# WATERBIRDS IN THE RHINE VALLEY IN 1995

Results of a coordinated survey in January

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- Institute for Inland Water Management and Waste Water Treatment (RIZA);
- National Institute of Public Health and Environmental Protection (RIVM);
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- DLO Institute for Forestry and Nature Research (IBN-DLO);
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The aim of the project is to contribute to the ecological rehabilitation of the rivers Rhine and Meuse. One of the project's activities are publications in the series 'Publications and reports of the project Ecological Rehabilitation of the rivers Rhine and Meuse'.

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Results of a coordinated survey in January

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**Summary**

In the Rhine Valley in Switzerland, Germany, France and The Netherlands, several ecological monitoring schemes have been initiated by the International Rhine Commission (IRC). The main aim of this research is to assess the status and developments in fish stocks, zoo- and phytoplankton and macro-invertebrates. These surveys are reviewed once every five years and provide a framework to evaluate the different management measures taken and support further outlines for rehabilitation of the original river-ecosystem. Counts of waterbirds may add a valuable contribution to these monitoring programmes, but have not been taken into consideration so far.

In all countries within the Rhine Valley, surveys of waterbirds have already been carried out as early as the 1950s and 1960s. These counts refer to the river basin as well as gravel-, clay- and sandpits and reservoirs which are situated in close vicinity of the river. Fieldwork is carried out by both volunteers and professionals and is coordinated on a national level by the 'Schweizerische Vogelwarte Sempach' in Switzerland, the 'Office National de la Chasse' and 'Centre d'Etudes Ornithologiques d'Alsace' in France, the 'Zentrale für Wasservogelforschung und Feuchtgebietsschutz in Deutschland' in Germany' and 'SOVON Vogelonderzoek Nederland' in The Netherlands. On behalf of the IRC, a pilot-study has been carried out in 1995 to review the occurrence of waterbirds in the Rhine Valley. For this purpose, the internationally coordinated midwinter census in January 1995 has been analysed. It is for the first time that such an analysis is made for the Rhine Valley as a whole.

During the count nearly 1 million (864,393) waterbirds and 38 species were present in the area. According to the 1% threshold level adapted by the Ramsar-Convention, numbers of international importance were recorded in 18 species. Most abundant are herbivores such as White-fronted Goose (222,364), Coot (134,544), Mallard (105,-372) and Wigeon (95,594), as well as Barnacle Goose (21,773), Greylag Goose (10,603), Teal (10,084), Bean Goose (9,986), Gadwall (9,814) and Bewick's Swan (2,879). These species are mainly found in the Niederrhein area in Germany and The Netherlands where they feed extensively on the pastures in the forelands. Many of these species have increased in the past decades as a result of protection measures and an overall improvement of the quality of their food resources.

A different picture exists for Red-crested Pochard (2,992). Within the Rhine Valley, they are almost exclusively found in the Bodensee area (Lake of Constance). Contrary to many other herbivorous species, Red-crested Pochard has been subject to a decrease in the past decades, due to a decline in the biomass of submerged macrophytes which was caused by eutrophication. Improvements in water quality recently have contributed to a revival of submerged macrophytes and consequently an increase of Red-crested Pochard numbers.

Besides herbivorous waterbirds, also Tufted Duck (132,688) and Pochard (60,317) were numerous. These mainly depend on macroinvertebrates for their food, particularly the Zebra Mussel *Dreissena polymorpha*. The largest biomass of this bivalve is found in the Bodensee area, which consequently also holds large numbers of Tufted Ducks and Pochard (69,856 and 37,658 respectively). Both species have benefitted from the exponentional increase of Zebra Mussels in the Bodensee area by the end of the 1960s and in the Niederrhein area in the 1970s. To some extent, also Coot have responded to this development, although in many areas this species can be regarded as a herbivore. Goldeneye were also recorded in large numbers (8,267), but depend less on Zebra Mussels and predominantly feed on other small molluscs, crustaceans and insect-larvae.

Fish-eating species are less abundant and represented by relatively few species. They are dominated by Great Crested Grebe (12,584) and Cormorant (12,377), which often concentrate at relatively large waterbodies like e.g. the gravel-pits and reservoirs along the Oberrhein and Niederrhein. Both species have increased from the 1970s onwards, as eutrophication affected species composition and biomass of fish stocks.

Results of the different species show that monitoring of waterbirds may be an effective tool in evaluating measures taken in the context of the restoration of the original river-ecosystem. In contrast to other ecological parameters, the occurrence of waterbirds can also be assessed relatively accurately in quantitative terms and therefore often markedly point out changes at lower trophic levels. It is recommended that surveys of waterbirds in the non-breeding season should be implemented in an internationally coordinated body acting within the existing biological monitoring schemes of the IRC. For this purpose extra support will particularly be needed to enhance the coordination on both national and international levels, since the actual counts are carried out already in a major part of the area. Such a setup will be valuable as an extra tool to review current management policy and permit future outlines to be developed.

**Zusammenfassung**

Auf Initiative der Internationale Kommission zum Schutze des Rheins (IKSR) werden im Einzugsgebiet des Rheins in der Schweiz, Deutschland, Frankreich und in den Niederlanden ökologische Monitoring-Programme durchgeführt. Dies hat den Zweck, den Zustand der ökologischen Gruppen Phyto- und Zooplankton, Makrofauna und Fisch, und die auftretenden Änderungen, abzuschätzen. Einmal in den fünf Jahren werden die Ergebnisse ausgewertet, um festzustellen, ob die Politik und die getroffenen Maßnahmen in bezug auf die ökologische Wiederherstellung des Fluß-Ökosystems erfolgreich gewesen sind. Ergebnisse der Wasservogelzählungen können dabei eine Indikatorrolle erfüllen, aber fehlen im heutigen Ansatz der Monitoring-Programme der IKSR.

In den unterschiedlichen Ländern am Rhein werden schon seit den fünfziger und sechziger Jahren Wasservogelzählungen durchgeführt. Sie beziehen sich sowohl auf den Fluß selbst als auch auf die nahegelegenen Kiesgruben und Stauseen. Freiwillige und Profis arbeiten dabei zusammen unter der Koordination nationaler Institute wie der 'Schweizerische Vogelwarte Sempach' in der Schweiz, 'Office National de la Chasse' und 'Centre d'Etudes Ornithologiques d'Alsace' in Frankreich, der 'Zentrale für Wasservogelforschung und Feuchtgebietsschutz in Deutschland' in Deutschland und 'SOVON Vogelonderzoek Nederland' in den Niederlanden. Auf Wunsch der IKSR wurde 1995 eine sondierende Studie über das Vorkommen von Wasservögeln im Einzugsgebiet des Rheins durchgeführt. Dazu wurden die Ergebnisse der internationalen Wasservogelzählung im Januar 1995 bearbeitet. Es ist zum erstenmal, daß die Ergebnisse von Wasservogelzählungen im Ausmaß des Einzugsgebietes analysiert werden.

Während der Zählung wurden fast 1 Million (864.393) Wasservögel beobachtet, verteilt über 38 Arten. Von 18 Arten wurden in einer oder mehreren Teilstrecken Zahlen von internationaler Bedeutung gezählt. Die internationale Relevanz wurde dabei definiert nach den Normen der Ramsar-Konvention, was beinhaltet, daß minimal 1% der geographischen Population in einem Gebiet anwesend sein muß. Unter den zahlreichen Arten befinden sich vor allem Pflanzenfresser (Herbivoren) wie Bläßgans (222.364), Bläßhuhn (134.544), Stockente (105.372) und Pfeifente (95.594). Zu den sonstigen wichtigen Arten in dieser Gruppe gehören: Weißwangengans (21.773), Graugans (10.603), Krickente (10.084), Saatgans (9.986), Schnatterente (9.814), Zwergschwan (2.879). Herbivoren konzentrieren sich besonders im Niederrheingebiet in Deutschland und den Niederlanden und finden sich dort namentlich auf den Wiesen in den Vorlandbereichen. Durch Schutzmaßnahmen und Verbesserung der Nahrungsqualität haben viele dieser Arten in den vergangenen Jahrzehnten an Zahl zugenommen.

Ganz verschieden ist das Auftreten der Kolbenente (2.992). Diese Art konzentriert sich fast nur am Bodensee. Anders als die sonstigen Pflanzenfresser, ist die Population Kolbenenten durch die Abnahme von Wasserpflanzenvegetationen als Folge der Eutrophierung während der vergangenen Jahrzehnte zurückgegangen. Neueste Verbesserungen in Wasserqualität und Wiederherstellung von Wasserpflanzen haben diesen Trend gestoppt und zurzeit werden wieder zunehmende Zahlen gemeldet.

Zu den zahlreichen Arten gehören sonst noch Reiherente (132.688) und Tafelente (60.317). Sie sind beide Arten, die von Makrofauna leben (Benthivoren). Ihr Vorkommen wird besonders bestimmt durch die Anwesenheit der Wandermuschel *Dreissena polymorpha*, deren größte Biomasse im Bereich des Bodensee gefunden wird. Die größten Zahlen Reiher- und Tafelenten sind denn auch in diesem Gebiet beobachtet (bzw. 69.856 und 37.658). Das Erscheinen der Wandermuschel im Bodensee am Ende der sechziger Jahre und im Niederrhein in den siebziger Jahren hat stark positiv auf die Zahlenentwicklung dieser Arten ausgewirkt. In geringerem Maße hat auch Bläßhuhn von dieser Entwicklung profitiert, obwohl dieser Art in anderen Gebieten haupsachlich Pflanzliche Nahrung nützt. Schellenten wurden auch in bedeutenden Zahlen beobachtet (8.267), aber sind weniger auf Wandermuscheln angewiesen, und nützen vor allem anderen kleinen Mollusken und Anthropoden.

Fischfresser (Piscivoren) kommen verhältnismäßig wenig vor und werden namentlich durch Haubentaucher (12.584) und Kormoran (12.377) vertreten. Sie konzentrieren sich besonders auf größere Gewässer wie Kiesgruben und Stauseen (Niederrhein, Oberrhein) und im Bodensee. Auch bei diesen Arten ist eine Zunahme eingetreten, die besonders durch sich ändernde Fischpopulationen als Folge der Eutrophierung der europäischen Gewässer in den siebziger und achtziger Jahren verursacht wurde.

Die Ergebnisse der einzelnen Arten zeigen, daß das Vorkommen von Wasservögeln bei der Evaluierung von Maßnahmen zur Wiederherstellung des ursprünglichen Fluß-Ökosystems eine Rolle spielen kann. Im Vergleich zu anderen ökologischen Gruppen sind Ergebnisse von Vogelzählungen auch leicht quantitativ auszudrücken. Sie können damit oft eine effektive Rolle beim Hinweisen auf Entwicklungen in niedrigeren trophischen Niveaus erfüllen. Es empfiehlt sich denn auch, die Wasservogelzählungen, nicht nur die im Januar (nur eine Momentaufnahme), aber auch die im Rest des Winterhalbjahres, in einen internationalen übergreifenden Rahmen innerhalb des ökologischen Monitoring-Programmes des Rheins aufzunehmen. Dabei kann man völlig an schon bestehende Zählreihen anschließen, wobei nur -wo erforderlich- die nationale Koordination eine breitere Basis erhalten sollte. Solch ein Ansatz wäre ein wichtiges zusätzliches Instrument, um bestehende Politik zu prüfen und neue Maßnahmen zu steuern.

**Résumé**

A l'initiative de la Commission Internationale pour la Protection du Rhin (CIPR), des programmes de monitorage écologiques sont réalisés dans la vallée du Rhin en Suisse, en Allemagne, en France et aux Pays-Bas. Leur but est de faire connaître la situation des groupes écologiques de phytoplancton et zooplancton, macrofaune et poissons, et les changements qui se produisent. Les résultats sont évalués une fois tous les cinq ans afin de vérifier si la politique suivie et les mesures prises à l'égard du redressement écologique de l'écosystème fluvial, ont eu du succès. Les résultats des recensements des oiseaux d'eau peuvent avoir un rôle indicateur dans ces programmes, mais ils ne font pas partie de la conception actuelle des programmes de monitorage de la CIPR.

Depuis les années cinquante et soixante déjà, des recensements des oiseaux d'eau sont déjà réalisés dans les différents pays riverains du Rhin. Ils concernent aussi bien le fleuve lui-même que les gravières et les plans d'eau se trouvant à proximité. Des bénévoles et professionnels y travaillent ensemble sous la coordination d'instituts nationaux tels que le 'Schweizerische Vogelwarte Sempach' en Suisse, l'Office National de la Chasse et le Centre d'Etudes Ornithologiques d'Alsace en France, le 'Zentrale für Wasservogelforschung und Feuchtgebietsschutz in Deutschland' en Allemagne et le 'SOVON Vogelonderzoek Nederland' aux Pays-Bas. En 1995, à la demande de la CIPR, a été réalisée une étude de reconnaissance sur la présence des oiseaux d'eau dans la vallée du Rhin. Les résultats du comptage international du milieu de l'hiver, de janvier 1995, ont été adaptés à cet effet. C'est la première fois que les résultats de recensements des oiseaux d'eau font l'objet d'une analyse à l'échelle du bassin fluvial.

