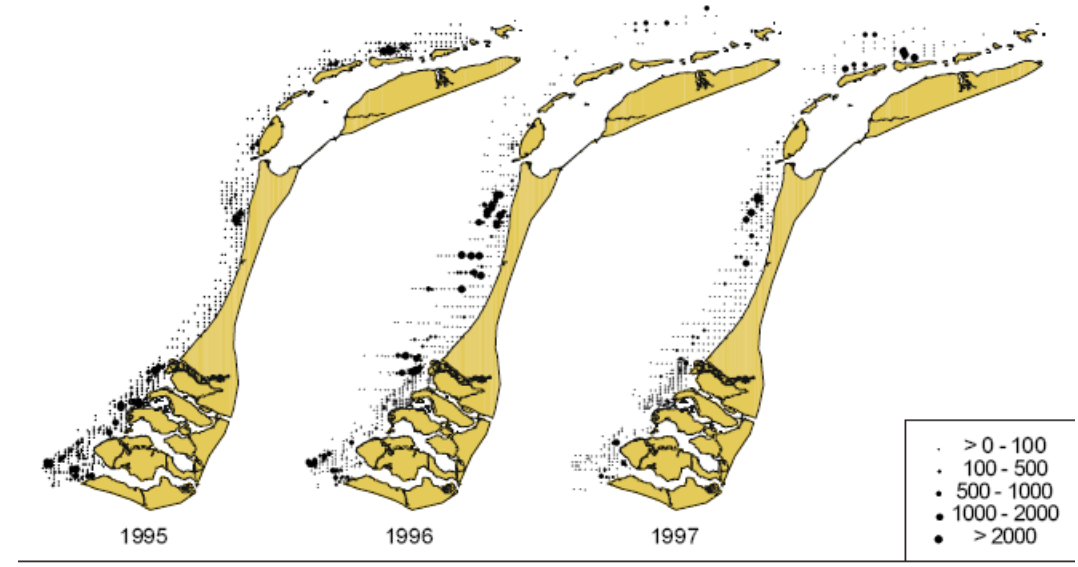
- **Reference (minimal human influence or other deemed appropriate year; give justification based on incidental/anecdotic data and estimate relative state at start of monitoring program)[2]:**
  Biomass between 0.8 and 21 g per m^2 (25 and 75 percentile from values of species in coastal points of the MWTL-program (1991-2001) for the coastal zone (van der Moolen 2004). With a conversion of 0.05 for AFDW/fresh weight this comes to between 16 and 420 g fresh weight per m^2.

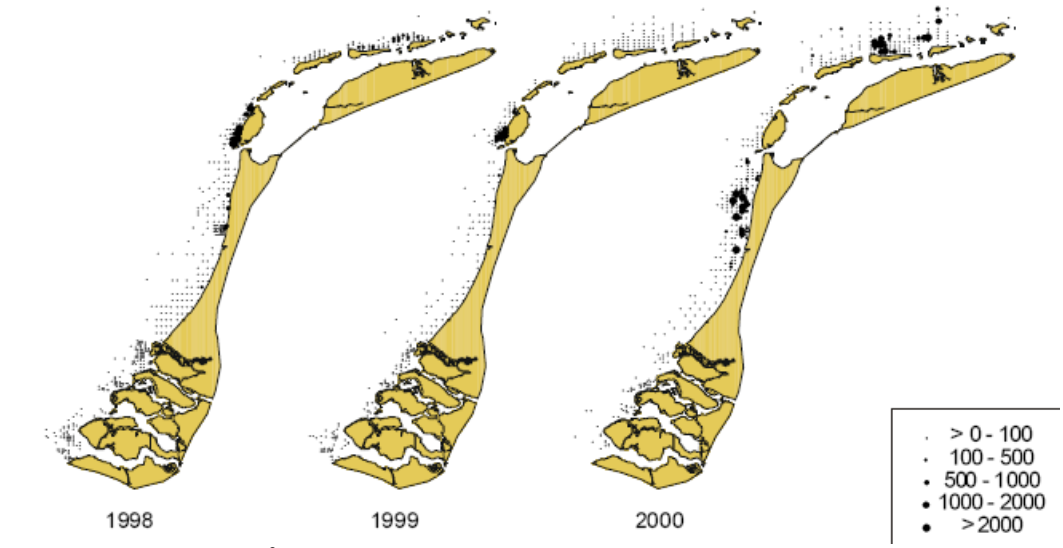
- **Available data for other years**
  Total number and biomass coastal zone 1995-2000.
  Total number and biomass Voordelta 1993 and 1994.

[3] estimate of data quality: 1. based on good quantitative/empirical data
2. poor/no quantitative data, lim. expert judgement
3. intermediate

Distribution data

Steenbergen, 2005
Yearly reports, Craeymeersch *et al* 2001; Craeymeersch 1999.





Totale dichtheid (ind./m^2) van *Spisula subtruncata* (1995-2000) from *et al*. (2001).

Monitoring network information

Surveys were part of a monitoring network up to 2005.

- **Other variables measured: other fauna elements (infauna; epifauna)**

5.4 Mytilus edulis (Mussel bed / Mosselbank)

Habitat name	Mussel bed
English name	Mussel bed
Dutch name	Mosselbank
Dominating species	*Mytilus edulis* (Mussel, Mossel)

Ecological data

Age: between 1 and >10 years (Brinkman *et al.* 2003)
Density/biomass (in optimal habitat): Bed consists of patches (20-70% cover) within patch 10-20 kg/m^2 Fresh weight, totalling to 20-150 ton/ha.
Estimate of minimal viable habitat size: Long recovery time when disappeared.

Geografical	Habitat	Fysical/chemical
Distribution ● North Sea ● coastal (20 km/other…) ○ offshore ○ deep sea ● Wadden Sea ● Delta Zeeland	• Occurs from below mean sea level (i.e. low intertidal) to the shallow subtidal • Mytilus edulis is relatively tolerant of extreme cold and freezing, surviving a drop in tissue temperature to minus 10 °C • Substratum for mussel beds: Muddy gravel, sandy mud, muddy sand, mixed; Mussel patches can be found on biogenic reef substratum, artificial material (e.g. metal, wood, concrete), rockpools, under boulders, bedrock, large to very large boulders, small boulders, • Tidal strength preferences: Weak (<1 kn) to Strong (3-6 kn) • Wave exposure: very sheltered to very exposed	**Salinity** ● saline, > 18‰ salinity, temporarily 8-10‰ ○ brackish ○ freshwater

Pressures

Causes of change in habitat size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
● Habitat degradation ● Habitat destruction ○ Succession ● Overfishing / over-harvesting ○ Bycatch ○ Human disturbance ● Natural disturbance ○ Pollution ○ Eutrophication ○ Wind farms	●Invasive species (Oyster) ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic ● Naturally, there are strong spatial and temporal fluctuations in densities and biomass.	● Food ○ Medicine ○ Recreation ○ Agriculture ○ Coastal protection ○ Breeding area ● Fouraging area	○ Resting area ○ Building material ○ Energy ● Other: settling-substrate for organisms that require hard substrate.

Data set information

- **Name of data set or monitoring programme:**
  1: stock assessment of "wild" (not cultivated) mussels in Spring,
  2: stock assessment of culture plots in the Oosterschelde in Spring.
  3: contours/surface area of litoral mussel beds in Spring and Autumn
  4: Population dynamics on a selection of individual beds in summer
- **Measurement unit:**
  number and biomass per m^2/area in hectare
- **Brief description of contents data set and/or monitoring program or hyperlink**
  Ad 1: distribution and abundance of "wild" mussels in the Wadden Sea in Spring. Sampling method: stratified sampling; strata according to prior knowledge of or expectation on the distribution and density of mussels.
  Ad 2: abundance of cultivated mussels on culture plots in the sub littoral part of the Oosterschelde in spring. Sampling of a stratified grid with a grabber, only on culture plots.
  Ad 3: Contours of mussel beds stored in GIS. Yearly reconstruction (Steenbergen *et al*. 2006).
  Ad 4: Dankers *et al*. 2005
- **Brief description/reference/hyperlink of sampling method**
  Craeymeersch *et al* 2004
- **Begin date of data set**
  Ad 1: Wadden Sea, start 1992
  Ad 2: Oosterschelde, start 1992
  Ad 3: Wadden Sea, start 1994
  Ad 4: Wadden Sea, start 1994
- **Are other data sets available (give dates)**
  Qualitative stock assessment in Autumn by dredging and expert judgment, Wadden Sea, start 1994.
  Stock assessment of" wild" mussels in the Oosterschelde, Spring 1995 and Autumn 1994, 1995 (survey only when mussel seed is found abundant)
  Stock assessment of the coastal zone, Summer 1996.
  Abundance of cultivated mussels on culture plots in the sub littoral part of the Wadden Sea in Spring, 2004.
- **Frequency of monitoring and next monitoring date**
  Yearly, next date: Spring 2007.
- **Range/variation of available data in space and time:**
  not calculated.
- **Estimate of percentage inaccuracy of measurements:**
  95% confidence interval of estimates (Bult, 2004)
  Biomass mussels, recent surveys, littoral, ±30-40%, surveys in the past had bigger intervals because the sampling was not stratified and another sampling device was used.
  Biomass mussels, survey, sublittoral, ±25-30%
- **Mean values of stocks:**
  not calculated.

- **Total stocks for North Sea (indicate whole/NCP), Wadden Sea and Delta area:**
- **Present (2004/2005, 106 kg fresh weight), Data quality**[4]:
  Wadden sea "wild"mussels, Spring
  Littoral, sublittoral: 73.80, 23.29 / 50.40, 9.08
  Oosterschelde "wild" mussels and cultivated mussel, Spring,
  Littoral, sublittoral: 0.00, 47.90/0.00, 42.50
  Recent (2001/2002/2003, 10^6 kg fresh weight), Data quality[5]**: 1**
  Wadden sea "wild"mussels, Spring
  Littoral, sublittoral: 18.66, 10.37 / 50.34, 25.61 / 64.75, 19.62
  Oosterschelde "wild"mussels and cultivated mussels, Spring
  Littoral, sublittoral: 0.64, 49.94 / 0.00, 25.31 / 0.00, 62.34
- **Mean values of surface area:**
  not calculated.
- **Surface area for the littoral beds in Wadden Sea:**
  for reconstruction see (Steenbergen 2003, 2006), Data quality[1]: 3
  Present (2004 / 2005; ha)
  not yet completely reconstructed
  Spring 2193.8 / 2052.3
  Recent (2001 / 2002 / 2003, ha)
  Spring 891.2 / 2992.3 / 2013.2
- **Reference Value & year**[6]
  Estimate based on recent data (ha=hectare) only "wild" mussel beds

Delta area	700, subdivided into
Westerschelde	200
Oosterschelde	500, estimated because of mixing wild and culture beds
Wadden Sea	5005, subdivided into
Western Wadden Sea	1500
Eastern Wadden Sea	3500
Eems Dollard	5 (Baptist en Jagtman, 1997)

- **Available data for other years**
  Biomass "wild"mussels, Wadden Sea, sublittoral 1992-2000
  Biomass "wild"mussels, Wadden Sea, littoral 1990-2000
  Biomass "cultivated mussels", Oosterschelde 1992-2000

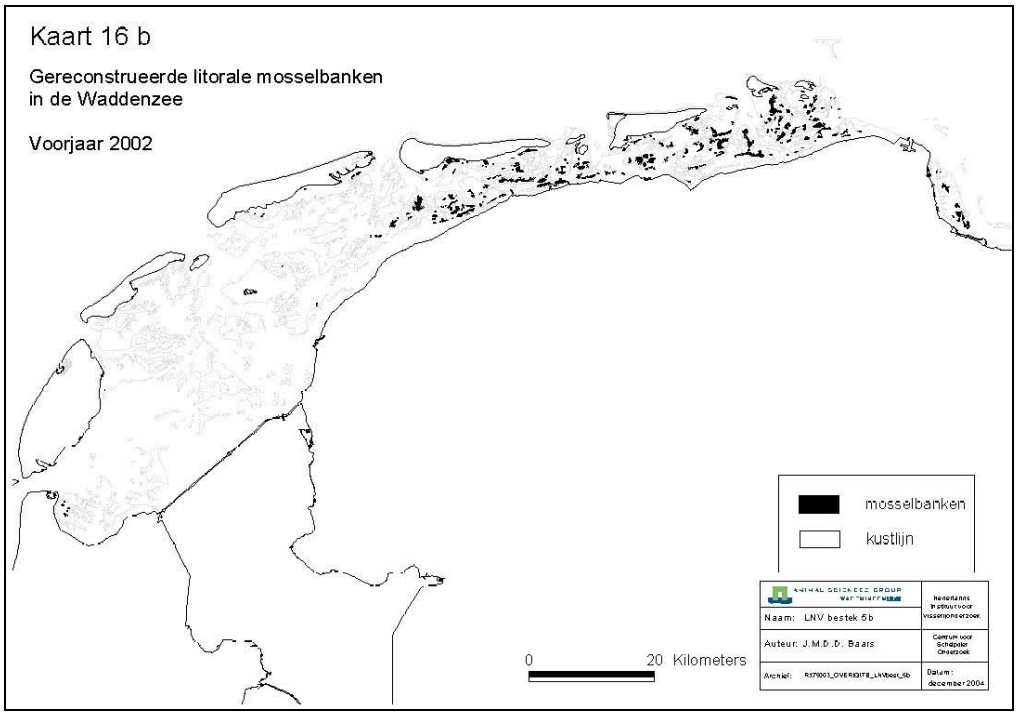
[4] estimate of data quality: 1. based on good quantitative/empirical data
2. poor/no quantitative data, lim. expert judgement
3. intermediate

[5] estimate of data quality: 1. based on good quantitative/empirical data
2. poor/no quantitative data, lim. expert judgement
3. intermediate

[6] minimal human influence or other deemed appropriate year; give justification based on incidental/anecdotic data and estimate relative state at start of monitoring program

Distribution data

- 1 map of present distribution (2004-2005)
- 1 map of recent distribution (2000/2001/2003) (Steenbergen 2003)



Monitoring network information

Surveys are no longer part of a monitoring network, except for the surface area of littoral beds.

- **Other variables measured:**
  Only on specifically monitored beds (Dankers *et al.* 2005)

5.5 Crassostrea gigas (Pacific oyster / Japanse Oester)

Habitat name	Oyster bed
English name	Oyster bed
Dutch name	Oesterbed
Dominating species	*Crassostrea gigas* (Pacific oyster, Japanse oester)

Ecological data

Guild ○ herbivore ○ piscivore ○ omnivore ○ scavenger ○ detritivore ● planktivore ○ molluscivore	**Max. Body weight (adults)** both sexes: 400 g (Eastern Scheldt, 2002) **Max. Length:** 36 cm **Maturity age:** 1 year **Reproduction:** 10^6-10^8 eggs each year, survival rate unknown **Age:** 20 years **Density/biomass (in optimal habitat):** >25 kg/m^2 (Eastern Scheldt and Wadden Sea) **Home range:** - **Dispersal distance:** unknown **For populations**: unknown **Diet:** fytoplankton

Geografical	Habitat	Fysical/chemical
Distribution ○ North Sea ○ coastal (20 km/other…) ○ offshore ○ deep sea ● Wadden Sea ● Delta Zeeland (saline)	**Position in the water column** ○ pelagic ○ demersal ○ planktonic ● benthic	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic ● unknown
Migratory behavior ● sedentary ○ migratory ○ variable/dependent on geographical location	**Seabed/bottom preferences** ● sand, attached to small shells or stones ● gravel ● mud, attached to small shells or stones ● rock ● biogenic substrate (mussel bed)	**Light conditions** ○ tolerant for turbidity ● intolerant for turbidity
	Intertidal ○ Low in the intertidal area, below MHT ○ also subtidal, oysters are found at depths of max 42 m	**Salinity** ● saline ● brackish (>15 ‰) ○ freshwater

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
○ Habitat degradation ○ Habitat destruction ○ Overfishing/overharvesting ○ Bycatch ○ Human disturbance ○ Natural disturbance ○ Pollution ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ○ Sea surface temp. incr. ○ Sea level change ○ Oil/gass extraction ○ Ship traffic Other…..	● Food ○ Medicine ○ Recreation	● Building material (a current study is researching possibilities) ○ Energy ○ Other:….

Areas of Pacific oyster banks are growing in the Netherlands, there are, at the moment, no signs of reaching the carrying capacity of the water systems for this species. Therefore it is difficult to give causes of changes in population sizes or distributions.

Data set information

- **Name of data set or monitoring programme:**
  a: Oestersurvey Oosterschelde (IMARES),
  b: moskok survey Waddenzee (IMARES)
  c: Permanent quadrats for ground truthing (survival, spatfall) etc.
- **Measurement unit:**
  Surface areas of litoral oyster beds: a and b.
  Brief description of contents data set and/or monitoring programme or hyperlink: b and c
  Dataset contains surface areas based on:
  Measuring contours of oyster beds by walking around them with a GPS: a and b.
  Stabbing method: from a boat the surface is explored with a stick for oysters: a
  Reconstruction from aerial photographs (Kater & Baars, 2004): a
- **Brief description/reference/hyperlink of sampling method:**
  For contour measuring: Kater & Baars, 2004; Kater & Baars, 2003b; Perdon & Smaal, 2000
  For stabbing method: Kater & Baars, 2003b; Perdon & Smaal, 2000
  For reconstruction with aerial photographs: Kater & Baars, 2004; Kater & Baars, 2003a
- **Begin date of data set**
  Oosterschelde: 1998
  Waddenzee: 2004
  Westerschelde: no data
- **Are other data sets available (give dates)**
  Oosterschelde: 1998, 1999, 2000, 2002, 2003, 2004, 2005 > no complete surveys, but part of the water system depending on the funding
  Waddenzee: 2004, 2005
- **Frequency of monitoring and next monitoring date:**
  monitoring on a yearly base, next monitoring unknown
- **Range/variation of available data in space and time**

- **Estimate of percentage inaccuracy of measurements:**
  Contour measuring: 90% (rough estimate)
  Stabbing: 50% (rough estimate)
  Aerial photographs: 87% (overall accuracy, see Kater & Baars, 2004)
- **Mean values for North Sea (indicate whole/NCP), Wadden Sea, Delta area and/or Coastal zone for:**
  Present (2004/2005); Data quality[7]: 1
  Waddenzee: no data
  Westerschelde: no data
  Oosterschelde: IMARES is working on a new oyster map 2005; data not available yet
  Recent (2000/2001/2003):
  Waddenzee: no data;
  Westerschelde: no data;
  Oosterschelde: 640 ha litoral oyster beds in 2003,quality class 3 intermediate
- **Reference value & year**
  Reference is not available for oysters; reference year is 1960 (before the introduction of this species) or 1975 (before the first spattfall). Influences from German and Danish oyster breeding activities in the Wadden Sea are dated after 1975. Reference value is 0.
- **Available data for other years**
  Oosterschelde: estimated surface area in 1980 is 25 ha and 240 ha in 1990. No data for the other water systems.
  Waddenzee: estimate for 2006: >400ha.
  Westerschelde: no data;

Distribution data

- 1 map of historic distribution (preferably reference year):
  because the Pacific oyster is an invader the reference situation is no oysters; there maps of 1980 and 1990, see Kater & Baars, 2003, 2004
- 1 map of present distribution (2004-2005):
  Oosterschelde oyster map not available at this moment, no maps of other water systems
- 1 map of recent distribution (2000/2001/2003).
  Only Oosterschelde, see Kater & Baars, 2003, 2004.

Monitoring network information

There is no regular monitoring network for Pacific oysters. Depending on funding sometimes inventories are performed in the Oosterschelde. Pacific oysters in the Waddenzee are counted when samples in the cockle-mussel survey contains this species. When encountered, oyster beds contours in the Waddenzee are measured, but all supplementary to other surveys.

For 2006 only a survey in the litoral of the Waddenzee, supplementary to the cockle mussel survey, is financed. Contact for this survey is IMARES Yerseke. There is no guarantee for continuation of this or other surveys.

[7] estimate of data quality: 1. based on good quantitative/empirical data
2. poor/no quantitative data, lim. expert judgement
3. intermediate

5.6 Arctica islandica (Ocean Quahog / Noordkromp)

Species common name	Ocean Quahog
Scientific name	*Arctica islandica*
Dutch name	Noordkromp

Ecological data

Guild ● herbivore ○ piscivore ○ omnivore ○ scavenger ○ detritivore ○ planktivore ○ molluscivore ● other: Filterfeeder	**Max. Body weight (adults)** both sexes: up to 0.012 kg AFDW (average) **Max. Length:** 12cm **Maturity age:** between 6 and 10 years (average) **Reproduction:** unknown **Age:** between 0 and >300 years (average unknown) **Density/biomass (in optimal habitat):** between10 and 286 individuals m² (average) **Home range:** 0.1 meter **Dispersal distance:** only as larvae up to 42 days and will depend on currents. **For populations: estimate of minimal viable population size per area:** unknown

Geografical	Habitat	Fysical/chemical
Distribution ● *North Sea north of 53.30N* ○ coastal ○ offshore ○ deep sea ○ Wadden Sea ○ Delta Zeeland (saline)	**Position in the water column** ○ pelagic ○ demersal ○ planktonic ● *benthic*	**Nutrient conc.** ○ oligotrophic ○ mesotrophic ○ eutrophic
Migratory behavior ○ sedentary ○ migratory ○ variable/dependent on geographical location ● none	**Seabed/bottom preferences** ○ sand ○ gravel ● *mud* ○ rock	**Light conditions** ○ tolerant for turbidity ○ intolerant for turbidity
	Intertidal ○ preferred height (relative to MHT) ● *other preferences: subtidal*	**Salinity** ● *saline* ● *brackish* ○ freshwater

Pressures

Causes of change in population size and/or distribution (more options possible; specify if possible)		Use of indicator (more options possible)	
● *Habitat degradation* ● *Habitat destruction* ● *Overfishing / overharvesting* ● *Bycatch* ○ Human disturbance ○ Natural disturbance ● *Pollution unknown but possible* ○ Eutrophication ○ Wind farms	○ Invasive species ○ Disease ○ Poisoning ● *Sea surface temperature increase* ● *upper temp limit ~ 16°C* ○ Sea level change ○ Oil/gass extraction ○ Ship traffic ● *Other: locally by gravel extraction*	● *Food* ○ Medicine ○ Recreation	○ Building material ○ Energy ○ Other:….

Data set information

No systematic scientific research programs are undertaken to monitor the status of this species. The data available come from various research cruises with other research goals.

- **Name of data set or monitoring programme:** BIOMON
- **Measurement unit:** number / m²
- **Brief description of contents data set and/or monitoring programme or hyperlink**
  Biomass and abundance data of macrobentic fauna on the dutch contitnental shelf.
- **Brief description/reference/hyperlink of sampling method**
  Sampled by boxcore or other grabs in BIOMON, which is not suited to get a good impression of densities or presence
- **Begin date of data set:** 1991

Are other data sets available (give dates):

Best data-sets available come from deep digging dredge (M.J.N. Bergman, NIOZ).

- **Frequency of monitoring and next monitoring date**
  Irregular, available data do not come from monitoring but comprise of data collected for other purposes.
- **Range/variation of available data in space and time**
  From approximately 1994 the first quantitative data on the presence and abundance of *Arctica islandica* on the NCP were obtained by Bergman en Santbrink. Since then data has been collected sporadically within the framework of other programs. Last program in which quantitative data were collected date back to the year 2000. The data only cover restricted areas within the Oystergrounds and on the Frisian Front.
- **Estimate of percentage inaccuracy of measurements**
  Depends highly on the research program from which the data have been derived. In some programs over 100 quantitative dredge samples were obtained from an area of 2 × 3 Km, while for other areas only one sample is available for representation of an area of 10 tot 100dreds of square km.
- **Mean values for North Sea for:**
  Present (2004/2005): Unknown; only one spot measurement available.
  Recent (2000/2001/2003): Largely unknown; Data only available for restricted areas not representing the entire potential habitat. Most comprehensive data come from the BIOMON program 1996-'97 in which spread over the North Sea (NCP) all (normal BIOMON) locations were sampled with a deep digging dredge in addition to the normally taken boxcore stations. This is may be the best data-set to get an overview of the recent distribution and densities found. However the data set is already relatively old (1996-'97). Similar data sets for recent period is urgently needed but not available. A new assessment has been carried out in November 2006.

Regio/locatie	Program	Year	Max (N/m^2)	Avg (N/m^2) (Range)	Aantal	literatuurbron
Fladen Grounds 59°00'N 00°30'E	REFLEX	1983	80	11-17	52 BC	Wilde *et al*, 1986
Fladen Grounds 59°00'N 00°30'E.	CLIVAR	2000	300	205	30 DD	Witbaard & Bergman, 2003
Oyster Grounds	BIOMON	1996-'97	0.4	0.02	77 DD	Witbaard & Bergman, 2003;
Frisian Front	BIOMON	1996-'97	0.07	0.004	27 DD	Witbaard & Bergman, 2003
Oyster Grounds~54°58'N 04°39'E	IMPACT	1994	0.03	0.008	30 DD	Witbaard & Bergman, 2003
Witte bank ~54°34'N 06°16'E	IMPACT	1994-'95	0.19	0.024	74 DD	BergmanNIOZ unpublished
Oyster Grounds 53°35'N, 04°05'E	LNV	2005	0.12	0.07[8]	29 DD	Witbaard & Bergman, 2003
Oyster Grounds 54°14'N 04°57'E	REDUCE	2000		0.1	110 DD	Witbaard & Bergman, 2003
Oyster Grounds 54°43'N 4°41'E	MICRO	1997		0.03	20 DD	BergmanNIOZ unpublished
Oyster Grounds 54°19'N 04°22' E	MICRO	1997		0.21	10 DD	BergmanNIOZ unpublished,
Oyster Grounds 53°52'N 04°14' E	MICRO	1997		0.06	11 DD	BergmanNIOZ unpublished,

- **Reference year (minimal human influence or other deemed appropriate year; give justification based on incidental/anecdotic data and estimate relative state at start of monitoring programme).**
  From Witbaard (2007) a reference value of 0.36 m^{-2} of individuals of more than 5 years old can be deduced.
- **Available data for other years:** See table above.