Près de 1 million (864.393) des oiseaux d'eau, répartis sur 38 espèces, ont été recensés. Pour 18 espèces, on a procédé au recensement d'une ou de plusieurs sections d'intérêt international, défini suivant les normes de la Convention de Ramsar selon laquelle 1% au minimum de la population géographique doit être présente dans une région. Parmi les nombreuses espèces, se trouvent principalement des herbivores tels que l'Oie rieuse (222.364), la Foulque macroule (134.544), le Canard colvert (105.372) et le Canard siffleur (95.594). Comptent parmi les autres espèces importantes de ce groupe : la Bernache nonnette (21.773), l'Oie cendrée (10.603), la Sarcelle d'hiver (10.084), l'Oie des moissons (9.986), le Canard chipeau (9.814), le Cygne de Bewick (2.879). Les herbivores se concentrent principalement dans la région du Niederrhein en Allemagne et aux Pays-Bas, et vivent notamment dans les prairies des lits d'hiver. Beaucoup de ces espèces ont vu croître leur nombre au cours des dernières décennies, suite aux mesures de protection et à l'amélioration de la qualité de leur nourriture.

L'histoire de la Nette rousse (2.992), une espèce vivant presque exclusivement dans la région du lac de Constance, est particulière. Les végétations aquatiques ayant diminué à cause de l'eutrophisation, la population de Nettes rousses s'est réduite pendant les dernières décennies. De récentes améliorations de la qualité de l'eau et le redressement des végétations aquatiques ont inversé cette tendance. De nos jours, on observe une nouvelle croissance.

Parmi les espèces nombreuses, on compte aussi les Fuligules morillons (132.688) et milouins (60.317), deux espèces malacophages (benthivores). La présence de la Moule zébrée *Dreissena polymorpha*, dont la plus grande biomasse se trouve dans la région du lac de Constance, est déterminante pour l'existence de ces espèces. C'est aussi dans cette région qu'on a recensé les plus grands nombres de Fuligules morillons et milouins (resp. 69.856 et 37.658). L'apparition de la Moule zébrée dans le lac de Constance à la fin des années soixante et dans le Niederrhein dans les années soixante-dix, a eu un effet très positif sur l'évolution du nombre de ces espèces. La Foulque macroule ont profité également, dans une moindre mesure, de cette évolution; bien que en autres régions, la Foulque macroule est une herbivore. Une autre espéce malacophage nombreux est le Garrot à l'oeil d'or (8.267), qui prisent particulièrement autres mollusques, crustacés et vers de vase.

Les piscivores sont relativement peu nombreux et sont principalement représentés par le Grèbe huppé (12.584) et le Grand Cormoran (12.377). Ces espèces se concentrent surtout dans les régions de vastes plans d'eau telles que les gravières et lacs de retenue (Niederrhein, Oberrhein), et dans la région du lac de Constance. Le nombre de ces espèces a augmenté lui aussi, notamment à cause des changements survenus dans les populations piscicoles suite à l'eutrophisation des eaux européennes dans les années soixante-dix et quatre-vingt.

Les résultats pris séparément par espèce montrent que la présence des oiseaux d'eau peut jouer un rôle dans l'évaluation des mesures destinées à redresser l'écosystème fluvial. En outre, les résultats des recensements d'oiseaux s'expriment aisément, en comparaison des autres groupes écologiques, en termes quantitatifs. Ainsi, ils peuvent souvent aider à signaler les évolutions dans les niveaux trophiques inférieurs. Aussi est-il recommandé, dans le programme de monitorage écologique du Rhin, d'intégrer les recensements d'oiseaux aquatiques, non seulement de janvier (moment arbitraire) mais aussi du reste de l'hiver, dans un cadre de coordination international. Pour ce faire, on pourra se référer intégralement aux séries de recensements déjà existantes, en prenant seulement soin d'élargir, si nécessaire, la base de la coordination nationale. Une telle conception serait un instrument supplémentaire important pour contrôler la politique actuelle et donner une orientation aux nouvelles mesures.

**Samenvatting**

Op initiatief van de Internationale Rijncommissie (IRC) worden in het stroomdal van de Rijn in Zwitserland, Duitsland, Frankrijk en Nederland ecologische monitoring-programma's uitgevoerd. Doel hiervan is inzicht te krijgen in de toestand van de ecologische groepen phyto- en zooplankton, macrofauna en vis en de veranderingen die optreden. Eénmaal per vijf jaar worden de resultaten geëvalueerd om na te gaan of het beleid en de genomen maatregelen ten aanzien van het ecologisch herstel van het rivier-ecosysteem succesvol zijn geweest. Resultaten van watervogeltellingen kunnen hierin een indicatorrol vervullen maar ontbreken in de huidige opzet van de monitoringprogramma's van de IRC.

In de verschillende landen langs de Rijn worden al vanaf de jaren vijftig en zestig watervogeltellingen uitgevoerd. Deze hebben betrekking op zowel de rivier zelf als nabij gelegen grindgaten en stuwmeren. Vrijwilligers en professionals werken hierbij samen onder de coördinatie van nationale instituten zoals de 'Schweizerische Vogelwarte Sempach' in Zwitserland, de 'Office National de la Chasse' en 'Centre d'Etudes Ornithologiques d'Alsace' in Frankrijk, de 'Zentrale für Wasservogelforschung und Feuchtgebietsschutz in Deutschland' in Duitsland en 'SOVON Vogelonderzoek Nederland' in Nederland. Op verzoek van de IRC is in 1995 een verkennende studie uitgevoerd naar het voorkomen van watervogels in het stroomdal van de Rijn. Hiervoor zijn de resultaten bewerkt van de internationale midwintertelling in Januari 1995. Het is voor het eerst dat de resultaten van watervogeltellingen op de schaal van het stroomdal worden geanalyseerd.

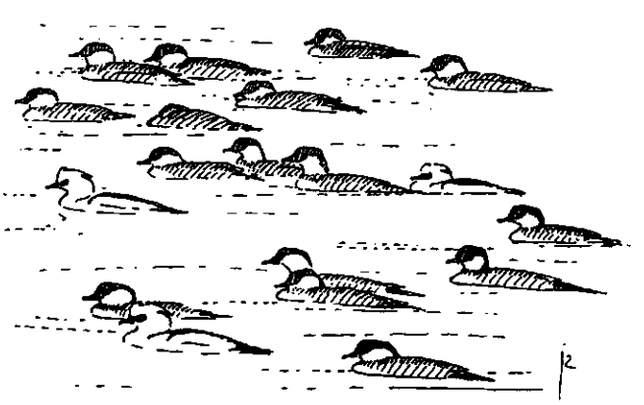
Tijdens de telling werden bijna 1 miljoen (864.393) watervogels geteld, verdeeld over 38 soorten. Van 18 soorten zijn in één of meerdere deeltrajecten aantallen van internationaal belang geteld. De internationale relevantie is hierbij gedefinieerd volgens de normen van de Ramsar-Conventie, wat inhoudt dat minimaal 1% van de geografische populatie in een gebied aanwezig moet zijn. Onder de talrijke soorten bevinden zich vooral planteneters (herbivoren), zoals Kolgans (222.364), Meerkoet (134.544), Wilde Eend (105.372) en Smient (95.594). Tot de andere belangrijke soorten in deze groep kunnen worden gerekend: Brandgans (21.773), Grauwe Gans (10.603), Wintertaling (10.084), Rietgans (9.986), Krakeend (9.814), Kleine Zwaan (2.879). Herbivoren concentreren zich vooral in het Niederrhein-gebied in Duitsland en Nederland en worden daar met name aangetroffen op de graslanden in de uiterwaarden. Door beschermende maatregelen en verbetering van de voedselkwaliteit zijn veel van deze soorten in de afgelopen decennia in aantal toegenomen.

Een verhaal apart is de Krooneend (2.992). Deze soort wordt vrijwel uitsluitend aangetroffen in de Bodensee. De populatie Krooneenden is door de afname van waterplantvegetaties als gevolg van eutrofiëring, gedurende de afgelopen decennia achteruit gegaan. Recente verbeteringen in waterkwaliteit en herstel van waterplantvegetaties hebben deze trend stopgezet en tegenwoordig worden weer toenemende aantallen gemeld.

Tot de talrijke soorten behoren verder Kuifeend (132.688) en Tafeleend (60.317), beide soorten die van macrofauna leven (benthivoren). Hun voorkomen wordt vooral gestuurd door de aanwezigheid van de Driehoeksmossel *Dreissena polymorpha*, waarvan de grootste biomassa wordt gevonden in het gebied van de Bodensee. De grootste aantallen Kuif- en Tafeleenden zijn dan ook in dit gebied waargenomen (resp. 69.856 en 37.658). Het verschijnen van de Driehoeksmossel in de Bodensee aan het eind van de jaren zestig en in de Niederrhein in de jaren zeventig heeft een sterk positief effect gehad op de aantalsontwikkeling van deze soorten. In mindere mate heeft de Meerkoet van deze ontwikkeling geprofiteerd, hoewel deze soort in grote delen van het stroomgebied vooral plantaardige voedselbronnen benut. Talrijk waren ook Brilduikers (8.267). Deze soort is nauwelijks afhankelijk van Driehoeksmosselen, en voedt zich vooral met andere kleine molluscen, kreeftachtigen en insektenlarven.

Viseters (piscivoren) komen relatief gezien weinig voor en worden vooral vertegenwoordigd door Fuut (12.584) en Aalscholver (12.377). Deze concentreren zich vooral op grotere wateroppervlakken zoals grindgaten en stuwmeren (Niederrhein, Oberrhein) en in de Bodensee. Ook bij deze soorten heeft zich een toename voorgedaan, die vooral is ingegeven door veranderende vispopulaties als gevolg van eutrofiëring van de Europese wateren in de jaren zeventig en tachtig.

De resultaten van de soorten afzonderlijk laten zien dat het voorkomen van watervogels een rol kan spelen bij de evaluatie van maatregelen ter herstel van het oorspronkelijke rivier-ecosysteem. In vergelijking met andere ecologische groepen, zijn resultaten van vogeltellingen ook gemakkelijk in kwantitatieve termen uit te drukken. Ze kunnen daarmee vaak een effectieve rol vervullen bij het signaleren van ontwikkelingen in lagere trofische niveau's. Aanbevolen wordt dan ook om de watervogeltellingen, niet alleen die in januari (slechts een momentopname) maar ook die in de rest van het winterhalfjaar, op te nemen in een internationaal overkoepelend kader binnen het ecologische monitoringprogramma van de Rijn. Daarbij kan geheel worden aangesloten op reeds bestaande telreeksen, waarbij alleen -waar nodig- de nationale coördinatie een bredere basis moet krijgen. Een dergelijke opzet zou een belangrijk extra instrument zijn om bestaand beleid te toetsen en nieuwe maatregelen te sturen.



## 1 Introduction

The River Rhine ranks among the largest river ecosystems in Europe. Its river basin is situated in the most densely populated areas of the continent and includes parts of the national territories of Switzerland, Liechtenstein, Austria, Germany, France, Luxembourg, Belgium and The Netherlands. The river acts as the backbone of the infrastructure for inland shipping in NW-Europe and is an important supplier of drinking water and energy (hydropower). Due to canalization, creation of barrages and embankment of forelands, the river has lost most of its hydrodynamics during the last centuries, and has become entirely controlled by man nowadays. Especially during the 1960s, the Rhine gained a notorious reputation as "the sewer of Europe", being mainly the result of the input of large quantities of chemical and organic compounds by industrial, communal and agricultural waste. The Rhine ended up in a heavily polluted and highly eutrophicated ecosystem, reaching rock bottom in the early 1970s. By that time, the need for comprehensive international measures to improve the water quality became clear and much progress to reach this goal has been made since then.

An important task in this international cooperation has been carried out by the International Rhine Commission (IRC; German: 'Internationale Kommission zum Schutze des Rheins', IKSR; French: 'Commission Internationale pour la Protection du Rhin', CIPR). The IRC was already established as early as 1950, but obtained a more effective basis when it became authorised by international law, through the Treaty of Bern in 1963. It consists of representatives of Switzerland, France, Germany, Luxembourg, The Netherlands and the EU and is divided into several working groups. One of its main objectives is to initiate biological and chemical surveys and to develop concepts with respect to the ecological conservation and rehabilitation of the river ecosystem. Major steps have been achieved by the end of the 1980s, with the 'Rhine Action Programme' (IKSR 1987) and the 'Ecological Master Plan for the River Rhine' ('Ökologisches Gesamtkonzept für den Rhein', IKSR 1991), which focus on further improvement of the water quality in the river and the rehabilitation of its ecosystem as a whole.

To support the goals of the IRC, coordinated research has been set up within the so-called Convention Area, being the stretch between the Bodensee and the North Sea. This research is initiated both on national and international level, in order to provide a framework to evaluate different management measures. It concentrates on chemical, physical and biological parameters. The biological

monitoring includes surveys of fish, macro-invertebrates, zooplankton and phytoplankton. Results of the different topics are reviewed once every five years (a so-called 'Stichjahr') and published in a status report ('Statusbericht Rhein'). So far, data have been summarised for 1985 and 1990 (IKSR 1993). The next status report will review the situation in 1995.

Birds have hitherto not been taken into consideration in the current international monitoring programmes. Since many of them act as top-predators in food-webs and show close links to other biological parameters, the monitoring of birds can be very useful for the evaluation of management measures, especially as their presence can be expressed by relatively accurate quantitative data. Moreover, several areas in the Rhine Valley have officially been qualified as Important Bird Areas (IBAs), Ramsar sites or Special Protection Areas (SPAs), due to their international importance for waterbirds (Langeveld 1990). Therefore, the IRC welcomed the initiative of The Netherlands to review the status of wintering waterbirds in the International Rhine Valley, with the option to include the results in the status report for 1995.