Distribution data if available (preferably send digital maps otherwise description)

- 1 map of historic distribution (preferably reference year), (see report LNV streefdoelen)
- 1 map of present distribution (2004-2005),
- 1 map of recent distribution (2000/2001/2003). (see report LNV streefdoelen)

Monitoring network information

- Name of monitoring network Not available
- Brief description of network/hyperlink Not available
- Other variables measured in network Not available
- Contact for network Not available
- Starting date network Not available
- Guaranteed continuation of network till what date/year Not available
- Name/map of area covered by network Not available
- Reference of last network progress report Not available
- Restrictions on availability of data Not available

[8] These include many young

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Bult, T.P., B.J. Ens, J.M.D.D. Baars, R. Kats, M. Leopold, 2004. B3: Evaluatie van de meting van het beschikbare voedselaanbod voor vogels die grote schelpdieren eten. Nederlands Instituut voor Visserij Onderzoek, RIVO rapport C018/03. pp 118.

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Degraer, S. (1999). Macrobenthos of shallow marine habitats (Belgian coast) and its use in coastal zone management. PhD thesis. Rijksuniveristeit Gent, Gent.

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Kater, B.J., A.G. Brinkman, J.M.D.D. Baars, G. Aarts, 2003. Kokkelhabitatkaarten voor de Oosterschelde en Waddenzee. Nederlands Instituut voor Visserij Onderzoek, RIVO rapport. C060/03. pp 164.

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6 Nature quality

6.1 Introduction

The Natural Capital Index (NCI) is an indicator for the biodiversity of habitats (Ten Brink and Tekelenburg 2000, UNEP 1997). NCI considers biodiversity of an ecosystem as the stock of its characteristic species including their corresponding abundances. The loss of biodiversity is characterized by the decrease in abundance of many species and increase of a few others, due to human interventions. NCI is a function of changes in the area of ecosystems ('ecosystem quantity') and the changes in abundance of a core set of species within the remaining ecosystem ('ecosystem quality' or 'nature quality'). Nature quality has been determined by comparing the present-day abundance of characteristic species with their abundance in the baseline state. An exact match results in a figure of 100%. But if species have declined in numbers or have become extinct, the quality is proportionally lower. The nature quality has been established using data on the abundance of certain species of plants, birds, mammals, reptiles, fishes, aquatic macrofauna, butterflies and molluscs. Characteristic species have been selected for each ecosystem type (forest and woodland; heathland; marshes, swamps and bogs; dunes; fens; brooks; lakes; large freshwater bodies; brackish and saline water bodies; agricultural area. Ten Brink *et al.* 2002).

6.2 Calculation of nature quality

In this report *nature quality* will be calculated for the given indicators of the Dutch marine ecosystems. From the data in the profiles and some extra data we constructed a table in which the values for recent and present values are expressed as a percentage of the reference value (see Table below).

Table 2. Summary of data and nature quality of each indicator for the Delta area. Abbreviations: P., present; R., recent; Ref., reference value; Qual., nature quality.

Delta area

Birds	Unit	Period	Value	Ref.	Qual.
Bar-tailed Godwit / Rosse Grutto	n ind.	P. (01-04)	6076	6000	100
Bar-tailed Godwit / Rosse Grutto	n ind.	R. (99-02)	5786	6000	96
Common Tern/Visdief (breeding)	n pair	P. (02-04)	3751	3500	100
Common Tern/Visdief (breeding)	n pair	R. (00-02)	3447	3500	98
Dark-bellied Brent Goose/ Zwartbuikrotgans	n ind.	P. (01-04)	7833	10000	78
Dark-bellied Brent Goose/ Zwartbuikrotgans	n ind.	R. (99-02)	8484	10000	85
Dunlin/Bonte strandloper	n ind.	P. (01-04)	32053	25000	100
Dunlin/Bonte strandloper	n ind.	R. (99-02)	32604	25000	100
Eur. Oystercatcher/ Scholekster	n ind.	P. (01-04)	35481	64000	55
Eur. Oystercatcher/ Scholekster	n ind.	R. (99-02)	35849	64000	56
Great Cormorant /Aalscholver	n ind.	P. (01-04)	687	1500	46
Great Cormorant /Aalscholver	n ind.	R. (99-02)	821	1500	55
Great Knot – Kanoet	n ind.	P. (01-04)	8884	6000	100
Great Knot – Kanoet	n ind.	R. (99-02)	8842	6000	100
Grey Plover/ Zilverplevier	n ind.	P. (01-04)	6064	7000	87

Birds	Unit	Period	Value	Ref.	Qual.
Grey Plover/ Zilverplevier	n ind.	R. (99-02)	6009	7000	86
Kentish Plover/ Strandplevier (breeding)	n pair	P. (02-04)	161.3	250	65
Kentish Plover/ Strandplevier (breeding)	n pair	R. (00-02)	155.7	250	62
Little Tern/ Dwergstern (breeding)	n pair	P. (02-04)	279.3	600	47
Little Tern/ Dwergstern (breeding)	n pair	R. (00-02)	282	600	47
Pied Avocet /Kluut (breeding)	n pair	P. (02-04)	1.9	960	0
Pied Avocet /Kluut (breeding)	n pair	R. (00-02)	1932	960	100
Sanderling / Drieteenstrandloper	n ind.	P. (01-04)	1526	600	100
Sanderling / Drieteenstrandloper	n ind.	R. (99-02)	1094	600	100
Sandwich Tern / Grote stern (breeding)	n pair	P. (02-04)	5700	28000	20
Sandwich Tern /Grote stern (breeding)	n pair	R. (00-02)	6042	28000	22

Fish	Unit	Period	Value	Ref.	Qual.
Eelpout/Puitaal	n haul^{-1}	P. (04-05)	46.3	16	100
Eelpout/Puitaal	n haul^{-1}	R. (00-03)	28.8	16	100
Smelt/Spiering	n haul^{-1}	P. (04-05)	18	Unknown	
Smelt/Spiering	n haul^{-1}	R. (00-03)	8.8	Unknown	

Invertebrates	Area	Unit	Period	Value	Ref.	Qual.
Pacific oyster	Oosterschelde	ha	P. (03-05)	640	0.01	*
Pacific oyster	Oosterschelde	ha	R. (01-03)	640	0.01	*
Mussel	Oosterschelde "wild" mussels and cultivated mussel, Spring, Littoral	10^6kg fresh weight	P. (03-05)	0		
Mussel	Oosterschelde "wild" mussels and cultivated mussel, Spring, Littoral	10^6kg fresh weight	R. (01-03)	0.21		
Mussel	Oosterschelde "wild" mussels and cultivated mussel, Spring, Sublittoral	10^6kg fresh weight	P. (03-05)	50.91		
Mussel	Oosterschelde "wild" mussels and cultivated mussel, Spring, Sublittoral	10^6kg fresh weight	R. (01-03)	45.86		
Cockle	Oosterschelde	10^6 kg	P. (03-05)	27.1	26	100
Cockle	Oosterschelde	10^6 kg	R. (01-03)	24.61	26	95
Cockle	Westerschelde	10^6 kg	P. (03-05)	9.57	7.00	100
Cockle	Westerschelde	10^6 kg	R. (01-03)	4.04	7.00	58

*: Invasive species; not included in nature quality.

The overall nature quality of the Delta area amounts to 79% for the recent period (approx. 1999-2003) and 75% for the present situation (approx. 2003-2005). Grouping of the different species groups (according to Ten Brink *et al*, 2002) results in an overall nature quality of 85% (recent) to 90% (present situation).

Table 3. Summary of data and nature quality of each indicator for the Wadden Sea. Abbreviations: Ref., reference value; Qual., nature quality; P., present; R., recent.

Wadden Sea

Birds	Unit	Period	Value	Ref.	Qual.
Bar-tailed Godwit / Rosse Grutto	n ind.	P. 01/02-03/04	57625	33000	100
Bar-tailed Godwit / Rosse Grutto	n ind.	R. 99/00-01/02	50927	33000	100
Common Eider/Eidereend (breeding)	n pair	P. 01/02-03/04	6060	9000	67
Common Eider/Eidereend (breeding)	n pair	R. 99/00-01/02	7382	9000	82
Common Eider/Eidereend	n ind.	P. 01/02-03/04	110075	120000	92
Common Eider/Eidereend	n ind.	R. 99/00-01/02	83938	120000	70
Common Tern/Visdief (breeding)	n pair	P. 01/02-03/04	4427	8450	52
Common Tern/Visdief (breeding)	n pair	R. 99/00-01/02	5298	8450	63
Dark-bellied Brent Goose/ Zwartbuikrotgans	n ind.	P. 01/02-03/04	24759	25000	99
Dark-bellied Brent Goose/ Zwartbuikrotgans	n ind.	R. 99/00-01/02	28231	25000	100
Dunlin/Bonte strandloper	n ind.	P. 01/02-03/04	211433	130000	100
Dunlin/Bonte strandloper	n ind.	R. 99/00-01/02	207839	130000	100
Eur. Oystercatcher/Scholekster (breeding)	Index pair	P. 01/02-03/04	59.3	100	59
Eur. Oystercatcher/Scholekster (breeding)	Index pair	R. 99/00-01/02	67.7	100	68
Eur. Oystercatcher/Scholekster	n ind.	P. 01/02-03/04	120990	160000	76
Eur. Oystercatcher/Scholekster	n ind.	R. 99/00-01/02	130052	160000	81
Great Cormorant /Aalscholver	n ind.	P. 01/02-03/04	4846	5000	97
Great Cormorant /Aalscholver	n ind.	R. 99/00-01/02	3880	5000	78
Great Knot – Kanoet	n ind.	P. 01/02-03/04	36555	40000	91
Great Knot – Kanoet	n ind.	R. 99/00-01/02	48568	40000	100
Grey Plover/Zilverplevier	n ind.	P. 01/02-03/04	23220	12000	100
Grey Plover/Zilverplevier	n ind.	R. 99/00-01/02	20253	12000	100
Kentish Plover/ Strandplevier (breeding)	n pair	P. 01/02-03/04	12.3	215	6
Kentish Plover/ Strandplevier (breeding)	n pair	R. 99/00-01/02	10.7	215	5
Little Tern/Dwergstern (breeding)	n pair	P. 01/02-03/04	191.7	300	64
Little Tern/Dwergstern (breeding)	n pair	R. 99/00-01/02	145.3	300	48
Pied Avocet /Kluut (breeding)	n pair	P. 01/02-03/04	3090	5300	58
Pied Avocet /Kluut (breeding)	n pair	R. 99/00-01/02	3806	5300	72
Sanderling / Drieteenstrandloper	n ind.	P. 01/02-03/04	6946	1300	100
Sanderling / Drieteenstrandloper	n ind.	R. 99/00-01/02	4952	1300	100
Sandwich Tern/Grote stern (breeding)	n pair	P. 01/02-03/04	11482	28000	41
Sandwich Tern/Grote stern (breeding)	n pair	R. 99/00-01/02	9330	28000	33

Fish	Unit	Period	Value	Ref.	Qual.
Eelpout/Puitaal	n per haul	P. 04-05	22.1	112.1	20
Eelpout/Puitaal	n per haul	R. 00-03	33.8	112.1	30
Smelt/Spiering	n per haul	P. 04-05	62.3	94.1	66
Smelt/Spiering	n per haul	R. 00-03	69.8	94.1	74

Mammals	Unit	Period	Value	Ref.	Qual.
Grey Seal	n counted	P. 04-05	1305	unknown	
Grey Seal	n counted	R. 00-03	731	unknown	
Harbour Seal	n counted	P. 04-05	3319	16000	21
Harbour Seal	n counted	R. 00-03	3318	16000	21

Invertebrates	Area	Unit	Period	Value	Ref.	Qual.
Mussel bed area	Surface area littoral beds	ha	P. 03-05	2086.43	5005	42
Mussel bed area	Surface area littoral beds	ha	R. 01-03	1965.57	5005	39
Mussel	Littoral "wild"mussels, spring	10^6kg FW	P. 03-05	62.98		
Mussel	Littoral "wild"mussels, spring	10^6kg FW	R. 01-03	44.58		
Mussel	Sublittoral "wild"mussels, spring	10^6kg FW	P. 03-05	17.33		
Mussel	Sublittoral "wild"mussels, spring	10^6kg FW	R. 01-03	18.53		
Cockle		10^6 kg	P. 03-05	165.83	192	86
Cockle		10^6 kg	R. 01-03	169.66	192	88

The overall nature quality of the Wadden Sea amounts to 68-69% for both periods. Grouping of the different species groups (according to Ten Brink *et al*, 2002) results in an overall nature quality of 58% (recent) to 54% (present situation).

Table 4. Summary of data and nature quality of each indicator for the North Sea. Abbreviations: Ref., reference value; Qual., nature quality; P., present; R., recent.

North Sea

Birds	Area	Unit	Period	Value	Ref.	Qual.
Kentish Plover / Strandplevier Breeding	Coast	n pair	P. 02-04	6.7	455	1
Kentish Plover / Strandplevier Breeding	Coast	n pair	R. 00-02	11.7	455	3
Sanderling / Drieteenstrandloper	Coast	n ind.	P. 01-04	2383	1700	100
Sanderling / Drieteenstrandloper	Coast	n ind.	R. 99-02	1804	1700	100
Sandwich Tern / Grote stern Breeding	Coast	n pair	P. 02-04	17182	28000	61
Sandwich Tern / Grote stern Breeding	Coast	n pair	R. 00-02	15372	28000	55
Common Tern / Visdief Breeding	Coast	n pair	P. 02-04	2449	20000	12
Common Tern / Visdief Breeding	Coast	n pair	R. 00-02	2705	20000	14

Fish	Area	Unit	Period	Value	Ref.	Qual.
Cod/Kabeljauw	Whole North Sea	SSB [9] kton	P. 04-05	46	200	23
Cod/Kabeljauw	Whole North Sea	SSB kton	R. 00-03	43	200	22
Haddock/Schelvis	Whole North Sea	n caught h^{-1}	P. 04-05	357.1	519.3	69
Haddock/Schelvis	Whole North Sea	n caught h^{-1}	R. 00-03	1822.6	519.3	100
Herring/Haring	Whole North Sea	SSB 1,000 kton	P. 04-05	1.9	3.5	54
Herring/Haring	Whole North Sea	n caught h^{-1}	P. 04-05	2283.3	157.2	100
Herring/Haring	Whole North Sea	n caught h^{-1}	R. 00-03	3328.8	157.2	100
Herring/Haring	Whole North Sea	SSB *1,000 kton	R. 00-03	1.3	3.5	37
Norway pout/Kever	Whole North Sea	n caught h^{-1}	P. 04-05	687.6	3641.9	19
Norway pout/Kever	Whole North Sea	n caught h^{-1}	R. 00-03	3242.2	3641.9	89
Plaice/Schol	Whole North Sea	SSB kton	P. 04-05	187	400	47
Plaice/Schol	Whole North Sea	SSB kton	R. 00-03	208	400	52
Sole/Tong	Whole North Sea	SSB kton	P. 04-05	45	35	100
Sole/Tong	Whole North Sea	SSB kton	R. 00-03	35	35	100

[9] Spawning Stock Biomass

Fish	Area	Unit	Period	Value	Ref.	Qual.
Sprat/Sprot	Whole North Sea	n caught h^{-1}	P. 04-05	2207.3	974.3	100
Sprat/Sprot	Whole North Sea	n caught h^{-1}	R. 00-03	2100.8	974.3	100
Whiting/Wijting	Whole North Sea	SSB kton	P. 04-05	124	315	39
Whiting/Wijting	Whole North Sea	SSB kton	R. 00-03	175	315	56

Mammals	Area	Unit	Period	Value	Ref.	Qual.
Harbour Porpoise	North Sea (NCP)	n/km2 in april/may	P. 04-05	0.43	0.36	100
Grey Seal	North Sea (NCP)	n/km2 in april/may	R. 00-03	0.36	0.36	100

Invertebrates	Area	Unit	Period	Value	Ref.	Qual.
Ocean Quahog	North Sea	mean number/m^2	P. 03-05		0.36	
Ocean Quahog	North Sea	mean number/m^2	R. 01-03	0.02	0.36	6
Spisula	North Sea coastal zone	10^6 numbers	P. 03-05	5726		
Spisula	North Sea coastal zone	10^6kg fresh weight	P. 03-05	13.77		
Spisula	North Sea coastal zone	10^6 numbers	R. 01-03	67345		
Spisula	North Sea coastal zone	10^6kg fresh weight	R. 01-03	189.13		

The overall nature quality of the North Sea amounts to 62% for the recent period (approx. 1999-2003) and 55% for the present situation (approx. 2002-2005). Grouping of the different species groups (according to Ten Brink *et al,* 2002) results in an overall nature quality of 55% (recent) to 68% (present situation). For the present situation no data of invertebrates are available.

7 Discussion and conclusions

This report presents ecoprofiles for a large number of species. These profiles offer valuable ecological and geographical information, as well as data on each species' sensitivity to environmental pressures and monitoring data. The list of species is not exhaustive and more species can be added to increase the robustness of the nature quality index. This may not always be possible, however, as limited data may be available for certain groups. For example, as regards sea mammals there are hardly any long-term data available for species other than the ones used here, and in most cases, these additional data consist of anecdotal reports. Another problem is the availability of historical data which can be used to determine reference values.

The results of this nature quality study with respect to biodiversity have to be interpreted in relation to the sparse amount of data available for certain species groups or even the complete absence of species groups. For example, available data or references cover only one indicator (one species) for fish in the Delta area and for invertebrates in the Delta area and the North Sea. These single species will presumably not be representative of the species groups as a whole, nor as indicators of the pressures acting upon the ecosystems as a whole. Other aspects which may contribute to the nature quality of the systems under study, especially the size and quality of seagrass beds and salt marshes in the Delta area and Wadden Sea, are not represented.

The implementation of an indicator for biodiversity, like the one presented in this study, probably needs further reflection. For certain species groups, e.g. benthic organisms, an overall biodiversity indicator might be more appropriate than using individual species as indicators. Another option might be to use indicators for functional groups. This might result in the concept of nature quality becoming different from that for terrestrial ecosystems, for which it was designed, but might make it more suitable for marine ecosystems.

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Appendix 1 Rationale behind estimates of the Nature Capital Index for birds in Delta area, Wadden Area and North Sea Coastal Zone (in Dutch) - by SOVON

Onderbouwing getallen voor natuurwaardegraadmeter vogelsoorten van wad en kust.

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SOVON Vogelonderzoek Nederland
7 maart 2006

Bijlage bij het ecoprofielbeschrijvingen van vogelsoorten voor de natuurgraadmeter Wadden, Deltagebied en Noordzeekust in opdracht van het Milieu- en Natuurplanbureau (thans opgegaan in het Planbureau voor de Leefomgeving)

De in deze rapportage gebruikte vogelgegevens van de Zoute Delta zijn afkomstig uit het Biologisch Monitoring Programma Zoute Rijkswateren van het RIKZ (Rijksinstituut voor Kust en Zee), hetgeen onderdeel uitmaakt van het Monitoring-programma Waterstaatkundige toestand van het Land (MWTL) van Rijkswaterstaat. Het RIKZ neemt geen verantwoordelijkheid voor de in deze rapportage vermelde conclusies op basis van het door haar aangeleverde materiaal.

Inleiding

SOVON is gevraagd om bij te dragen aan het opstellen van een natuurwaardegraadmeter voor estuariene en kustsystemen. Deze graadmeter wordt ontwikkeld door het Planbureau voor de Leefomgeving (PBL, voorheen het Milieu- en Natuurplanbureau ,MNP; Ten Brink *et al.* 2002). De natuurwaardegraadmeter zet de gemiddelde aantallen/dichtheden van kenmerkende soorten van een systeem af tegen een natuurlijke referentie. Onderdeel van het project is het opstellen van ecoprofielen van de soorten die opgenomen worden in de graadmeter. De ecoprofielen worden ingevuld volgens een bepaald format met een beschrijving van de ecologische kenmerken van de soorten.

Voor het opstellen van de graadmeter zelf zijn gegevens nodig over de aantalsontwikkeling van de soorten. Een cruciaal onderdeel is bovendien het opstellen van de referentiewaarde. Omdat voor het bepalen van de referentiewaarde en bijbehorende getallen over de actuele aantalsontwikkeling een aantal soortspecifieke overwegingen dienen te worden gemaakt wordt in deze notitie per soort aangegeven welke benadering is gekozen en welke gegevens ten grondslag liggen aan de getallen. Het Planbureau voor de Leefomgeving beoogt een natuurwaardegraadmeter op te stellen voor (a) de Waddenzee, (b) de Zoute Delta en (c) de Noordzee.

Algemeen

Voor het opstellen van een referentie zijn de volgende overwegingen van belang:

(1) een duidelijke omschrijving van de referentiesituatie.
Vaak wordt daarbij gerefereerd aan een bepaalde periode in de tijd. Deze omschrijving is weergegeven in het rapport van Ten Brink *et al.* (2002), waarbij als referentieperiode 1900 wordt genoemd, zij het dat bepaalde grote ingrepen als een gegeven worden beschouwd. Uit de beschrijvingen valt niet op te maken welke dat precies zijn. Wel wordt weergegeven dat uitgegaan wordt van de toen geldende situatie betreffende de abiotische randvoorwaarden (bijv. nutriëntensituatie) en een geringe directe verstoringssituatie door mensen (door bijv. visserij, recreatie, jacht). Overigens kunnen de referentiewaarden afwijken van de door het beleid of beheer opgestelde streefwaarden voor een soort per gebied. Daarbij spelen andere beslissingsfactoren een rol zoals de instandhoudingsdoelstellingen die voor de kwalificerende soorten van de Natura 2000-gebieden zijn opgesteld.

(2) getallen voor het voorkomen van soorten uit de referentieperiode
Voor de genoemde referentieperiode is een duidelijk beeld nodig van toen geldende aantallen van een bepaalde soort. Dat kan worden verkregen door een historische vergelijking (telgegevens uit deze periode) of door een geografische vergelijking waarbij een vergelijkbaar gebied wordt genomen dat tegenwoordig nog in dezelfde toestand verkeert. Voorbeelden daarvan zijn eerdere graadmeter-studies voor terrestrische ecosystemen die door SOVON zijn uitgevoerd in opdracht van het Planbureau voor de Leefomgeving en waarbij gekeken is naar dichtheden van broedvogelsoorten in referentiesituaties in zowel het verleden als in vergelijkbare buitenlandse gebieden (zie bijv. Van Kleunen en Sierdsema 2001).

(3) monitoring van de soorten die opgenomen worden in de natuurwaardegraadmeter
De Soortgroep Trend Index (zie ook Meesters *et al.*, 2008) wordt jaarlijks geactualiseerd door de actuele gegevens over het voorkomen van soorten te vergelijken met een index-waarde (veelal de situatie in 1990). In veel gevallen worden deze gegevens verzameld in

het kader van het Netwerk Ecologisch Monitoring (NEM). De opdrachtgevers in het NEM zijn de Ministeries LNV, V&W en VROM, Planbureau voor de Leefomgeving (PBL), Centraal Bureau voor de Statistiek (CBS) en de Provincies. Lang niet alle in Nederland voorkomende soorten zijn opgenomen in monitoringprogramma's. Voor vogelsoorten is de situatie relatief gunstig. Er kan worden gekozen uit een brede selectie van soorten, zowel broedvogels als niet-broedvogels.

(4) de referentiewaarde dient vergelijkbaar te zijn met de monitoringwaarde
Samenhangend met het vorige punt dient voor een goede vergelijking de referentiewaarde te worden uitgedrukt in dezelfde grootheid als de gegevens die beschikbaar zijn voor de monitoring van de gekozen soorten. Met name voor de niet-broedvogelsoorten is de wijze van gegevensverzameling van invloed op de wijze waarop de jaarlijkse index-waarden worden uitgedrukt. In sommige gevallen leidt dit tot een zogenaamd maandgemiddelde, hetgeen een gemiddelde is van de getelde aantallen in de periode juli-juni van een bepaald seizoen. Voor andere soorten wordt de jaarlijkse indexering gebaseerd op de midwintertellingen in januari.

Achtergronden voor de soortspecifieke natuurgraadmetergetallen

Per soort zal worden aangegeven welke gegevens beschikbaar zijn, welke inschattingen worden gemaakt voor het bepalen van de referentiewaarde en hoe vervolgens de gevraagde getallen zijn bepaald. Voor de referenties is zo veel als mogelijk uitgegaan van al eerder gepubliceerde getallen. De referenties zijn gebaseerd op tellingen maar zijn niet noodzakelijkerwijs een rekenkundig gemiddelde daarvan. Ze zijn voor de duidelijkheid afgerond, afhankelijk van de orde van grootte op duizend- of tienduizendtallen.

Door de opdrachtgever (PBL) zijn ook vergelijkbare aantallen gevraagd voor de recente en huidige situatie. Voor broedvogels is daarvoor het jaarlijks bepaalde aantal broedparen weergegeven per deelgebied voor de periode 2000-2004. Voor de niet-broedvogels is een driejarig lopend gemiddelde weergegeven. Dit omdat niet-broedvogelaantallen, o.a. vanwege de wintersituatie, jaarlijks nogal kunnen variëren. Overeenkomstig de gevraagde periodes worden twee getallen gepresenteerd. De recente periode wordt weergegeven door het 3-jarige lopend gemiddelde over de telseizoenen 1999-2000 tot en met 2001-2002. De huidige periode wordt weergegeven door het 3-jarige lopend gemiddelde over de telseizoenen 2001-2002 tot en met 2003-2004.

Omdat dikwijls wordt gerefereerd aan gegevens van bepaalde monitoringmeetnetten uit het NEM worden de belangrijkste meetnetten hier kort besproken.

1. Landelijk Soortonderzoek Broedvogels (LSB)
Dit project wordt georganiseerd door SOVON in samenwerking met het Centraal Bureau voor de Statistiek en in opdracht van het NEM. Daarbij wordt ook samengewerkt met diverse provincies, RIKZ en RIZA.
Voor een aantal zeldzame broedvogelsoorten en koloniebroeders heeft SOVON een apart monitoringmeetnet. Het streven is om jaarlijks een zo groot mogelijk deel van de totale aanwezige populatie te tellen. Daarbij worden de belangrijkste broedgebieden bezocht en geteld. Het betreft dus gerichte inventarisaties waarbij op een standaardwijze de broedparen of territoria worden geteld. Het LSB produceert jaarlijkse schattingen van de totale populatie van een soort in Nederland en in deelgebieden. Zie Van Dijk *et al* (2005).