In all countries, counts of wintering waterbirds in the Rhine Valley have already been carried out since the 1950s and 1960s (e.g. Suter & Schifferli 1988, Andres *et al.* 1994, Van den Bergh *et al.* 1979). From 1967 onwards, these surveys have been coordinated at an international level, especially the annual January 'mid-winter' counts which are supervised by Wetlands International (formerly International Waterfowl and Wetlands Research Bureau, IWRB). The results of these counts have contributed much to the current knowledge on waterbird populations and their distribution (e.g. Monval & Pirot 1989, Rose 1995) and have initiated the designation of different areas as Important Bird Areas (IBAs), Ramsar Sites or Special Protection Areas (SPAs)(see e.g. Langeveld 1990).

The Institute for Inland Water Management and Waste Water Treatment (RIZA) in The Netherlands commissioned 'SOVON Vogelonderzoek Nederland' to summarise the status of waterbirds in the international Rhine Valley in 1995. For the purpose of this project a close cooperation was set up with the coordinators in the other parts of the Rhine Valley, being the 'Zentrale für die Wasservogelforschung und Feuchtgebietsschutz' in Germany, the 'Office National de la Chasse' and 'Centre d'Etudes Ornithologiques d'Alsace' in France, the 'Schweizerische Vogelwarte' in Switzerland and the Ornithologische Arbeitsgemeinschaft Bodensee in the Bodensee area.

This report presents the number and distribution of waterbirds in the Rhine Valley, i.e. the IRC Convention Area as well as Bodensee and Alpenrhein, in January 1995 and summarises the present knowledge on occurrence patterns and trends. First, a general description of the Rhine Valley and the organisation and methods of the census work is given. The results are presented in chapter 3, both on a general level and by separate species accounts. Finally, the results of the January 1995 count are reviewed with respect to international relevance and population trends and their use in monitoring schemes is discussed.

# 2 Methods

## 2.1 Introduction

During the conference 'Anatidae 2000', organised by Wetlands International, in Strasbourg in December 1994, the national coordinators of the four participating countries agreed on a joint project proposal which described the common use of the data and the general outline of the status report. For this pilot-project, it was decided to use mainly data of the January 1995 count. During this census, all stretches along the Rhine were counted as part of the international mid-winter waterbird census (IWC), organised by Wetlands International. The species taken into consideration include most waterbird species, such as divers *Gaviidae*, grebes *Podicipedidae*, swans, geese and ducks *Anatidae*, as well as Cormorant *Phalacrocorax carbo* and Coot *Fulica atra*.

## 2.2 General description of the Rhine Valley

From the origin in the eastern part of Switzerland to the mouth near Rotterdam in The Netherlands the Rhine reaches a length of just over 1300 km. The entire river basin covers approximately 189.000 km$^2$ (Figure 1) and is mainly situated in Germany (57%), Switzerland (15%), The Netherlands (13%) and France (12%). Besides the mainstream, numerous tributaries exist, the most important ones being the Aare in Switzerland and the Neckar, Mosel, Main and Ruhr in Germany. In The Netherlands the Rhine branches off into three different streams: Waal, Nederrijn/Lek and IJssel, which end up in Lake IJsselmeer (IJssel) or North Sea (Waal, Nederrijn/Lek).

Geomorphological and hydrological characters split the Rhine Valley into five parts, which are commonly used to describe the area (see e.g. IKSR 1989; Figure 1). The first part is the so-called 'Alpenrhein'. From their springs in the centre of the Alps, the 'Vorderrhein' and 'Hinterrhein' flow northwards and join into one river, which marks the border of Switzerland with Liechtenstein and Austria, before entering the Bodensee (Lake of Constance). The Bodensee is one of the largest waterbodies in Central Europe (540 km$^2$). Its average depth varies from 100m in the so-called 'Obersee' (the main part) to 13m in the 'Untersee', the western part of the lake which is divided from the

'Obersee' by a narrow river stretch at Konstanz. Especially the 'Untersee' holds many shallow and sheltered areas. After the Bodensee the 'Hochrhein' starts. Here, the landscape is dominated by a range of low hills which are largely in agricultural use. Especially along the upper part, till the junction with the river Aare, the banks are natural and partly wooded. The character of the river ranges from fast currents to mainly standing water, the latter as a result of several barrages which are used for hydropower.

Downstream of Basel the river is called 'Oberrhein' and marks the border between the French departments Haut-Rhin and Bas-Rhin and Baden-Württemberg in Germany. At this point the Rhine also becomes navigable. Originally, the 'Oberrhein' was known for its large floodplain and system of side-channels and extensive, partly wooded forelands. Nowadays, this part is canalised to a large extent and characterised by the presence of numerous (10) barrages, built from 1932 onwards, between Kembs and Iffezheim. From Village-Neuf (near Basel) to Breisnach an entirely artificial canal, 'le Grand Canal d'Alsace', has been created, running parallel to the old mainstream. From the former channel-system only some small relicts remain. The surrounding landscape is mainly agricultural. In the vicinity of the river several gravel pits (so-called 'Kiesseen' or 'Gravières') and reservoirs are found. Two of the larger tributaries flow into the 'Oberrhein'; the Neckar at Mannheim and the Main near Mainz.

At Bingen, just west of Mainz, the Rhine becomes the 'Mittelrhein' and flows into a rather narrow Valley in the Hunsrück-Taunus region, a mountainous area in Rheinland-Pfalz and Hessen. Forelands and side-channels hardly occur here and the riverbed itself is mainly natural, although the channel has been dredged, providing better opportunities for shipping. In the northern part of the area, from Koblenz to Bonn, some smaller forelands exist. In Koblenz, the Rhine is joined by its largest tributary, the Mosel.

Near Bonn the Rhine Valley becomes much wider, and here the 'Niederrhein' starts, which continues through the lowlands towards its mouth in The Netherlands. The German part of the 'Niederrhein' is partly dominated by the highly urbanised and industrialised Ruhr-area, including cities like Köln, Düsseldorf and Duisburg. Especially downstream of Duisburg extensive forelands can be found, which are mainly in agricultural use. Furthermore, this part of the Rhine Valley is characterised by gravel and clay pits and mining.

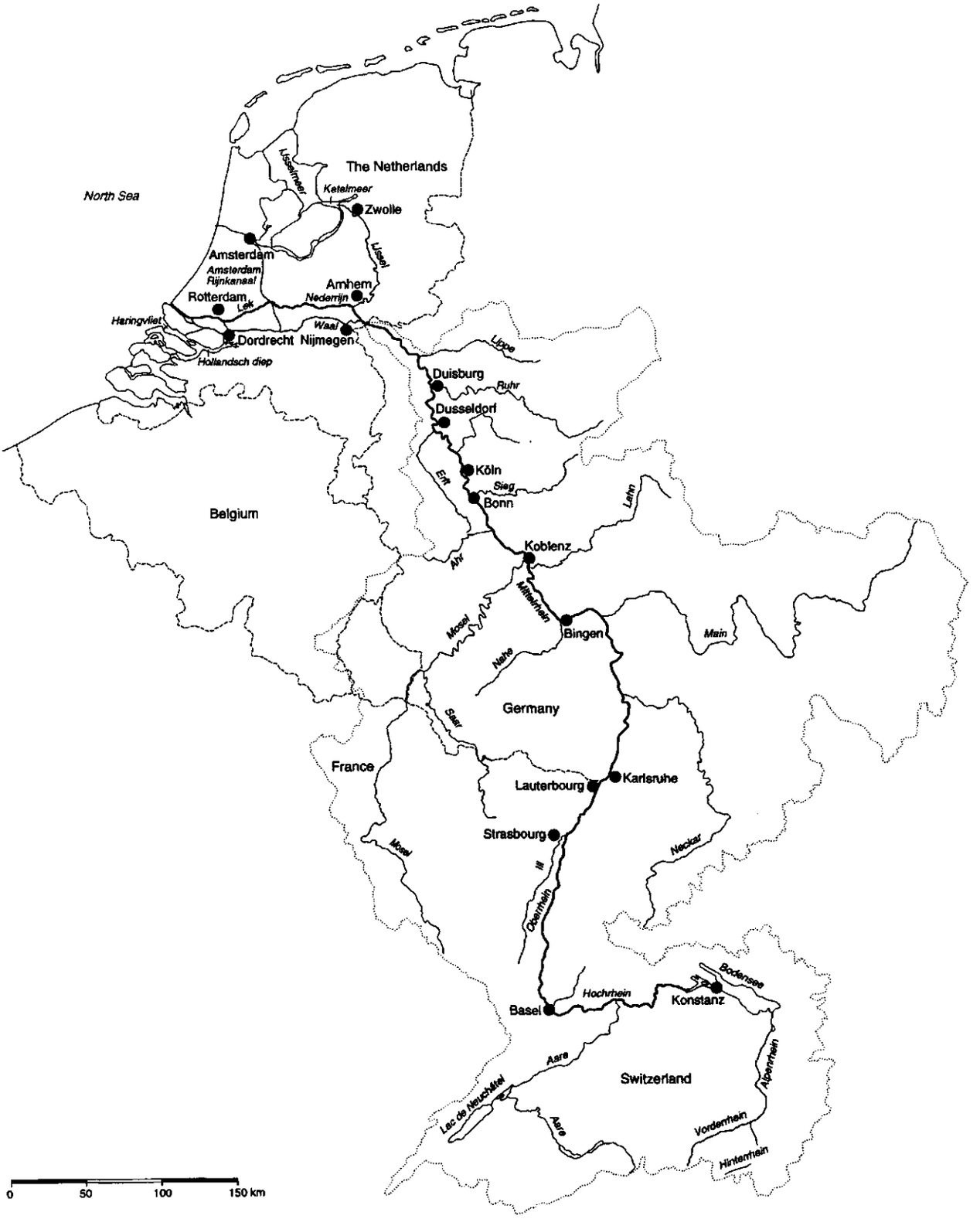



Figure 1. The river basin of the Rhine, showing the main tributaries and the different stretches according to geomorphological and hydrological characters.

Just after arrival in The Netherlands, near Nijmegen/Arnhem, the river branches into three different streams. One of these, the River IJssel, is flowing further north and ends up in the area of Lake IJsselmeer, near the city of Kampen. The others, Waal and Nederrijn/Lek continue further westward, towards Rotterdam. In the Nederrijn/Lek 3 barrages were built. In Tiel, the Amsterdam-Rijn kanaal starts, connecting both rivers with Amsterdam. Near Dordrecht, both rivers end in a junction of different rivers, flowing further downstream to the North Sea, through the estuaries of the northern Delta area (Hollandsch Diep/Haringvliet) and the harbour area of Rotterdam. Between Rotterdam and the North Sea, an artificial open connection exists (Nieuwe Waterweg). The Haringvliet and Hollandsch Diep (including the Biesbosch) are former tidal freshwater estuaries, which lost their dynamic characters in 1971 when the creation of the Haringvliet-dam in 1971 cut them off from the North Sea. Currently, experiments in water-management are being carried out to allow some tidal influence again.

The landscape surrounding the Dutch part of the Rhine and its branches mainly consists of agricultural areas. The river is entirely embedded by dikes, leaving forelands which are often flooded during exceptional high water tables only. In the forelands several clay and sand pits have been excavated. Near Dordrecht the landscape becomes highly dominated by the urban and industrial environment of Rotterdam and its suburbs, changing again into a more agricultural area further southwest along the Hollandsch Diep/Haringvliet.

In the context of the 'Ecological Rehabilitation of the Rivers Rhine and Meuse', much effort is being undertaken to develop outlines for a more natural floodplain along the Dutch rivers, in order to enhance the original dynamics in the forelands, e.g. by digging side-channels (De Bruin *et al.* 1987, WWF 1993). Similar plans are also developed in Germany and Switzerland.

## 2.3 Fieldwork and organisation

In many areas within the Rhine Valley, waterbirds are counted once every month between September and April (Table 1). Most of the actual fieldwork is carried out by volunteers, often operating in small groups with a regional coordinator. All together some 250 people participate in the counts. At least the data of the international mid-winter count are processed on a national level. For Switzerland this task is carried out by the 'Schweizerische Vogelwarte Sempach' (L. Schifferli), for France by the 'Office National de la Chasse' (G. Delacour) and the 'Centre d'Etudes Ornithologiques d'Alsace' (G. Dronneau & B. Wassmer), for Germany by the 'Zentrale für Wasservogelforschung und Feuchtgebietsschutz in Deutschland' (C. Sudfeldt) and for The Netherlands by 'SOVON Vogelonderzoek Nederland' (M. van Roomen). Counts in the Bodensee area, which includes German, Austrian and Swiss territory, are coordinated by the Ornithologische Arbeitsgemeinschaft Bodensee (H. Jacoby). Table 1 gives a review of the national organisation of the waterbird surveys.

Table 1. General organisation of bird counts in the Rhine Valley.
Coverage: + all areas surveyed each month; - only important areas surveyed each month but all surveyed in January.

| country/area | period & coverage | | coordinator |
|---|---|---|---|
| Bodensee[1] | Sep - Apr | + | Orn. Arbeitsgemeinschaft Bodensee |
| Switzerland[2] | Sep - Apr | - | Schweizerische Vogelwarte Sempach |
| France | Nov - Mar | + | Centre d'Etudes Ornithologiques d'Alsace/ Office National de la Chasse |
| Germany | Sep - Apr | - | Zentrale für Wasservogelforschung und Feuchtgebietsschutz in Deutschland |
| Netherlands | Sep - Apr | + | SOVON Vogelonderzoek Nederland |

[1] including German, Austrian and Swiss territory

[2] including Liechtenstein

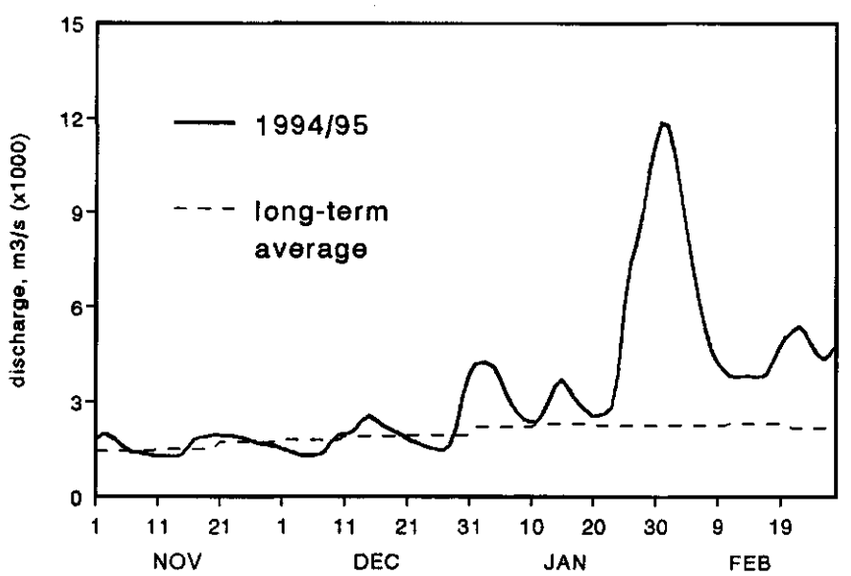



Figure 2. Discharge (in $m^3/s$) at Lobith, (Niederrhein, The Netherlands) between November 1994 and March 1995. Shown are average daily values and long-term averages (data RIZA).

In January 1995 almost all survey areas along the Rhine were counted in the period as determined by Wetlands International, being the weekend of 14/15 January. Only 3% of the sites were surveyed on other dates between 7 and 22 January. Counts were conducted during daytime. Only geese in France were counted at night-roosts. In general, the count was carried out in favourable weather conditions, without any major areas covered by ice. Only in the Niederrhein area some observers indicated poor visibility cased by fog. In the weeks before the count no exceptional weather conditions occurred (data Koninklijk Nederlands Meteorologisch Instituut, KNMI). From the beginning of January onwards, the discharge of water (and watertables) were higher than average, cumulating in the exceptional high floods by the end of this month and in February (Figure 2).

Except for 3 (out of 9) areas along the Alpenrhein and the whole stretch between Bonn and Bingen (Mittelrhein), the entire Rhine Valley (tributaries excluded) was covered during the count. The area between Bonn and Bingen only holds small numbers of waterbirds and is therefore not taken into account in the German survey. For the purpose of bird census work, the Rhine is divided into several small count units, covering in most areas stretches up to a few kilometres of the river (Table 2). Often both river banks are counted separately. Along the Oberrhein and Niederrhein, also side-channels, forelands, embankments (polders) and isolated branches are counted. These areas are mainly situated in the (former) winterbed of the river. In Germany and France also various so-called 'Kiesseen' (gravel pits) and reservoirs within approximately 5 km distance of the riverbed are surveyed. These areas may hold considerable numbers of waterbirds which use it as a roost during daytime and feed in the Rhine at night. Because of this interaction they are included in the counts. In The Netherlands observers are requested to restrict their counts to the area between the dikes, i.e. the current floodplain of the river. Also included in the German part is the entire Bodensee. The small count units have been lumped into main survey areas for data processing and presentation of the results (Table 2, Figure 3). These large units were assigned by the national coordinators.

A large part of the survey areas is rather well accessible and easy to count with binoculars and/or a telescope. Observations were made either from a car or by foot/bicycle. The species considered often can be well detected as they gather in flocks. Nevertheless, on several occasions birds can easily be missed, especially when their appearance or behaviour is less conspicuous, e.g. the smaller grebes or dabbling ducks hiding in reedbeds. Flocks of waterbirds, especially swans and geese, often disperse over large areas during consecutive days. Since the January 1995 count was mainly carried out during two days, the impact of this behaviour will be marginal.

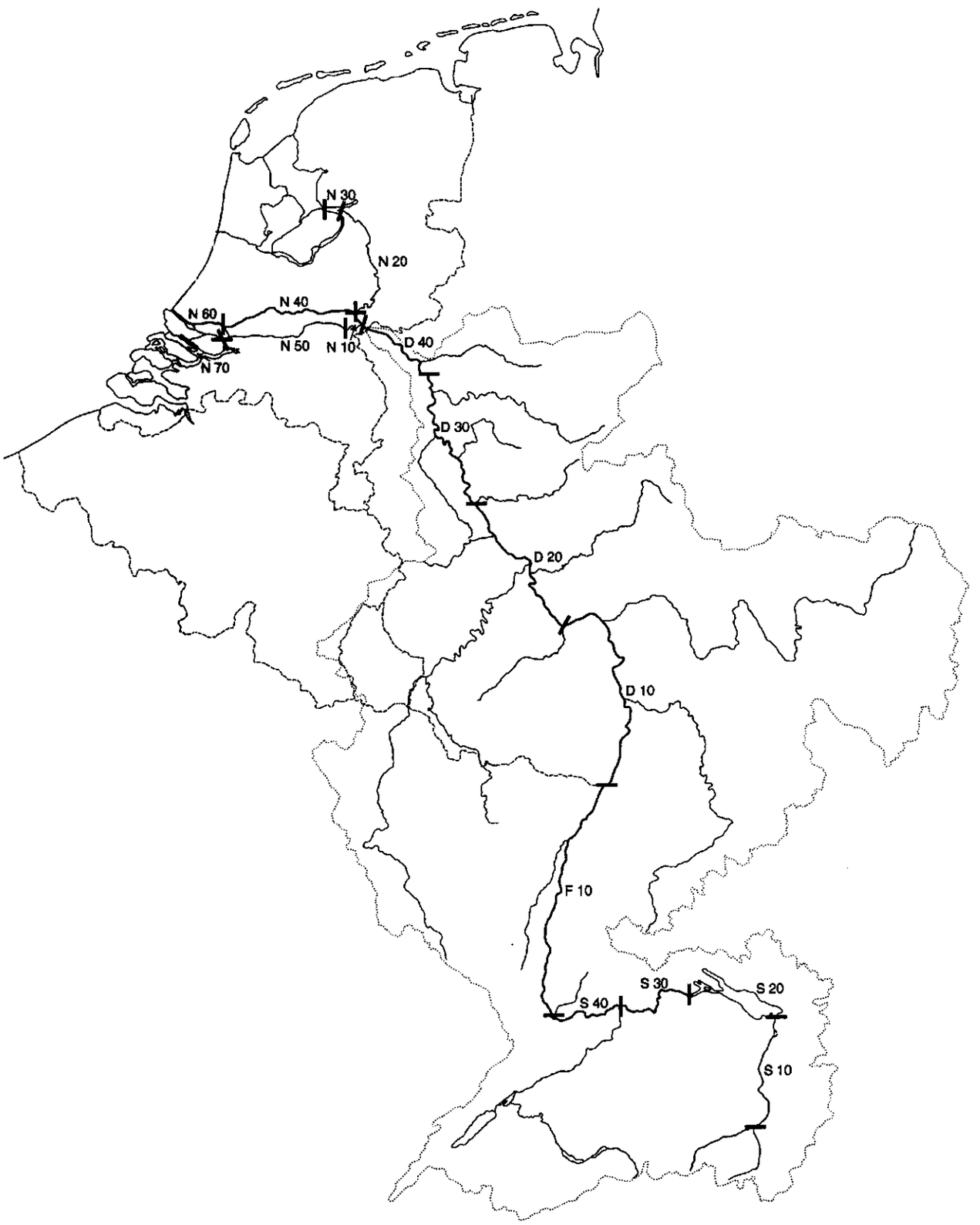



Figure 3. The Rhine Valley and situation of the main survey areas. Numbers indicate the stretch according to those listed in Table 2.

## 2.4 Data processing

Before field data are being processed, they often already have gone through several different stages, starting with the observers' notebook and ending up in a computer file or table. Except for France, all data were processed on a national level and stored into databases (dBase, Paradox). For France the data were computerised at SOVON. After receipt of all data, two related Paradox databases have been set up, one containing information on the survey area, date and observer, the other storing species and number of birds counted in each survey area. The database contains information on both the level of the small count units (Switzerland, The Netherlands) and the scale of main survey areas (France, Germany).

Table 2. System of survey areas used in the Rhine Valley for counts of waterbirds. Km indicates the kilometre marker along the river. The numbers given for the main survey areas correspond to those shown in Figure 3.

| Stretch | Country | Main survey area used for presentation of the data | Number of small count units |
|---|---|---|---|
| Alpenrhein | Switzerland/Liechtenstein | S10 Reichenau - Rheinecke | 9 |
| Bodensee | Switzerland/Germany/Austria | S20 Bodensee/Untersee | 79 |
| Hochrhein | Switzerland/Germany | S30 Rheinklingen - Aare junction, km 32 - km 103 | 12 |
| | | S40 Aare junction - Basel, km 103 - km 165 | 11 |
| Oberrhein | Germany/France | F10 Basel - Lauterbourg, km 165 - km 349 | 22 |
| | Germany | D10 Lauterbourg - Bingen, km 349 - km 530 | 13 |
| Mittelrhein | Germany | D20 Bingen - Bonn, km 530 - km 654 | - |
| Niederrhein | Germany | D30 Bonn - Walsum, km 654 - km 791 | 17 |
| | Germany | D40 Walsum - German/Dutch border, km 791 - 864 | 73 |
| | Netherlands | N10 Gelderse Poort, km 864 - km 879/885 | 9 |
| | | N20 IJssel, Westervoort - Ketelhaven, km 879 - km 1006 | 21 |
| | | N30 IJsseldelta, Ketelmeer | 1 |
| | | N40 Nederrijn/Lek, Arnhem - Krimpen a/d Lek, km 879 - km 989 | 20 |
| | | N50 Waal, Nijmegen - Woudrichem[1], km 885 - km 985 | 30 |
| | | N60 Rijnmond/Rotterdam[2], km 989 - km 1006 | 23 |
| | | N70 Biesbosch/Hollandsch Diep/Haringvliet[3] | 22 |

[1] including Waal, Boven Merwede, Beneden Merwede, Noord.
[2] including Dordtse Kil, Oude Maas, Spui, Nieuwe Maas, Nieuwe Waterweg/Calandkanaal, Hartelkanaal, Botlek.
[3] including Sliedrechtse Biesbosch, Dordtse Biesbosch, Brabantse Biesbosch, Nieuwe Merwede, Amer, Hollandsch Diep, Haringvliet.

## 3 Results

### 3.1 General results

A total of 38 species and nearly 1 million (864,393) birds were recorded during the January 1995 waterbird survey of the international Rhine Valley (Table 3, Appendix 1). White-fronted Goose (222,364), Coot (134,544), Tufted Duck (132,688), Mallard (105,372), Wigeon (95,594) and Pochard (60,317) were the most abundant species and represent 87% of the grand total.

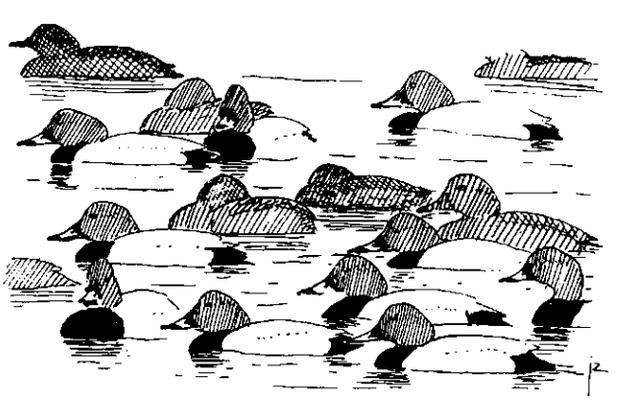
The population of waterbirds present in the area in January is dominated by herbivorous species (73% of the grand total)(for classification in food groups see Appendix 2). Almost all abundant species (geese, dabbling ducks) belong to this group, of which a majority feeds on grass in forelands. Benthivores, feeding mainly on benthos (predominantly Zebra Mussels *Dreissena polymorpha*), are less abundant (23% of the grand total) and represented mainly by two species: Pochard and Tufted Duck. Piscivorous species are a minority and only reported in relatively small numbers (4% of the grand total). Great Crested Grebe and Cormorant have the largest share in this group.