2. Broedvogel Monitoring Project (BMP)
   Dit project wordt georganiseerd door SOVON in samenwerking met het Centraal Bureau voor de Statistiek en in opdracht van het NEM. Daarbij wordt ook samengewerkt met diverse provincies, RIKZ en RIZA.

   Dit meetnet is gericht op algemene soorten en werkt met tellingen uit steekproefgebieden. Een waarnemer telt jaarlijks hetzelfde gebied waarbij de waarnemingen uit meerdere bezoeken worden verwerkt tot territoriumkaarten. Bij een voldoende representatief meetnet met een voldoende aantal 'positieve plots' (= steekproefgebieden waar de soort voorkomt) zijn zogenaamde populatie-indexen te bepalen waarbij de jaarlijkse verandering t.o.v. een jaar met een vaste index van 100 wordt weergegeven. Zie Van Dijk *et al.* (2005).

3. Watervogeltellingen (MW)
   Dit meetnet is een samenwerkingsverband tussen SOVON Vogelonderzoek Nederland, het Rijksinstituut voor Integraal Zoetwaterbeheer en Afvalwaterbehandeling (RIZA), het Rijksinstituut voor Kust en Zee (RIKZ), Vogelbescherming Nederland, de Directie Kennis van het Ministerie van Landbouw, Natuurbeheer en Voedselkwaliteit en het Centraal Bureau voor de Statistiek, in opdracht van het NEM.

   In het meetnet watervogels zijn op diverse wijzen verzamelde gegevens opgenomen die als basis hebben gediend voor dit project. Het gaat om de volgende tellingen:
   (a) maandelijkse tellingen in de Waddenzee*.
   (b) maandelijkse tellingen in de Zoute Delta
       De in deze rapportage gebruikte vogelgegevens van de Zoute Delta zijn afkomstig uit het Biologisch Monitoring Programma Zoute Rijkswateren van het RIKZ (Rijksinstituut voor Kust en Zee), hetgeen onderdeel uitmaakt van het Monitoring-programma Waterstaatkundige toestand van het Land (MWTL) van Rijkswaterstaat. Het RIKZ neemt geen verantwoordelijkheid voor de in deze rapportage vermelde conclusies op basis van het door haar aangeleverde materiaal.
   (c) Midwintertelling
       Hierbij worden aanvullende tellingen langs de gehele kust gehouden en voert RIKZ ook een vliegtuigtelling uit langs de kust (zie onder b).
   *(a) en (b) zijn kwa methodiek niet vergelijkbaar.

   Voor een uitgebreide beschrijving, zie Van Roomen *et al.* (2005).
   De getallen voor de referenties en telgegevens/indexwaarden voor de recente jaren zijn weergegeven in tabelvorm. Hieronder volgt per soort een verantwoording van de gekozen referentiewaarden.

Broedvogels

Dwergstern

Beschikbare gegevens: aantallen broedparen per jaar volgens LSB meetnet
Beschikbare referentie: Den Boer *et al.* (1993)

Beschrijving referentie:
In het rapport worden oude telgegevens over de broedende aantallen beschreven en worden daaruit streefwaarden afgeleid die gezien kunnen worden als een referentie voor de dwergstern

Referentiegetallen
Aantal in Delta: 300 paren
Aantal Waddenzee: 300 paren
Aantal Noordzeekust: -

Grote Stern

Beschikbare gegevens: aantallen broedparen per jaar volgens LSB meetnet
Beschikbare referentie: Baptist & Jagtman (1997)

Beschrijving referentie: Stienen (2006)
In het rapport van Baptist & Jagtman worden oude telgegevens over de broedende aantallen beschreven. Voor de Grote Stern beschikken we over aantalsgegevens vanaf 1900. Gekeken is naar het maximaal aantal gedurende deze periode.

Referentiegetallen
Aantal in Delta: -
Aantal Waddenzee: -
Aantal Noordzeekust: 28000 paren*
* omdat de soort zijn voedsel haalt uit de kustwateren en dat als een beperkende factor wordt gezien is door Baptist & Jagtman geen onderscheid gemaakt in broedvogelkolonies in de Waddenzee en de Delta en is de soort toegekend aan het systeem Noordzeekust.

Kluut

Beschikbare gegevens: aantallen broedparen per jaar volgens LSB meetnet
Beschikbare referentie: Baptist & Jagtman (1997), Arts & Meininger (1997)

Beschrijving referentie:
In het rapport van Arts & Meininger worden oude telgegevens over de broedende aantallen beschreven. Schattingen voor de periode rond 1900 zijn laag en dit heeft te maken met een toegenomen bescherming van de soort. Deze schattingen zijn derhalve niet geschikt als referentie. De referentie is afgeleid uit de broedende aantallen aan het begin van de negentiger jaren.

Referentiegetallen
Aantal in Delta: 960 paren
Aantal Waddenzee: 5300 paren
Aantal Noordzeekust: -

Strandplevier

Beschikbare gegevens: aantallen broedparen per jaar volgens LSB meetnet
Beschikbare referentie: Baptist & Jagtman (1997) en Arts & Meininger (1997)

Beschrijving referentie:
In het rapport van Arts & Meininger worden oude telgegevens over de broedende aantallen beschreven. Hierin worden ook schattingen gepresenteerd van de aantallen rond 1900. Voor geheel Nederland liggen deze tussen de 900 en 1000 paar en Baptist & Jagtman hebben hieruit een referentie afgeleid.

Referentiegetallen

Aantal in Delta: 250 paren
Aantal Waddenzee: 215 paren
Aantal Noordzeekust: 455 paren

Visdief

Beschikbare gegevens: aantallen broedparen per jaar volgens LSB meetnet en RIKZ kustbroedvogelrapporten (bijv. Strucker *et al*. 2005).
Beschikbare referentie: Baptist & Jagtman (1997), Stienen & Brenninkmeijer (1992)

Beschrijving referentie:
In het rapport worden oude telgegevens over de broedende aantallen beschreven. Getallen uit 1900 zijn niet beschikbaar. De referentie is afgeleid uit de broedende aantallen in de vijftiger jaren. Op grond van expert-inschatting door RIKZ delen we de Visdieven van de Delta op in kolonies waarvan de dieren in de kustzone foerageren (met name de kolonies op de Maasvlakte en het Westelijke Haringvliet) en overige (zie Meininger & Strucker 2001).

Referentiegetallen

Aantal in Delta: 3500 paren
Aantal Waddenzee: 8450 paren
Aantal Noordzeekust: 20000 paren

Eidereend

Beschikbare gegevens: populatie-index volgens BMP meetnet
Beschikbare referentie: Camphuysen (1996)

Beschrijving referentie:
Door Camphuysen is op basis van een overzicht van alle gegevens over broedende Eiders in de Waddenzee een referentie opgesteld van 9000 broedparen. Deze populatiestand werd gehaald gedurende de eerste helft van de jaren negentig. De soort had zich toen hersteld van overexploitatie, waarbij gedurende de zestiger jaren door vergiftiging enige tijd een teruggang was te bespeuren. Het optimum werd bereikt begin jaren negentig. Begin jaren negentig is de invloed van de verdwenen mosselbanken nog niet merkbaar in de stand (Van Roomen *et al*. 2005).Om te komen tot een index-waarde voor de referentie is de gemiddelde BMP index voor de periode 1990-1995 bepaald (vergelijk Scholekster). Deze indexwaarde representeert 9000 broedparen. Vervolgens zijn de BMP-indexen voor het Waddengebied per jaar uitgedrukt in een schatting voor het jaarlijkse aantal broedparen voor de gehele Waddenzee. Omdat de Eider een zeldzame broedvogel is in andere delen van de kust en Delta is hiervoor geen index/aantal opgesteld.

Referentiegetallen

Broedende aantallen in Delta: -
Broedende aantallen Waddenzee: 9000 paren
Broedende aantallen Noordzeekust: -

Scholekster

Beschikbare gegevens: populatie-index volgens BMP meetnet voor alleen de Waddenzee
Beschikbare referentie: -

Beschrijving referentie:
Voor de scholekster dient de referentie uitgedrukt te worden in een index-getal t.o.v. de index-getallen die met de BMP gegevens worden opgesteld. Aangezien we niet beschikken over indexen en integrale tellingen uit het verre verleden is het niet mogelijk getallen uit deze periode te gebruiken als basis voor de referentie. Wel is er een schatting van het aantal broedparen van 8400-8800 paren in de jaren zeventig van de vorige eeuw (Smit & Wolff 1983). Besloten is om de periode 1990-1995 waarin de Scholeksterstand stabiel was als referentieperiode te gebruiken (zie ook Eider). Begin jaren negentig is de invloed van de verdwenen mosselbanken nog niet merkbaar in de stand (Van Roomen *et al*. 2005).
De gemiddelde index over deze periode is op 100 gesteld.

Voor de Delta zijn niet voldoende BMP-gegevens beschikbaar om een betrouwbare broedvogelindex mee te berekenen. Voor de noordzeekust wordt het aantal broedvogels als zeer klein en derhalve niet relevant ingeschat

Referentiegetallen

Indexwaarde in Delta: onbekend
Indexwaarde Waddenzee: 100
Indexwaarde Noordzeekust: -

Niet-Broedvogels

Aalscholver

Beschikbare gegevens: meetnet Watervogels
Beschikbare referentie: geen

Beschrijving referentie:
Er zijn geen aantallen bekend van populatiegroottes uit de eerste helft van de vorige eeuw. Redelijke telgegevens komen pas beschikbaar vanaf het midden van de jaren zeventig, in de Delta pas na midden jaren tachtig.

De soort is in de Waddenzee sterk toegenomen als broedvogel door onder andere het stoppen van bejaging. Het is daarom erg lastig om een referentie aan te geven uit het verleden. Op grond van de huidige aangetroffen maandgemiddelden is de referentie voor de Waddenzee op 5000 bepaald. De aantallen in de Delta zijn vrij stabiel en de referentie is gebaseerd op de periode 1987-1996.

Referentiegetallen

Maandgemiddelde in Delta: 1500 exx.
Maandgemiddelde Waddenzee: 5000 exx.
Maandgemiddelde Noordzeekust: -

Eidereend

Beschikbare gegevens: Meetnet Watervogels, januari-tellingen, met name door RIKZ
Beschikbare referentie: Baptist & Jagtman (1997), Camphuysen (1996), Romke Kats (pers. med.)

Beschrijving referentie:
Er zijn geen aantallen bekend van overwinterende populaties uit de eerste helft van de vorige eeuw. Redelijke telgegevens komen pas beschikbaar vanaf het midden van de jaren zeventig.
Baptist & Jagtman noemen op grond van een beschouwing van oude telgegevens een referentie van 120000 aanwezige Eidereenden in de Waddenzee. Voor de Noordzeekust, inclusief de voordelta wordt 5000 individuen opgegeven. Probleem is dat afhankelijk van de winter- en voedselomstandigheden uitwisseling tussen Waddenzee en Noordzeekust optreedt.
De aantallen zijn gebaseerd op de vliegtuigtellingen in januari van het RIKZ. De huidige trendbepalingen geschieden ook op basis van deze tellingen.

Referentiegetallen

Aantal in Delta: -
Aantal januari Waddenzee: 120 000 exx.
Aantal januari Noordzeekust: 5000 exx

Vanwege de uitwisselingsproblematiek valt het te overwegen om geen scheiding aan te brengen tussen de aantallen in Waddenzee en aantallen aan Noordzeekust. Geredeneerd vanuit de ecologie van de soort zijn hoge aantallen aan de Noordzeekust als negatief te beschouwen!

Scholekster

Beschikbare gegevens: Meetnet Watervogels, maandgemiddelde
Beschikbare referentie: Arts *et al.* (1997)

Beschrijving referentie:
Er zijn geen aantallen bekend van overwinterende populaties uit de eerste helft van de vorige eeuw. Redelijke telgegevens komen pas beschikbaar vanaf het midden van de jaren zeventig.
Baptist & Jagtman noemen op grond van een beschouwing van oude telgegevens (opgesomd in Arts *et al.* 1997) een referentie van 200.000 resp. 80.000 aanwezige Scholeksters voor Waddenzee en Delta. Dit is om te rekenen naar een maandgemiddelde met een factor 0,8 (aanwezige aantal is gebaseerd op alleen maanden sep-mrt).

Referentiegetallen

Maandgemiddelde in Delta: 64 000 exx.
Maandgemiddelde Waddenzee: 160 000 exx
Maandgemiddelde Noordzeekust: (laag)

Rotgans

Beschikbare gegevens: Meetnet Watervogels, maandgemiddelde
Beschikbare referentie: geen

Beschrijving referentie:
Er zijn geen aantallen bekend van overwinterende populaties uit de eerste helft van de vorige eeuw. Redelijke telgegevens komen pas beschikbaar vanaf het midden van de jaren zeventig voor de Wadden vanaf eind jaren tachtig voor de Delta.