The composition of species and the numbers recorded varies between the different areas (Table 3, Figure 4). A large concentration of waterbirds was found on the Bodensee (205,867 birds, 24% of the grand total). The diversity in species (33) and numbers observed here, reflect the various habitats in this area. The population of waterbirds is characterised by benthivorous species like Tufted Duck (69,856) and Pochard (37,658). Moreover, large numbers of Coot (58,400) were recorded. These birds are attracted by the large biomass of Zebra Mussels *Dreissena polymorpha* and can be found in particularly large numbers in the relatively shallow Untersee (Suter 1982). Remarkable is also the high figure for Goldeneye (6,425), for which the Bodensee is one of the main wintering areas in central Europe. The proportion of herbivorous waterbirds on the Bodensee is artificial, since Coot have been categorised as herbivores, but do feed extensively on *Dreissena* in this area (Suter 1982). In fact, Coot included, benthivores represent 83% of the birds counted, whereas only 12% belong to herbivorous species. Although present in relatively small numbers, fish-eating species like Little Grebe (800), Great Crested Grebe (6,638), Black-necked Grebe (429) and Goosander (430) are more numerous in the Bodensee area than in other stretches. Besides, a local speciality for the Bodensee is the Red-crested Pochard (2,959 individuals, 99% of the total).

Table 3. Species and numbers of waterbirds counted in different sections of the international Rhine Valley in January 1995. Also indicated is the number of main survey areas for each section. The Mittelrhein was not covered during the survey.

| | Alpen-rhein[1] | Hoch-rhein | Ober-rhein | Nieder-rhein | Total |
|---|---|---|---|---|---|
| Number of main survey areas | 2 | 2 | 2 | 9 | 16 |
| Red-throated Diver | 9 | - | 8 | 4 | 21 |
| Black-throated Diver | 32 | - | - | - | 32 |
| Little Grebe | 810 | 358 | 416 | 122 | 1,706 |
| Great Crested Grebe | 6,638 | 157 | 2,504 | 3,285 | 12,584 |
| Red-necked Grebe | 61 | - | 8 | 2 | 71 |
| Slavonian Grebe | 4 | - | - | 2 | 6 |
| Black-necked Grebe | 429 | - | 1 | - | 430 |
| Cormorant | 1,300 | 521 | 6,444 | 4,112 | 12,377 |
| Mute Swan | 1,504 | 343 | 1,082 | 1,719 | 4,648 |
| Bewick's Swan | 3 | - | - | 2,876 | 2,879 |
| Whooper Swan | 270 | - | - | 330 | 600 |
| Bean Goose | - | - | 1,303 | 8,683 | 9,986 |
| White-fronted Goose | - | - | 7 | 222,357 | 222,364 |
| Greylag Goose | - | - | 419 | 10,184 | 10,603 |
| Canada Goose | 17 | - | - | - | 17 |
| Barnacle Goose | - | - | - | 21,773 | 21,773 |
| Egyptian Goose | - | - | 2 | 700 | 702 |
| Shelduck | 11 | 2 | 1 | 177 | 191 |
| Wigeon | 235 | 212 | 1,307 | 93,840 | 95,594 |
| Gadwall | 2,756 | 599 | 3,770 | 2,689 | 9,814 |
| Teal | 2,426 | 155 | 1,997 | 5,506 | 10,084 |
| Mallard | 13,553 | 2,942 | 25,764 | 63,113 | 105,372 |
| Pintail | 227 | - | 21 | 284 | 532 |
| Shoveler | 316 | 1 | 12 | 135 | 464 |
| Red-crested Pochard | 2,959 | 25 | 7 | 1 | 2,992 |
| Pochard | 37,669 | 3,035 | 5,602 | 14,011 | 60,317 |
| Ferruginous Duck | 4 | 2 | - | - | 6 |
| Tufted Duck | 69,894 | 5,685 | 15,495 | 41,614 | 132,688 |
| Scaup | 136 | 2 | 12 | 6 | 156 |
| Eider | 29 | - | 5 | 1 | 35 |
| Long-tailed Duck | 1 | - | - | - | 1 |
| Common Scoter | 13 | - | - | - | 13 |
| Velvet Scoter | 21 | - | 5 | - | 26 |
| Goldeneye | 6,429 | 178 | 957 | 703 | 8,267 |
| Smew | 13 | 1 | 50 | 460 | 524 |
| Red-breasted Merganser | 22 | - | - | 118 | 140 |
| Goosander | 458 | 56 | 297 | 1,023 | 1,834 |
| Coot | 58,405 | 1,939 | 13,297 | 60,903 | 134,544 |
| number of species | 33 | 19 | 28 | 31 | 38 |
| all species | 206,654 | 16,213 | 80,793 | 560,733 | 864,393 |

[1] including Bodensee



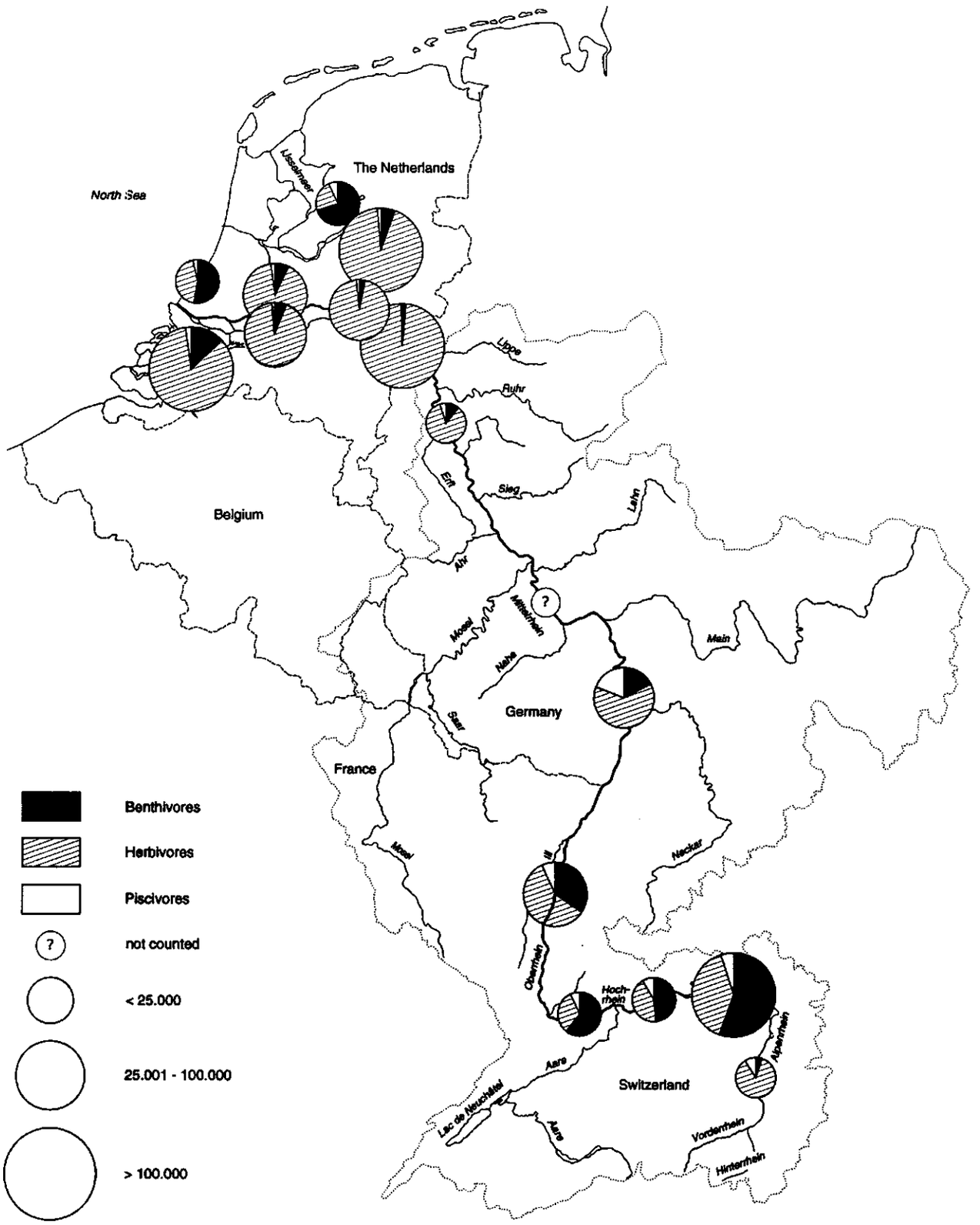



Figure 4. Distribution of waterbirds in the Rhine Valley in January 1995 according to food preference. The size of the pies indicates the total number of birds present.

Further downstream, along the Hochrhein, benthivores still dominate, but the numbers recorded here are far less compared to the Bodensee. In fact, both number of species and total number of waterbirds are the lowest among all stretches: 19 species and only 2% of the grand total. Tufted Duck (5,685), Pochard (3,035) and Mallard (2,942) are the most numerous species observed.

At the Oberrhein overall numbers were larger (9% of total) and the species-composition shifts towards herbivores, especially as a result of large numbers of Mallard (25,764). In this area also relatively large numbers of piscivores such as Cormorant (6,444) and Great Crested Grebe (2,504) were seen. This pattern can be attributed to some extent to the reservoirs which are situated in this area (Andres *et al.* 1994). These may hold a large biomass of fish (especially in winter) and have a higher water transparency compared to the river. Water transparency is important to fish-eating species as they detect their prey by eye.

Along the Niederrhein, more than half (65%) of the total of waterbirds in the entire Rhine Valley was counted. The extensive floodplain in this area supports very large numbers of herbivorous waterbirds (88% of the population present in the Rhine Valley). The majority of these consists of species which feed on the (wet) pastures situated in the forelands, like Bewick's Swan (2,876), Bean Goose (8,683), White-fronted Goose (222,357), Greylag Goose (10,184), Wigeon (93,840), Mallard (63,113) and Coot (60,903). For some of these species, the Niederrhein is also situated in the core area of their winter range (e.g. White-fronted Goose, Wigeon). Benthivores in this part mainly concentrate in the delta areas at Biesbosch, Hollandsch Diep and Haringvliet (Tufted Duck) and Lake Ketelmeer (Pochard, Tufted Duck). Compared to the river branches, these stretches contain slow- flowing and relatively shallow water and hold a large biomass of *Dreissena*.

## 3.2 Species accounts

In this chapter the results of the survey in January 1995 are described for each species separately. Only the most abundant species (in general > 500 individuals observed) are included. These species accounts are divided into three sections. First, background information is given on breeding and wintering areas, population size and trends in populations, based on information given by Cramp & Simmons 1977, Cramp & Simmons 1980, Rose & Scott 1994 and Rose 1995. In the second section, a short review of numbers, seasonal patterns, trends, as well as other relevant findings is given for the Rhine Valley. Details for this summary are taken from Van den Bergh *et al.* 1979, Schuster *et al.* 1983, Hölzinger 1987, SOVON 1987, Suter & Schifferli 1988, Schifferli 1992, Schifferli 1993, Andres *et al.* 1994, Van Roomen & Van Winden 1994, SOVON Ganzen- en Zwanenwerkgroep 1994, Bauer *et al.* 1995 and Voslamber *et al.* 1996. References are only quoted in the text when referring to sources other than the ones mentioned above. The final section actually presents the results of the count in January 1995. These are shown on the scale of main survey areas (see 2.3, Table 2) and compared to those of the 1970s and 1980s.

**Little Grebe** *Tachybaptus ruficollis*

Little Grebes breed in large parts of western and central Europe and the Mediterranean. Northern and eastern breeders migrate into central and southern Europe, while others may stay within their breeding range and disperse to favourable wintering sites. The population in the Western Palearctic is estimated at >100,000 individuals. In many regions numbers have decreased during the last decades.

Within the whole range of the Rhine Valley, the species may be found as a breeding bird. Wintering numbers generally peak in December/January (Netherlands, France), but on the Bodensee highest counts are made during migration in October-November. Within the Rhine Valley, local changes in this pattern may occur due to severe winter conditions, when especially the northern range of the area is partly abandoned. Exceptionally cold winters like 1962/63 also may cause a mass mortality (e.g. Leuzinger 1966, 80% reduction in numbers present in northern Switzerland). A long-term decline in wintering numbers is reported from the Oberrhein, though in the late 1970s and the 1980s the population has remained on a stable level here. For Switzerland, Suter & Schifferli (1988) have reported a 41% decline in wintering numbers between 1967 and 1988. At the Bodensee the population has decreased in the late 1980s. It is suspected that reduced stocks of cyprinid fish *Cyprinidae* might have contributed to this trend.

During the January count in 1995 1,706 Little Grebes were observed (Figure 5). The largest concentration was found on the Bodensee (800) and along the upper part of the Hochrhein and the southern Oberrhein (285 and 344 respectively). Along the Niederrhein numbers were relatively low and equally distributed among the different areas. The species prefers "small-scaled" areas which are shallow and provide shelter, e.g. parts of the Untersee at the Bodensee and the "Old-Rhine", along the southern Oberrhein. In comparison to previous years, the numbers counted generally fit in the range of numbers which has been observed during the last decade (Table 4).

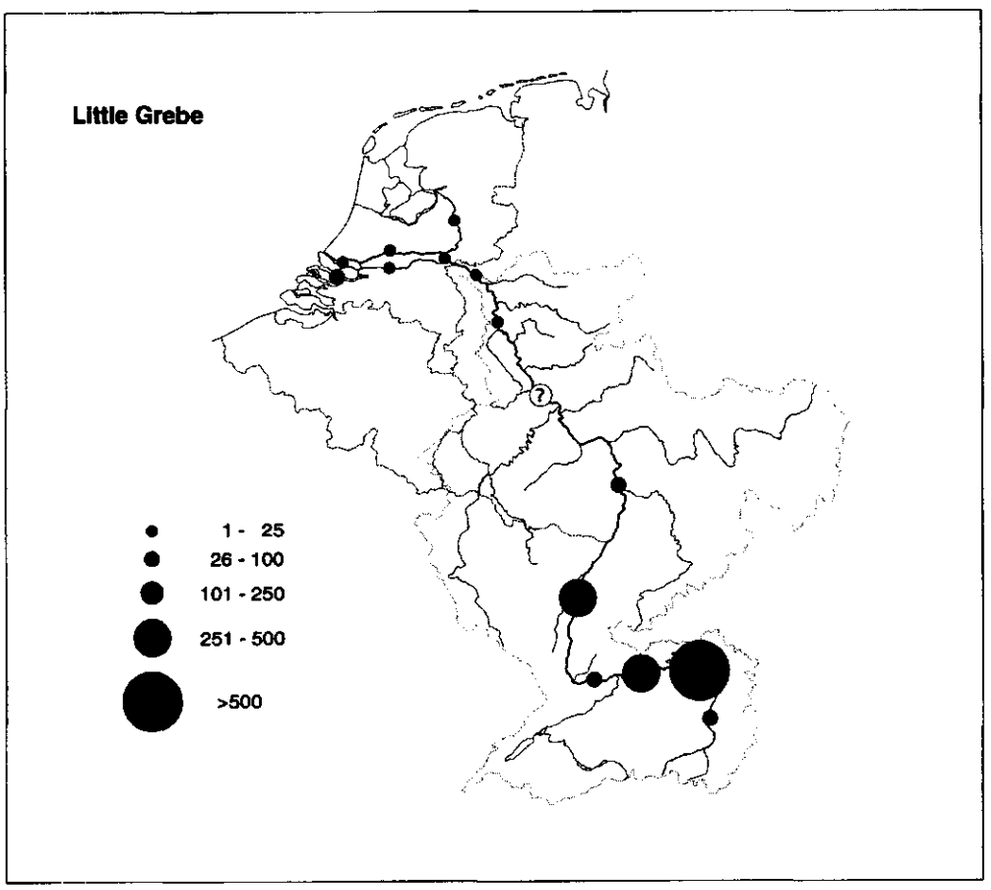



Figure 5. Distribution of Little Grebe in the Rhine Valley in January 1995. Numbers are shown for the main survey areas (see Figure 3, Table 1). The ? marks the Mittelrhein area, which was not counted in January 1995.

Table 4. Numbers of Little Grebes in the Rhine Valley in January. Average, minimum (min.), maximum (max.) and period are given as well as the number counted in January 1995. The sites refer to the main survey areas S20 (Bodensee, Germany, Switzerland & Austria); F10 (southern Oberrhein, France) and N10-N70 (Niederrhein, Netherlands), see Table 2 and Figure 3. Sources: [1] Bauer *et al.* 1995; [2] Andres *et al.* 1994; [3] data from various sources stored at SOVON Vogelonderzoek Nederland.

| Site / Source | Average | Min. | Max. | Period | January '95 |
|---|---|---|---|---|---|
| Bodensee[1] | 863 | | | 1977-86 | |
| | 819 | 630 | 1,066 | 1988-92 | 800 |
| Oberrhein[2] | 289 | 170 | 557 | 1977-91 | 344 |
| Niederrhein[3] | 90 | 24 | 180 | 1980-94 | 91 |

**Great Crested Grebe** *Podiceps cristatus*

The Great Crested Grebe is a common breeding bird throughout the larger part of Europe. In western Europe the species is mainly resident. Populations in the northern and eastern part winter in western and central Europe. The northwest European population counts >100,000 individuals. Overall, numbers have increased during the last decades. Among others, eutrophication of fresh waterbodies and consequently higher fish biomass, have contributed to this increase.

Great Crested Grebes breed in all parts of the Rhine Valley. In some areas (e.g. Bodensee) concentrations may occur during wing-moult in August/September. The seasonal pattern varies considerably between the different parts of the Rhine Valley. On the Bodensee and along the Oberrhein largest numbers are observed in January/February. In these areas, an influx may occur as a result of ice-conditions in the northern part of the wintering area. In the Dutch Niederrhein area, on the other hand, numbers peak during autumn (October) and early spring (March). In winter, Great Crested Grebes in The Netherlands concentrate at large waterbodies such as Lake IJsselmeer and the Delta area. During the last decades wintering numbers in the Rhine Valley generally have remained stable, although yearly fluctuations have occurred according to e.g. winter conditions. At the Bodensee, declining biomass of cyprinid fish *Cyprinidae* is thought to have contributed to the temporary decrease in the wintering population which was reported here in the beginning of the 1980s.

In January 1995 the Rhine Valley held 12,584 Great Crested Grebes (Figure 6). Important concentrations were found on the Bodensee (6,638), the southern Oberrhein (1,776) and the Biesbosch-Haringvliet area (1,008). This pattern is generally explained by the species' preference for large and relatively deep waters, such as the Bodensee (Obersee) and the reservoirs and gravel pits along the Oberrhein and the deltas in The Netherlands (parts of Lake Ketelmeer, Biesbosch, Hollandsch Diep and Haringvliet). In some of these areas a large biomass of wintering fish can be found, while the water is less turbid compared to the river. The Biesbosch-Haringvliet area, as well as Lake Ketelmeer, are situated within the important wintering areas in The Netherlands. Especially on the Bodensee and along the Dutch part of the Niederrhein the figures for January 1995 were higher than averages in the past decades (Table 5).

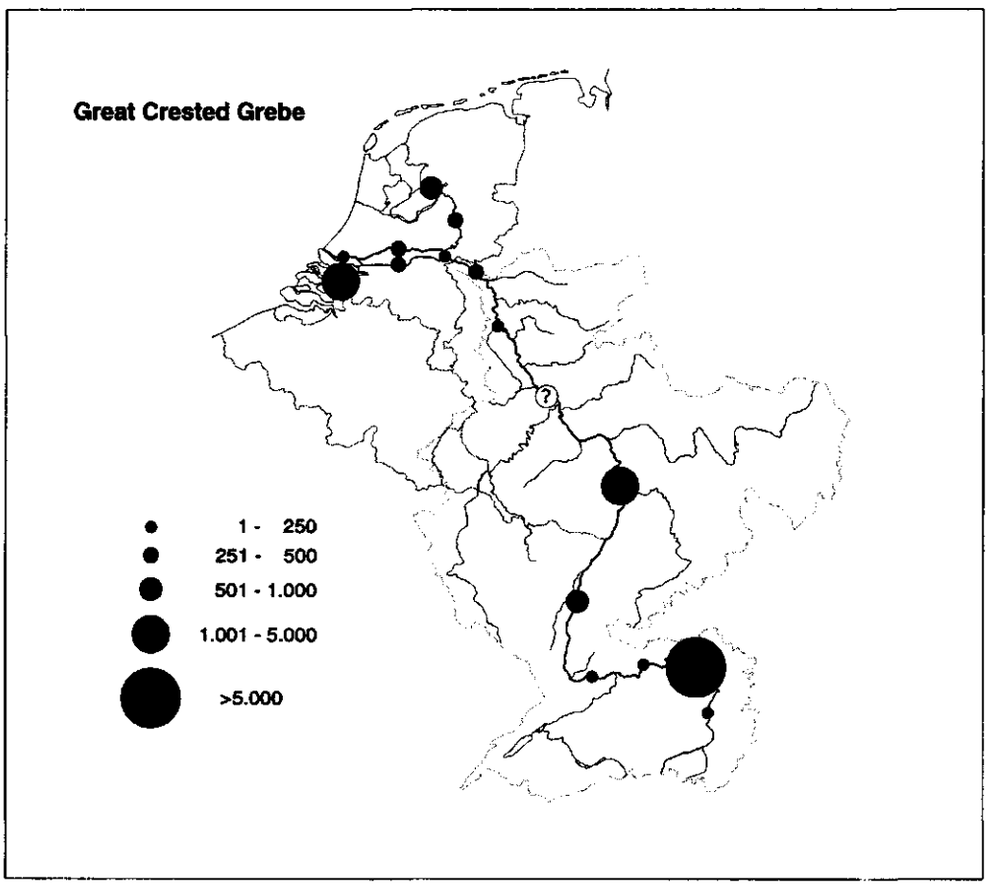



Figure 6. Distribution of Great Crested Grebe in the Rhine Valley in January 1995 (cf. Figure 5).

Table 5. Numbers of Great Crested Grebes in the Rhine Valley in January. Average, minimum (min.), maximum (max.) and period are given as well as the number counted in January 1995. For survey areas taken into account see Table 4. Sources: [1] Bauer *et al.* 1995; [2] Andres *et al.* 1994; [3] data from various sources stored at SOVON Vogelonderzoek Nederland.

| Site / Source | Average | Min. | Max. | Period | January '95 |
|---|---|---|---|---|---|
| Bodensee[1] | 4,238 | | | 1977-86 | |
| | 3,623 | 1,527 | 4,485 | 1988-92 | 6,638 |
| Oberrhein[2] | 666 | 315 | 1,137 | 1977-91 | 728 |
| Niederrhein[3] | 1,215 | 257 | 2,128 | 1980-94 | 2,894 |

**Cormorant** *Phalacrocorax carbo*

Breeding colonies of the continental subspecies *sinensis* are found scattered in eastern and northwestern Europe. Major strongholds are situated in The Netherlands and Denmark (Van Eerden & Gregersen 1995, Lindell *et al.* 1995). Especially since the late 1970s a strong increase has been noticed throughout the entire breeding range. This trend has been attributed to protection measures and eutrophication of many fresh waterbodies, the latter resulting in higher biomass of fish and changing foraging habits of the birds (Van Eerden *et al.* 1995). Recently, the larger colonies tend to level off, or even show declines (e.g. Van Eerden & Zijlstra 1995). The continental *sinensis* population is estimated at 300,000 birds.

In the Rhine Valley, most breeding colonies are found in The Netherlands. Smaller colonies have settled in the areas around the German Niederrhein (Buchheim & Bellebaum 1993) and Oberrhein (Hennig *et al.* 1995). In the Dutch part of the Rhine Valley, highest counts are made on migration in October-November, after which the population remains stable till February. In the area of Oberrhein and Bodensee numbers gradually build up in autumn and reach their maximum in December-February. These stretches have a more pronounced function as a wintering area. All areas within the Rhine Valley have reported a significant increase from the 1970s onwards. Several sites already seem to have reached their carrying capacity, as local numbers remain stable or decrease (e.g. Suter 1995).

The total of Cormorants seen during the 1995 January count is 12,377 (Figure 7). The results presented here only refer to daytime counts. Counts at night roosts generally result in much larger numbers, as Cormorants from various sites, often well away from the Rhine, gather at communal night roosts along the river (see e.g. Andres *et al.* 1994, Hennig *et al.* 1995).

Most Cormorants were present on the Bodensee (1,295) and along the southern and northern Oberrhein (1,864 and 4,580 respectively. At the Niederrhein numbers were much lower and equally spread over the different count units. Like Great Crested Grebe, Cormorants show a preference for large waterbodies within, or close to the riverbed, rather than the mainstream of the river. Numbers in January 1995 were close to the maximum figures in previous January counts (Table 6).

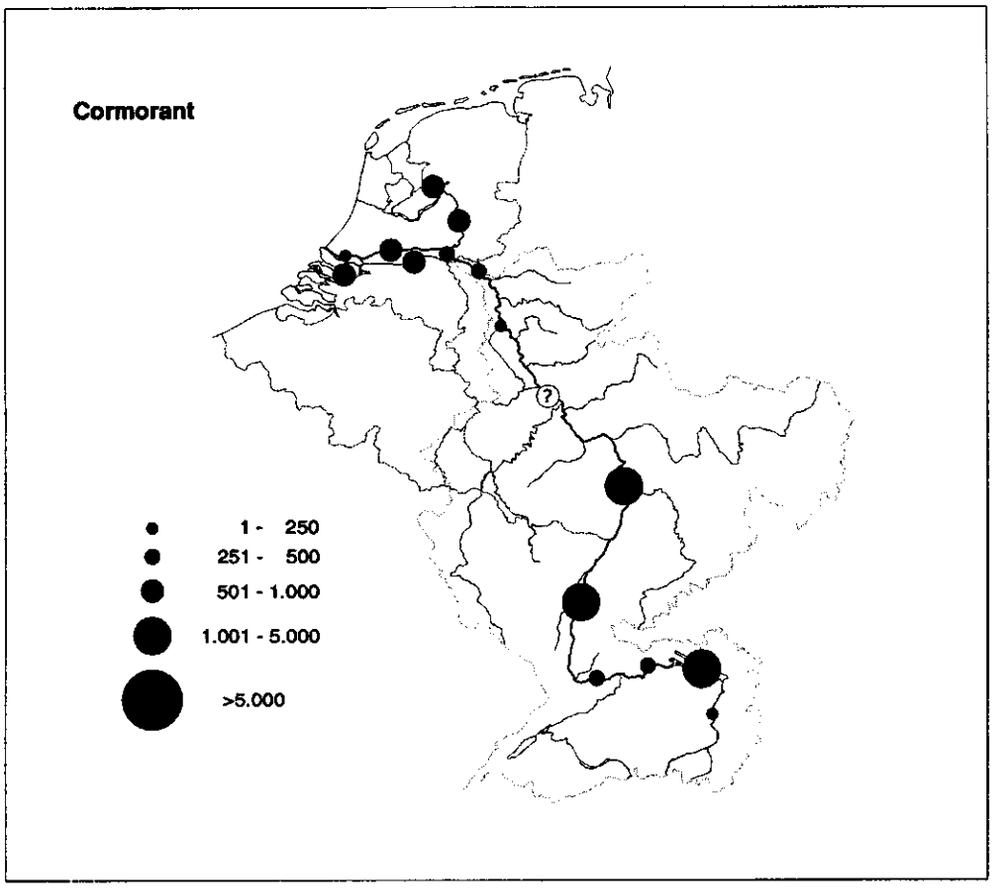



Figure 7. Distribution of Cormorant in the Rhine Valley in January 1995 (cf. Figure 5).