Aangezien de soort vanaf midden jaren zeventig een herstel laat zien door met name de afname van de jacht is het lastig een referentieperiode uit het verleden te kiezen. Aangezien de soort na 1990 redelijk is gestabiliseerd in de Waddenzee is zijn de gemiddelde maandgemiddeldes voor de tienjaarse periode vanaf 1990 gekozen als referentiewaarde. Voor de Deltaperiode geldt een gelijke periode.

Referentiegetallen

Maandgemiddelde in Delta: 10 000 exx.
Maandgemiddelde Waddenzee: 25 000 exx.
Maandgemiddelde Noordzeekust: -

Zilverplevier

Beschikbare gegevens: Meetnet Watervogels, maandgemiddelde
Beschikbare referentie: geen

Beschrijving referentie:
Er zijn geen aantallen bekend van overwinterende populaties uit de eerste helft van de vorige eeuw. Redelijke telgegevens komen pas beschikbaar vanaf het midden van de jaren zeventig voor de Wadden vanaf eind jaren tachtig voor de Delta.

Voor de Waddenzee is gekozen voor de referentieperiode 1975-1990 omdat toen nog op grote schaal wilde mosselbanken in de Waddenzee voorkwamen en daarna mede door het verdwijnen van deze mosselbanken allerlei soorten veranderingen in aantallen lieten zien (zie Van Roomen *et al*. 2005).

Voor de Delta speelt iets dergelijks niet en is gekozen voor het gemiddelde van de 10 eerste jaren van de tijdreeks periode 1987-2004.

Referentiegetallen

Maandgemiddelde in Delta: 7 000 exx.
Maandgemiddelde Waddenzee: 12 000 exx.
Maandgemiddelde Noordzeekust: -

Kanoet

Beschikbare gegevens: Meetnet Watervogels, maandgemiddelde
Beschikbare referentie: geen

Beschrijving referentie:
Er zijn geen aantallen bekend van overwinterende populaties uit de eerste helft van de vorige eeuw. Redelijke telgegevens komen pas beschikbaar vanaf het midden van de jaren zeventig voor de Wadden vanaf eind jaren tachtig voor de Delta.

Voor de Waddenzee is gekozen voor de referentieperiode 1975-1990 omdat toen nog op grote schaal wilde mosselbanken in de Waddenzee voorkwamen en daarna mede door het verdwijnen van deze mosselbanken allerlei soorten veranderingen in aantallen lieten zien (zie Van Roomen *et al*. 2005).

Voor de Delta speelt iets dergelijks niet en is gekozen voor het gemiddelde van de 10 eerste jaren van de tijdreeks in de periode 1987-2004.

Referentiegetallen

Maandgemiddelde in Delta: 6 000 exx.
Maandgemiddelde Waddenzee: 40 000 exx.
Maandgemiddelde Noordzeekust: -

Drieteenstrandloper

Beschikbare gegevens: Meetnet Watervogels, maandgemiddelde
Beschikbare referentie: Van Turnhout & Van Roomen (2005)

Beschrijving referentie:
Er zijn geen aantallen bekend van overwinterende populaties uit de eerste helft van de vorige eeuw. Redelijke telgegevens komen pas beschikbaar vanaf het midden van de jaren zeventig voor de Wadden vanaf eind jaren tachtig voor de Delta.

In het kader van een studie naar de effecten van zandsuppletie hebben Van Turnhout & Van Roomen alle beschikbare telgegevens van de soort op een rij gezet en hebben oorzaken van aantalsveranderingen onderzocht. Tevens zijn hieruit min of meer 'natuurlijke' dichtheden af te leiden voor stranden en andere kuststroken.

Referentiegetallen

Maandgemiddelde in Delta: 600
Maandgemiddelde Waddenzee: 1300
Maandgemiddelde Noordzeekust: 1700

Bonte strandloper

Beschikbare gegevens: Meetnet Watervogels, maandgemiddelde
Beschikbare referentie: geen

Beschrijving referentie:
Er zijn geen aantallen bekend van overwinterende populaties uit de eerste helft van de vorige eeuw. Redelijke telgegevens komen pas beschikbaar vanaf het midden van de jaren zeventig voor de Wadden vanaf eind jaren tachtig voor de Delta.

Voor de Waddenzee is gekozen voor de referentieperiode 1975-1990 omdat toen nog op grote schaal wilde mosselbanken in de Waddenzee voorkwamen en daarna mede door het verdwijnen van deze mosselbanken allerlei soorten veranderingen in aantallen lieten zien (zie Van Roomen *et al*. 2005).

Voor de Delta speelt iets dergelijks niet en is gekozen voor het gemiddelde van de 10 eerste jaren van de tijdreeks in de periode 1987-2004.

Referentiegetallen

Maandgemiddelde in Delta: 25 000
Maandgemiddelde Waddenzee: 130 000
Maandgemiddelde Noordzeekust: -

Rosse Grutto

Beschikbare gegevens: Meetnet Watervogels, maandgemiddelde
Beschikbare referentie: geen

Beschrijving referentie:
Er zijn geen aantallen bekend van overwinterende populaties uit de eerste helft van de vorige eeuw. Redelijke telgegevens komen pas beschikbaar vanaf het midden van de jaren zeventig voor de Wadden vanaf eind jaren tachtig voor de Delta. In aansluiting op de andere soorten, met name de schelpdiereters, is gekozen voor een referentieperiode 1990-1995 omdat zich daarna grote veranderingen in de Waddenzee hebben voorgedaan.

Referentiegetallen

Maandgemiddelde in Delta: 6 000
Maandgemiddelde Waddenzee: 33 000
Maandgemiddelde Noordzeekust: -

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Bijlage 1 Overzichtstabellen

Broedvogels	Bron huidige en recente waarde	Waddenzee					Delta					Noordzeekust				
	Data	2000	2001	2002	2003	2004	2000	2001	2002	2003	2004	2000	2001	2002	2003	2004
Dwergstern	LSB	127	113	196	212	167	277	306	263	276	299	0	0	0	0	0
Grote Stern	LSB	8.658	8.223	11.108	11.810	11.528	5.800	6.126	6.200	6.701	4.200	14.458	14.349	17.308	18.511	15.728
Kluut	LSB	4.367	3.197	3.854	2.977	2.438	2.088	1.874	1.833	2.145	1.775	0	0	0	0	0
Strandplevier	LSB	14	8	10	17	10	166	150	151	176	157	13	10	12	8	0
Visdief	LSB	5.338	5.201	5.354	4.796	3.130	3.471	4.171	2.699	4.348	4.207	3.045	2.587	2.482	2.878	1.987
Eidereend	BMP	7.257	8.005	6.882	5.461	5.835	nvt	nvt	nvt	nvt	nvt	nvt	nvt	nvt	nvt	nvt
Scholekster	BMP	72	72	59	59	60	onb	onb	onb	onb	onb	nvt	nvt	nvt	nvt	nvt
Aalscholver	MW	3.304	3.974	4.361	4.545	4.732	782	822	858	622	581	nvt	nvt	nvt	nvt	nvt

Broedvogels	Bron voor referentie	Referentie uitgedrukt in broedparen			Opmerkingen
		Waddenzee	Delta	Noordzeekust	
Dwergstern	Den Boer *et al.* (1993)	300	300	0	
Grote Stern	Baptist en Jagtman (1997)	0	0	28000	is waarde voor geheel nederland
Kluut	Baptist en Jagtman (1997)	5.300	960	0	
Strandplevier	Arts en Meininger (1997)	215	250	455	
Visdief	Baptist en Jagtman (1997)	8.450	3.500	20000	
Eidereend	Camphuysen (1996)	9.000	0	0	wadden is inclusief duinen
Scholekster	Arts *et al.* (1997)	100	100	100	indexwaarde voor broedvogelplots
Aalscholver		5.000	1.100	nvt	

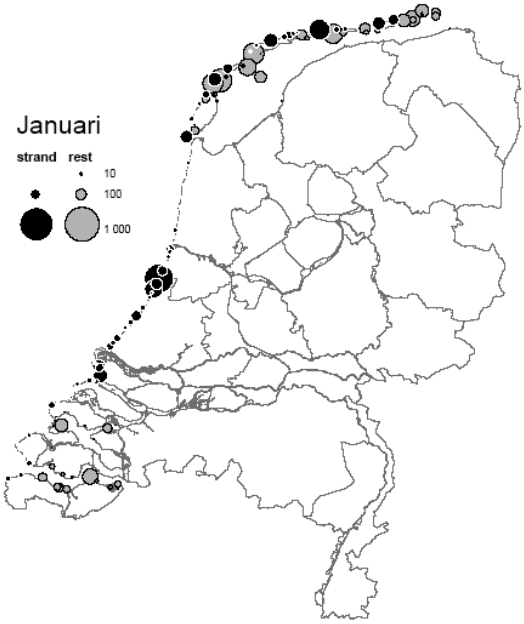
Niet-broedvogels	Bron huidig aantal+recent data	Waddenzee		Delta		Noordzee	
		periode recent telseizoen 99-02	periode huidig telseizoen 01-04	periode recent telseizoen 99-02	periode huidig telseizoen 01-04	periode recent telseizoen 99-02	periode huidig telseizoen 01-04
Aalscholver	maandgemiddelde	3.880	4.846	821	687	nvt	nvt
Eidereend	januaritelling	83.938	110.075	nvt	nvt	?	?
Scholekster	maandgemiddelde	130.052	120.990	35.849	35.481	nvt	nvt
Bonte Strandloper	maandgemiddelde	207.839	211.433	32.604	32.053	nvt	nvt
Drieteenstrandloper	maandgemiddelde	4.952	6.946	1.094	1.526	1.804	2.383
Kanoet	maandgemiddelde	48.568	36.555	8.842	8.884	nvt	nvt
Rosse Grutto	maandgemiddelde	50.927	57.625	5.786	6.076	nvt	nvt
Rotgans	maandgemiddelde	28.231	24.759	8.484	7.833	nvt	nvt
Zilverplevier	maandgemiddelde	20.253	23.220	6.009	6.064	nvt	nvt

Niet-broedvogels	referentie	uitgedrukt in aantallen seizoensmaxima			Uitgedrukt in maandgemiddelde volgens huidig meetnet			opmerking
		Waddenzee (aantal)	Delta (aantal)	Noordzeekust (aantal)	Waddenzee (maandgemiddelde)	Delta (maandgem)	Noordzeekust (maandgem)	
Aalscholver	Geen				5.000	1.500	nvt	
Eidereend	Baptist en Jagtman (1997)	120.000	nvt	5.000				probleem is uitwisseling NZ en Wadden
Scholekster	Baptist en Jagtman (1997)	200.000	80.000	nvt	160.000	64.000	nvt	
Bonte Strandloper	Baptist en Jagtman (1997)	60.000	90.000		130.000	25.000	nvt	
Drieteenstrandloper	Van Turnhout & Van Roomen 2005				1.300	600	1.700	gemiddelde maandgemiddelde in periode voor 1990, voor kust gemiddelde van laatste 10 jaar
Kanoet	geen				40.000	6.000	nvt	
Rosse Grutto	geen				33.000	6.000	nvt	
Rotgans	geen				25.000	10.000	nvt	
Zilverplevier	geen				12.000	7.000	nvt	

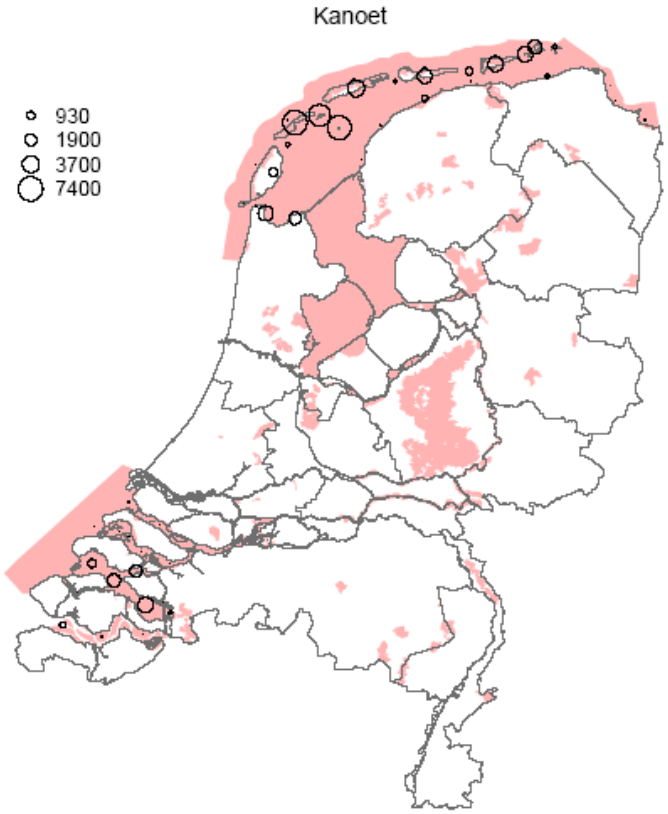
Bijlage 2 Distibution maps birds

Maps published in SOVON & CBS 2005. Trends van vogels in het Nederlandse Natura2000 netwerk. SOVON-informatierapport 2005/09. SOVON Vogelonderzoek Nederland, Beek-Ubbergen.