Table 6. Numbers of Cormorants in the Rhine Valley in January. Average, minimum (min.), maximum (max.) and period are given as well as the number counted in January 1995. For survey areas taken into account see Table 4. Sources: [1] Bauer *et al.* 1995; [2] Andres *et al.* 1994; [3] data from various sources stored at SOVON Vogelonderzoek Nederland.

| Site / Source | Average | Min. | Max. | Period | January '95 |
|---|---|---|---|---|---|
| Bodensee[1] | 468 | | | 1977-86 | |
| | 727 | 134 | 1,106 | 1988-92 | 1,295 |
| Oberrhein[2] | 778 | 163 | 1,617 | 1977-91 | 1,864 |
| Niederrhein[3] | 1,864 | 35 | 3,572 | 1980-94 | 3,556 |

**Mute Swan** *Cygnus olor*

The northwest European population of Mute Swans consists of 180,000 birds and is mainly distributed among countries bordering the North Sea and the Baltic. In many areas birds originate from feral populations and are mainly resident throughout the year. Baltic populations are largely migratory. During wing-moult in summer, extensive movements to moulting areas occur. The population level has increased in the past decades, but recently seems to have stabilised.

Breeding Mute Swans can be found in all parts of the Rhine Valley. Larger moult concentrations occur on the Bodensee and in the Haringvliet area where they feed on macrophytes and algae. In most areas the birds are resident and the seasonal pattern shows stable numbers throughout the winter. On the Bodensee and in the Haringvliet area maximum numbers are counted during wing-moult in late summer. In The Netherlands numbers generally tend to be largest in December-February. A pronounced mid-winter peak mainly occurs in ice-winters, when birds concentrate around the rivers. Birds present in the Dutch rivers undertake moult migration to the Delta area and Lake IJsselmeer. The overall population increase is also reported in all ranges of the Rhine Valley. Concentrations of Mute Swans in winter are mainly found on pastures and in flooded forelands. Besides, concentrations occur in urban areas, where they often are fed by humans.

The January 1995 count revealed 4,648 Mute Swans to be present in the Rhine Valley (Figure 8). Only the Bodensee supported a considerable concentration of Mute Swans (1,498), other areas holding numbers up to some hundreds. The results fit in the regular range of numbers seen recently (Table 7).

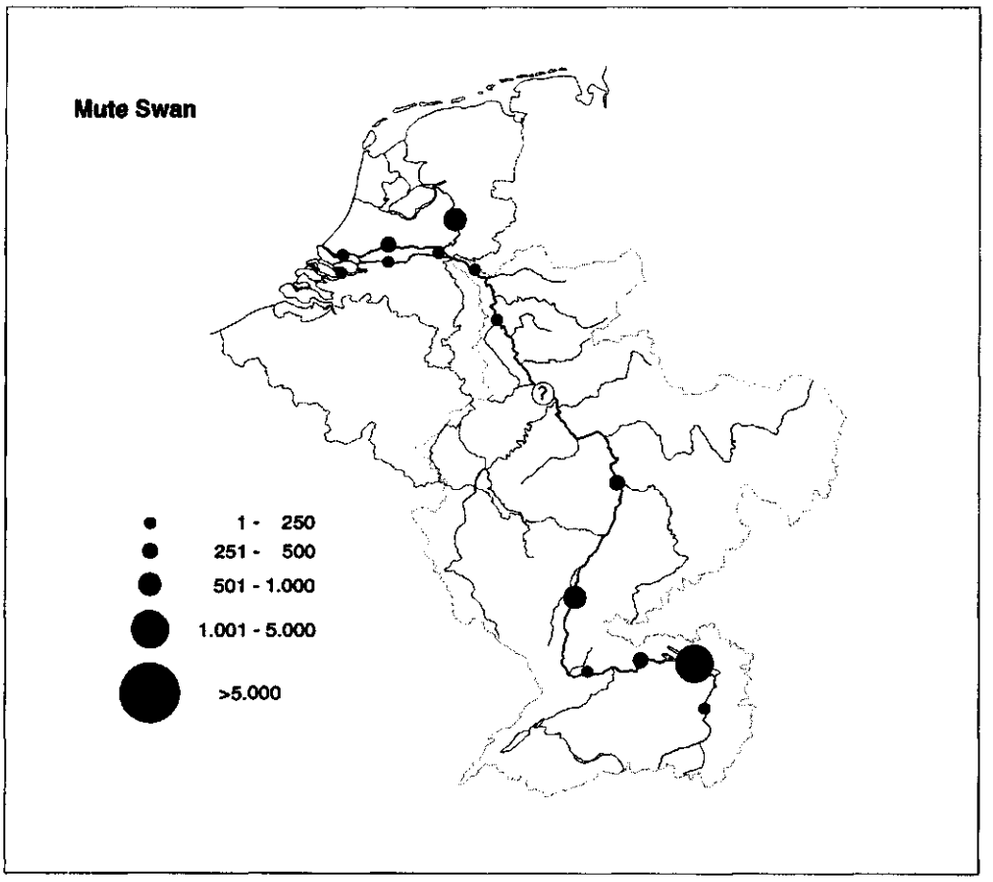



Figure 8. Distribution of Mute Swan in the Rhine Valley in January 1995 (cf. Figure 5).

Table 7. Numbers of Mute Swans in the international Rhine Valley in January. Average, minimum (min.), maximum (max.) and period are given as well as the number counted in January 1995. For survey areas taken into account see Table 4. Sources: [1] Bauer *et al.* 1995; [2] Andres *et al.* 1994; [3] data from various sources stored at SOVON Vogelonderzoek Nederland.

| Site / Source | Average | Min. | Max. | Period | January '95 |
|---|---|---|---|---|---|
| Bodensee[1] | 1,022 | | | 1977-86 | |
| | 1,382 | 1,158 | 1,602 | 1988-92 | 1,498 |
| Oberrhein[2] | 342 | 176 | 831 | 1977-91 | 755 |
| Niederrhein[3] | 1,695 | 719 | 4,907 | 1980-94 | 1,399 |

**Bewick's Swan** *Cygnus colombianus*

Bewick's Swans wintering in Europe originate from the Russian tundra along the Barents Sea coast. The wintering range is almost entirely restricted to Denmark, Germany, The Netherlands and the British Isles. This population is estimated at 17,000 birds, but fluctuates according to breeding success (1990 estimate 25,000). During the past decades overall numbers have increased, but recently they tend to be fairly stable.

The occurrence in the Rhine Valley is mainly restricted to the Dutch Niederrhein. Numbers build up here in December and peak in January. This pattern varies due to severe winter conditions, which may result in concentrations along the rivers, but also -when ice and snow conditions proceed- in migration to the British Isles. The species is particularly attracted by flooded forelands, and numbers in such conditions can be much higher than in more usual situations. In other parts of the Rhine Valley only scattered observations are made, often in mixed flocks with Whooper Swans. From the area around Oberrhein and Bodensee a more regular occurrence pattern has been reported recently, though still with very small numbers involved.

The January 1995 count yielded 2,879 Bewick's Swans (Figure 9). These were mainly present along the Dutch branches of the Niederrhein, where concentrations occurred along the IJssel (1,782), Waal (596) and Nederrijn (454). The numbers present in 1995 are in the upper range of counts between 1980-94 (average 1,909; minimum 498; maximum 3,776, data from SOVON Ganzen- en Zwanenwerkgroep).

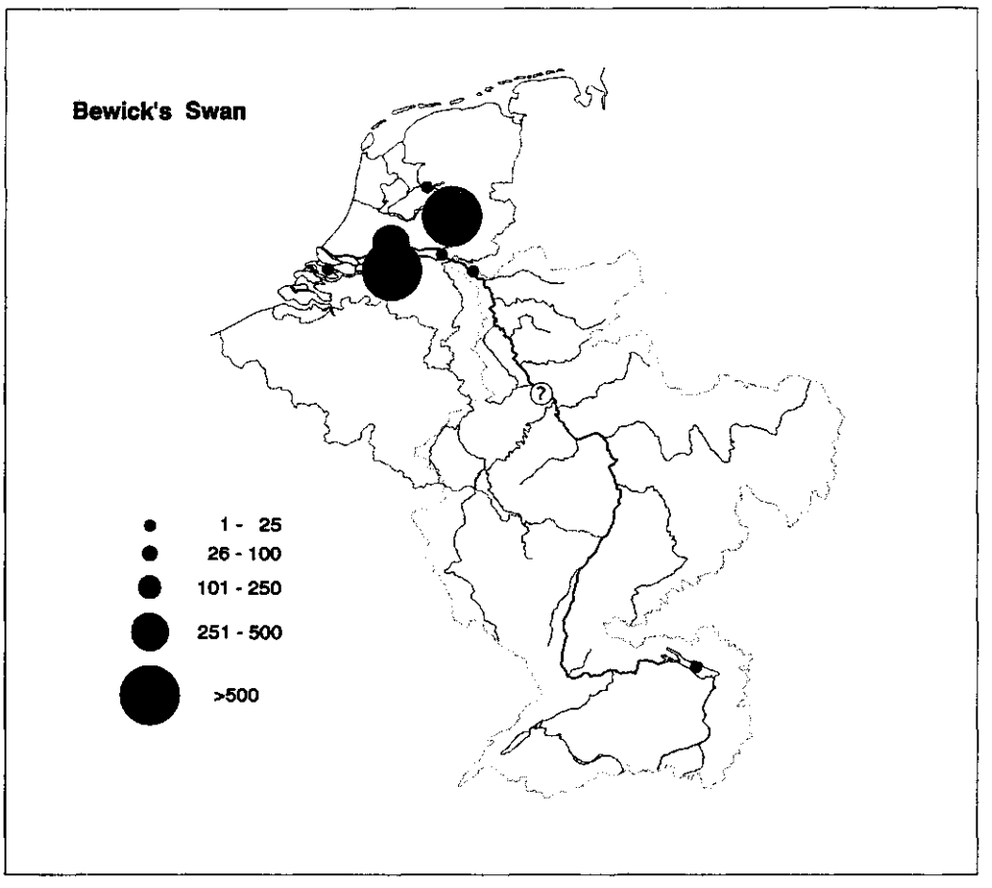



Figure 9. Distribution of Bewick's Swan in the Rhine Valley in January 1995 (cf. Figure 5).

**Whooper Swan** *Cygnus cygnus*

Breeding Whooper Swans on the European mainland are distributed over northwest Russia and Fenno-Scandinavia. Compared to Bewick's, wintering Whooper Swans disperse widely over northwest and central/eastern Europe. Major strongholds are situated in Denmark, Sweden and (northern) Germany, in severe winters also further south. The population is estimated at 25,000 birds. The population has increased, especially from the mid-1970s onwards.

Regular wintering areas of Whooper Swans in the Rhine Valley are mainly found in The Netherlands and on the Bodensee (mainly Untersee, see below). Whooper Swans tend to arrive as late as December and maximum numbers occur from December till February. Especially numbers present in The Netherlands largely depend on winter conditions in the Baltic. Severe winters in this area may lead to a large influx in the low countries. Whooper Swans in The Netherlands mainly gather in (wet) forelands. The Untersee in the Bodensee area is the main wintering site in central Europe. Numbers in this area have shown a steady increase since the 1960s and currently amount to 300 birds. These birds are mainly aquatic feeders, foraging on e.g. tubers of pondweed *Potamogeton* sp.

In January 1995 a total of 600 Whooper Swans was recorded (Figure 10). The largest concentration appeared to be at the Bodensee (270, of which 154 on the Untersee). This figure supports the population level which has been observed here recently (January 1988-1992 average 204; range 109-290; Bauer *et al.* 1995). In the German and Dutch Niederrhein area major flocks were found along the IJssel (cf. Bewick's Swan). Due to the mild winter conditions in the northern wintering range, numbers observed here were not exceptional (January 1990-94 average 544; range 220-1,194; data SOVON Ganzen- en Zwanenwerkgroep).