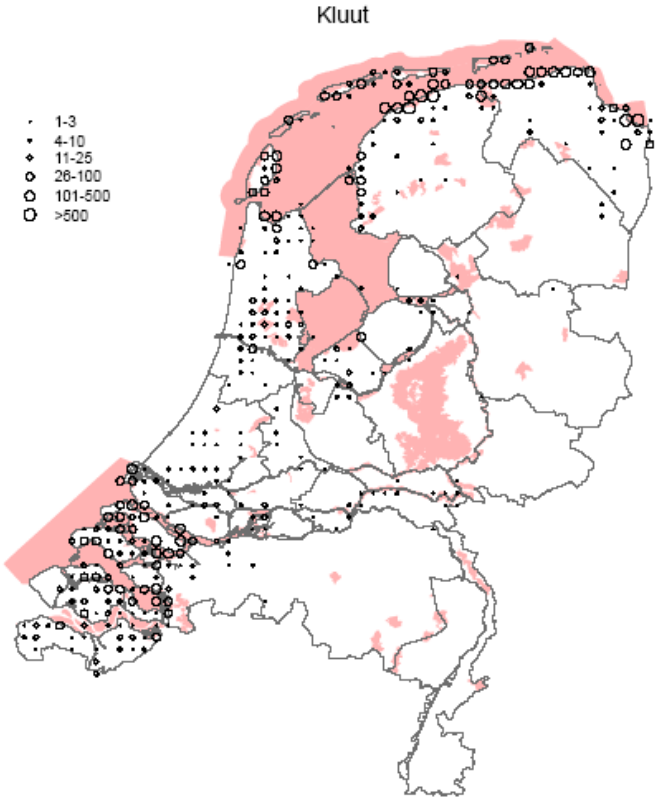
Calidris alba (Sanderling, non-breeding /Drieteenstrandloper)



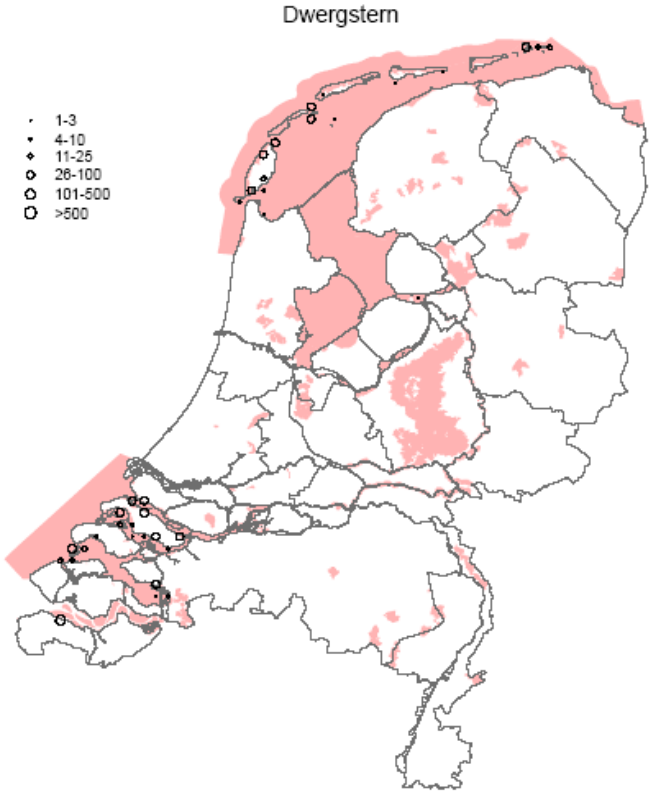
Calidris canutus canutus/islandica (Great Knot, non-breeding/Kanoet)



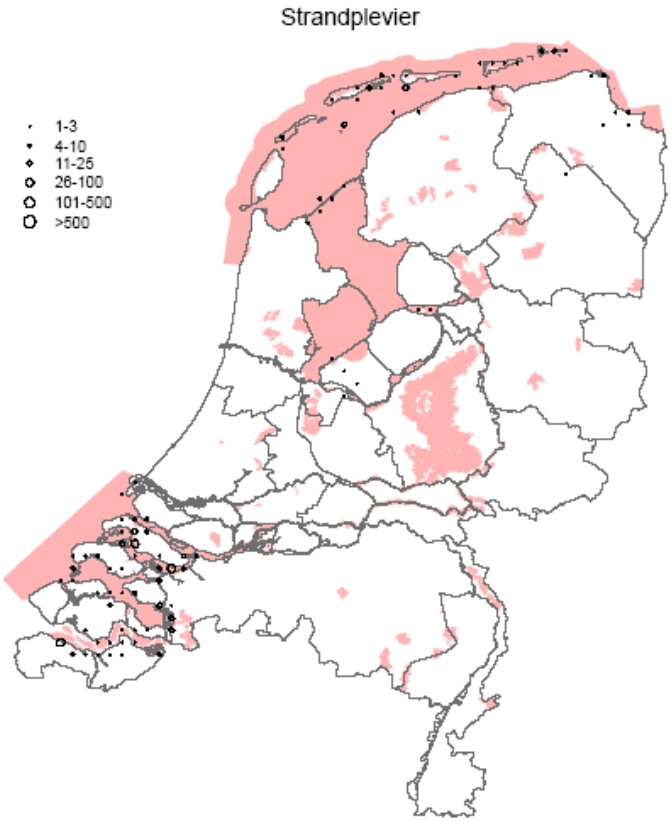
Recurvirostra avosetta (Pied Avocet /Kluut)



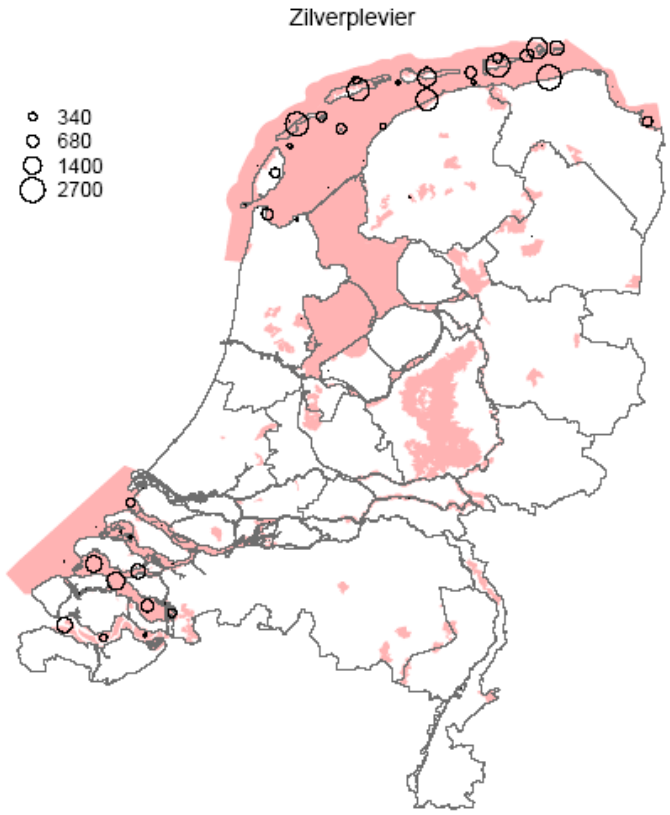
Sterna albifrons albifrons (Little Tern, breeding/Dwergstern)



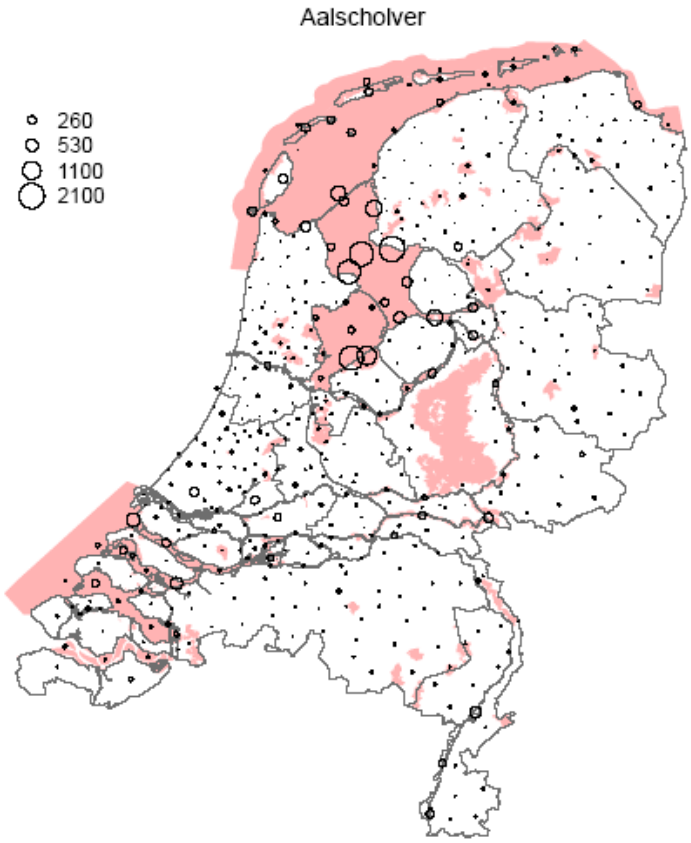
Charadrius alexandrinus alexandrinus (Kentish Plover/Strandplevier)



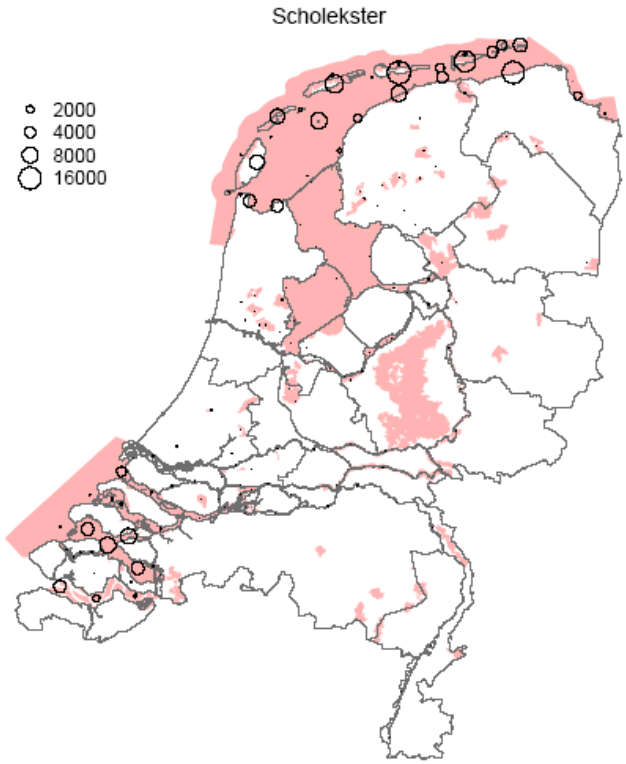
Pluvialis squaterola (Grey Plover, non-breeding/Zilverplevier)



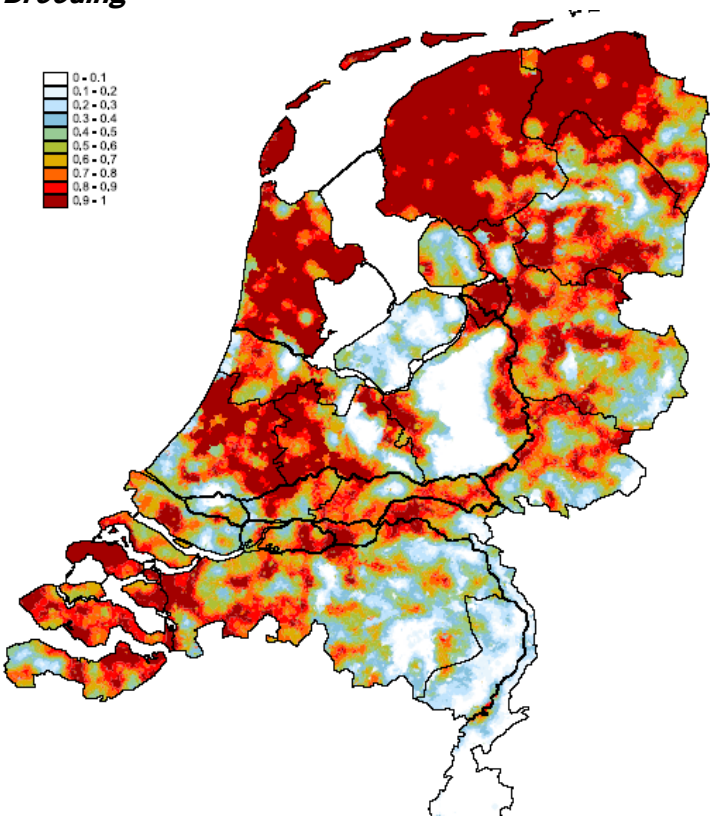
Phalacrocorax carbo sinensis (Great Cormorant, non-breeding /Aalscholver)



Haematopus ostralegus ostralegus (Eurasian Oystercatcher/Scholekster) Non-breeding

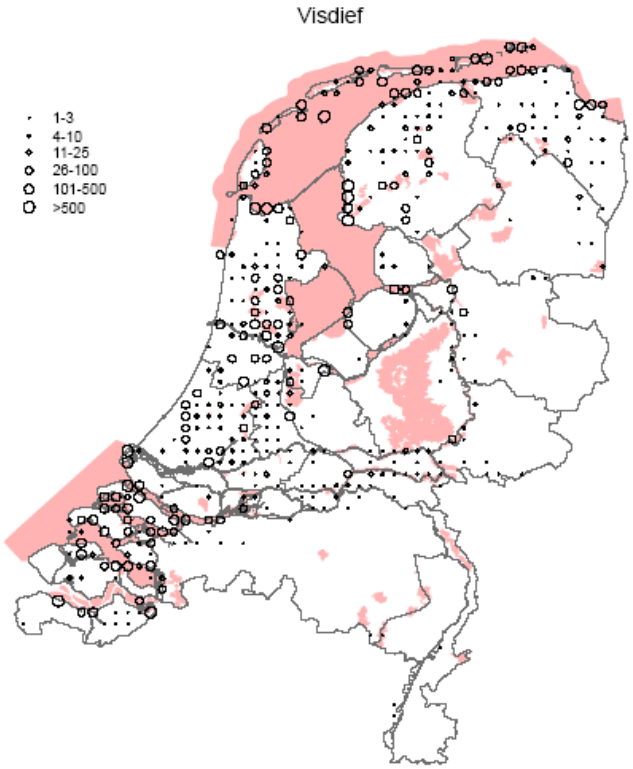


Haematopus ostralegus ostralegus (Eurasian Oystercatcher/Scholekster) Breeding

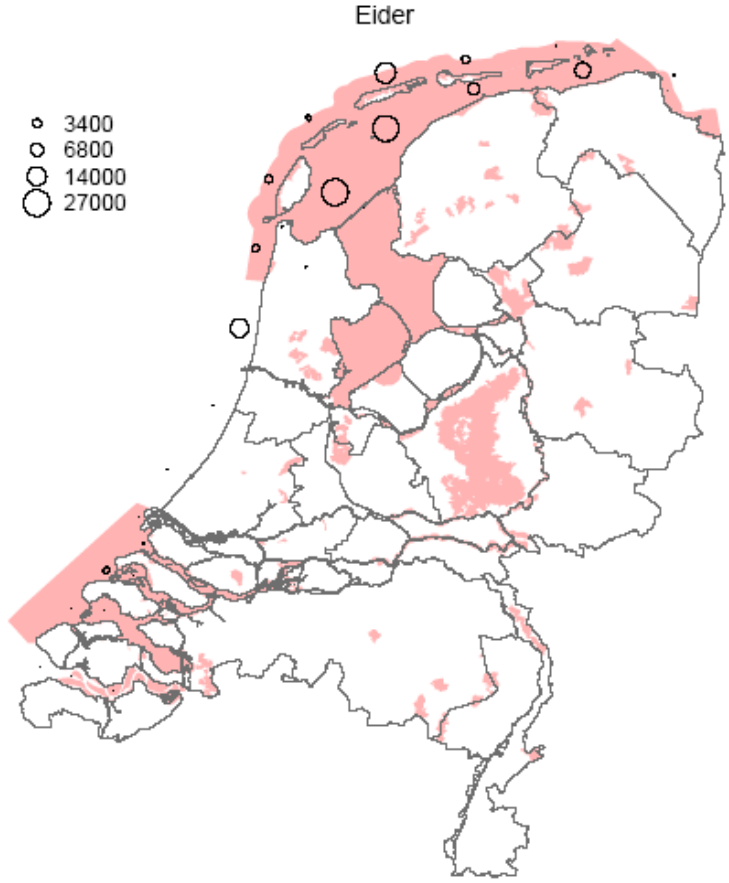


Broedvogelatlas 1998-2000

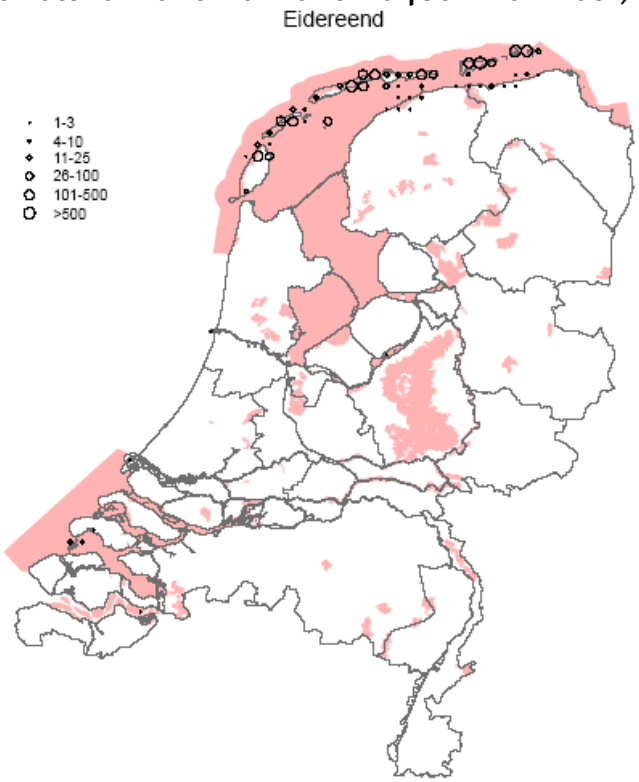
Sterna hirundo hirundo (Common Tern/Visdief)



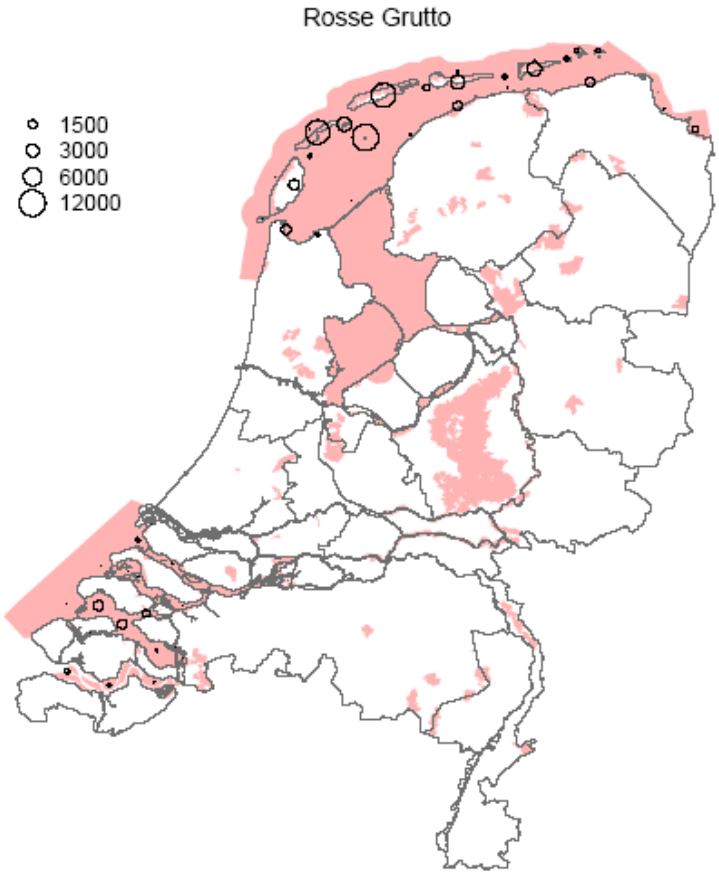
Somateria mollisima mollisima (Common Eider, non-breeding/Eidereend)



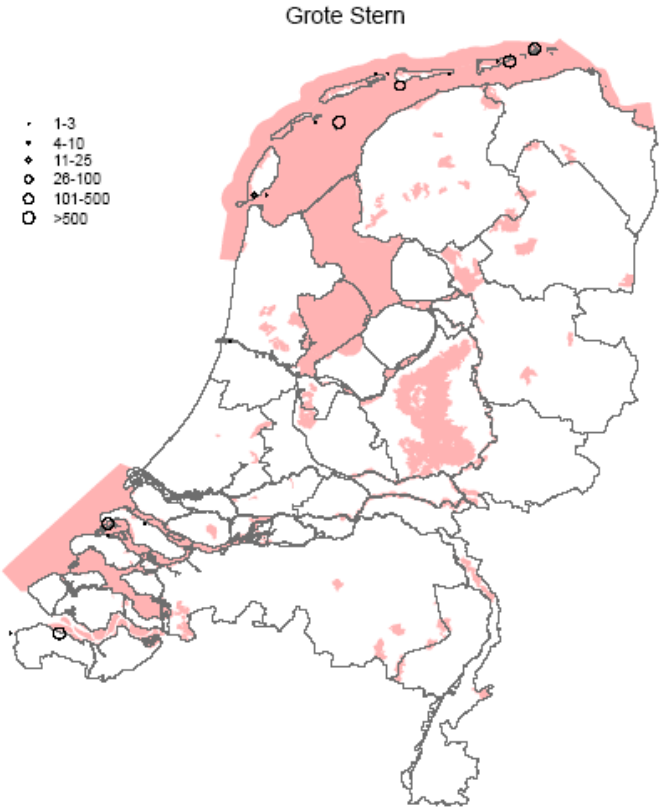
Somateria mollisima mollisima (Common Eider, breeding/Eidereend)



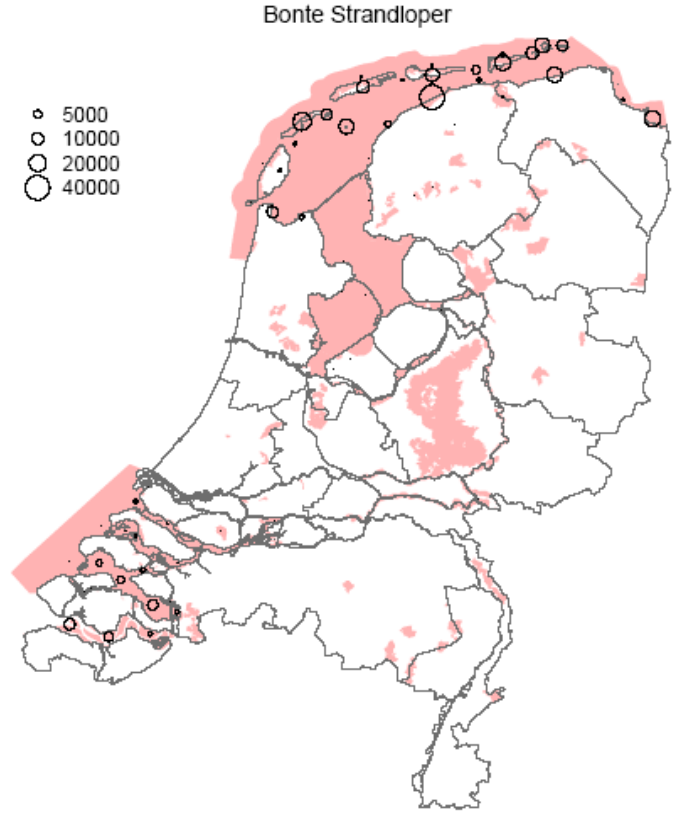
Limosa lapponica/taymirensis (Bar-tailed Godwit / Rosse Grutto): non-breeding



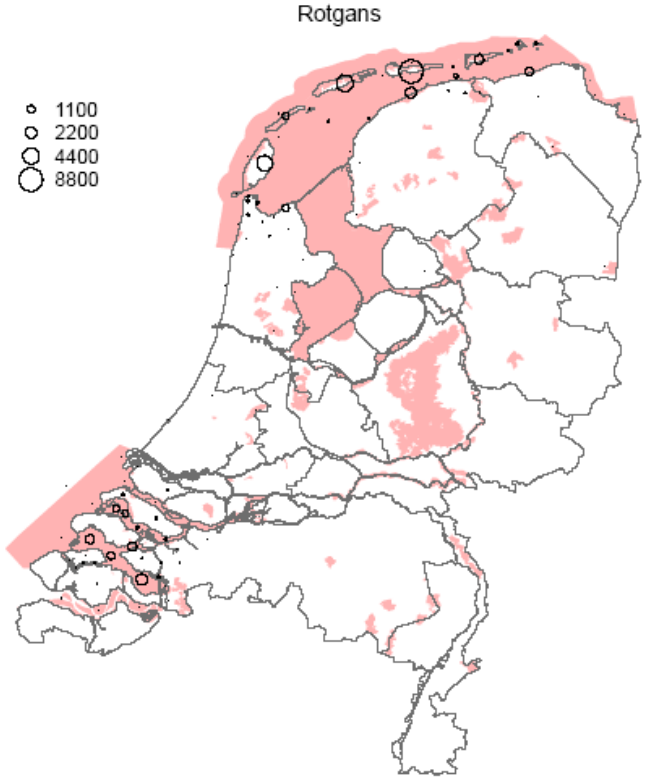
Sterna sandvicensis sandvicensis (Sandwich Tern/Grote stern)



Calidris alpina spec. (mainly alpina; Dunlin/Bonte strandloper)



Branta bernicla bernicla (Dark-bellied Brent Goose, non-breeding/Zwartbuikrotgans)



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