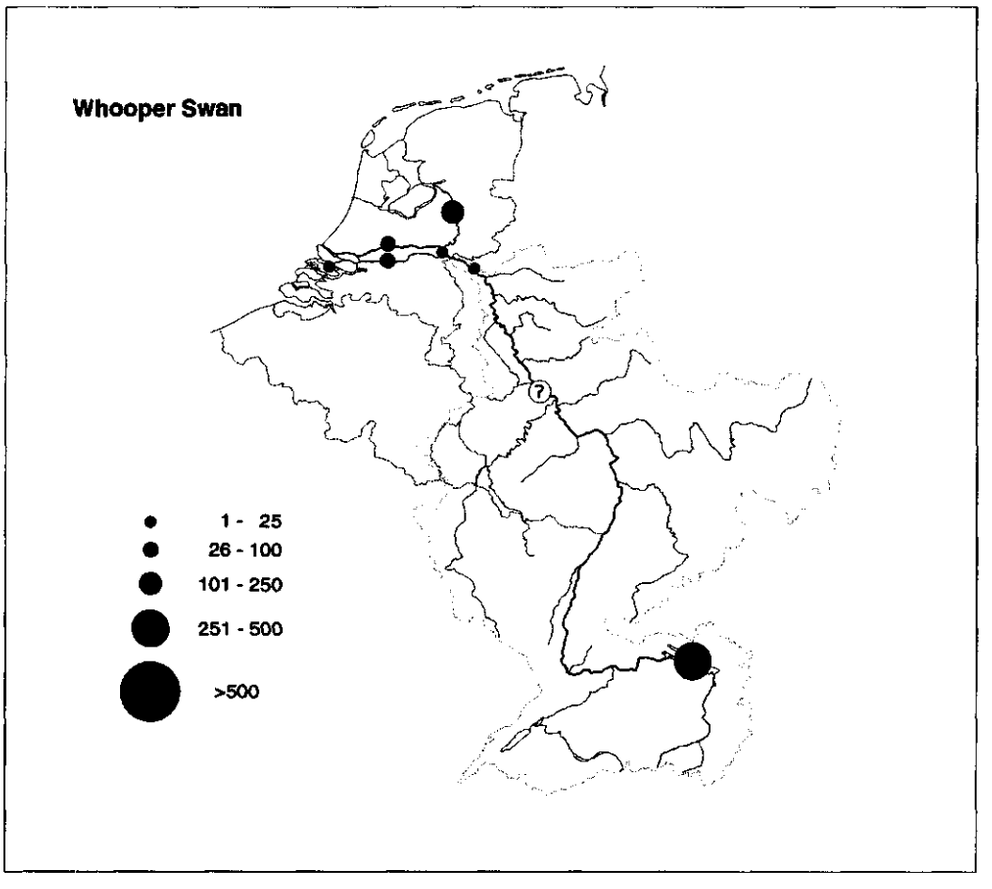



Figure 10. Distribution of Whooper Swan in the Rhine Valley in January 1995 (cf. Figure 5).

**Bean Goose** *Anser fabalis*

Bean Geese wintering in the Rhine Valley mainly belong to the population of the subspecies *rossicus* ('Tundra Bean Goose'). This population consists of 300,000 birds and breeds in northern Russia. Wintering areas are mainly situated in central Europe. An actual population trend is not clear. Influxes are noticed in severe winters, when many birds winter in western Europe. 'Taiga Bean Geese' (*A. f. fabalis*), which breed in northwest Russia and Fenno-Scandinavia (80,000 birds), mainly winter in the Baltic, but do migrate further south in hard winters. In such conditions Bean Geese populations wintering in the Dutch Rhine Valley may also involve considerable numbers of this species (Van den Bergh 1985).

Within the Rhine Valley, wintering Bean Geese occur at the Niederrhein and, to a lesser extent, the Oberrhein area. The major staging area is the Niederrhein at the Dutch/German border near Nijmegen/Kleve. Here, high numbers are present in December-February which peak in January. On a longer term the population has increased. However, after the cold winters in the mid-1980s numbers have decreased (Arbeitsgemeinschaft Wildgänse 1993, Mooij 1993). At the Oberrhein maximum counts are recorded in January and February (peak usually in January). In general, numbers tend to be rather stable here and fluctuate depending on the winter conditions elsewhere. Bean Geese in the Rhine Valley mainly feed on grassland, both in the floodplain of the river and up to distances of over 20 km from the mainstream. In several stretches along the river night roosts can be found.

During the count in January 1995 a number of 9,986 Bean Geese was counted (Figure 11). For a large part, these were observed in the German Niederrhein area (7,306). The number observed here, is close to the population level established here recently (Arbeitsgemeinschaft Wildgänse 1996). Obvious is also the concentration at the French Oberrhein (1,203). However, note that this figure represents counts of night roosts (!), where in other areas only counts at daytime have been used. The number present along the Oberrhein was close to the range which was found in 1982-91 (average 1,710; range 865-2,500; Andres *et al.* 1994). Numbers in The Netherlands were small (1,377), but within the current pattern of occurrence (January 1990-94 average 1,902; range 767-4,612; data SOVON Ganzen- en Zwanenwerkgroep).

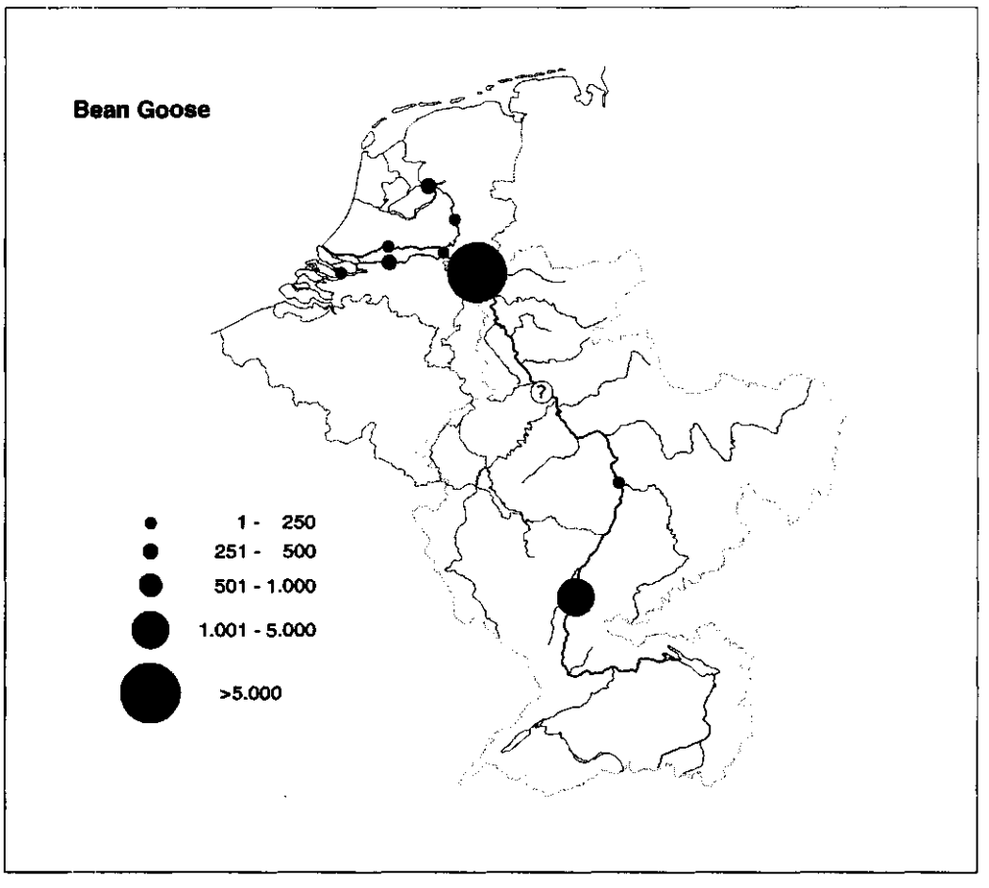



Figure 11. Distribution of Bean Goose in the Rhine Valley in January 1995 (cf. Figure 5).

**White-fronted Goose** *Anser albifrons*

White-fronted Geese breed in northern Russia and northwestern Siberia. Wintering sites are almost entirely restricted to The Netherlands, and the Belgian and German border areas. The population size is estimated at 450,000 birds, but has increased since this estimate was made. This development already started in the 1970s.

As the German/Dutch Niederrhein is situated within the regular wintering range, large numbers of White-fronted Geese can be found here. Large numbers are present in December-February and a maximum is usually observed in January. In the Dutch staging areas relatively large numbers also occur in February. The growth of the population in the German Niederrhein exceeds the overall population growth (Mooij 1993). In other ranges within the Rhine Valley, especially the Oberrhein, only scattered observations of small flocks are made throughout the winter. Birds feed mainly on pastures, in the floodplain as well as further away from the river. All these birds use large night roosts which are found along the river.

With an impressive figure of 222,364 birds, the White-fronted Goose was the most abundant species in the 1995 January survey (Figure 12). Main concentrations were found along the Niederrhein, especially in the German/Dutch border area near Nijmegen/Kleve (together 139,429) and along the IJssel (54,104). The numbers in the German/Dutch Niederrhein area were similar to those observed in recent winters (1993 and 1994 138,798 and 181,723 respectively, Arbeitsgemeinschaft Wildgänse 1996).

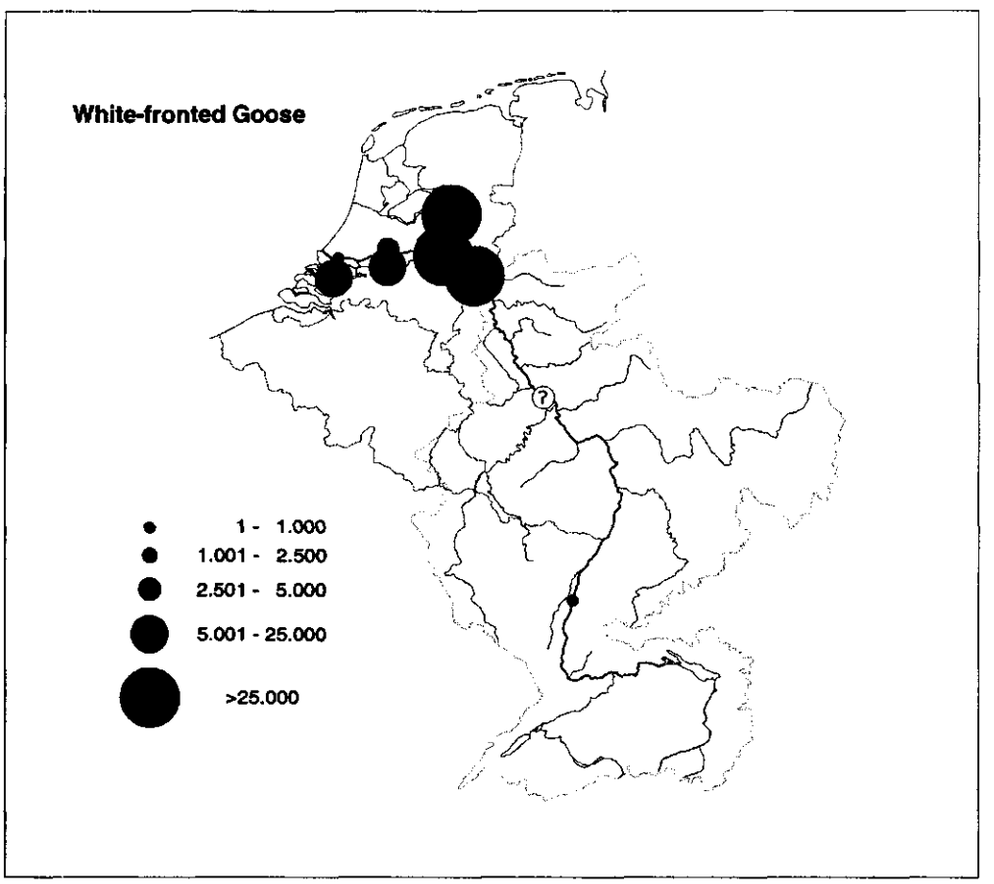



Figure 12. Distribution of White-fronted Goose in the Rhine Valley in January 1995 (cf. Figure 5).

**Greylag Goose** *Anser anser*

The breeding distribution of Greylag Geese is scattered over large parts of Europe, except for the south. These birds winter in northwestern Europe as well as Spain and other parts of the Mediterranean. The population in northwestern Europe has shown an overall increase. Its size was estimated to be 120,000 birds, but is probably much higher by now.

Greylag Geese are regular breeding birds in the Rhine Valley, especially the Niederrhein area in The Netherlands. This population is still undergoing expansion. In some areas, also feral birds are involved. Migrants and winterers are virtually only found in large numbers in The Netherlands. Numbers observed here support the overall population increase. In other parts of the Rhine Valley only small flocks are observed, most of them between October and February. Also local increases have been reported here. In The Netherlands numbers peak during autumn migration in October-November. However, along the river branches further inland, this peak is less pronounced, and the population level tends to be rather stable throughout the non-breeding season, suggesting many of the birds to be residents here. In severe winters many birds wintering in The Netherlands are forced to migrate south. Greylag Geese are mainly found in forelands, but contrary to Bean- and White-fronted Geese, may also feed on rhizomes of vegetation on riverbanks, e.g. *Scirpus* sp.

In January 1995 10,603 Greylag Geese were counted (Figure 13). The larger part of this number stayed at the Niederrhein. Strongholds were found in the German and Dutch Niederrhein area near Nijmegen/Kleve (1,647 and 1,247 respectively) and in the Biesbosch-Haringvliet area (4,776). The high number for The Netherlands (8,535) confirms the pattern established recently (1994 8,094; 1990-93 average 3,445; range 2,781-4,541; data SOVON Ganzen- en Zwanenwerkgroep).

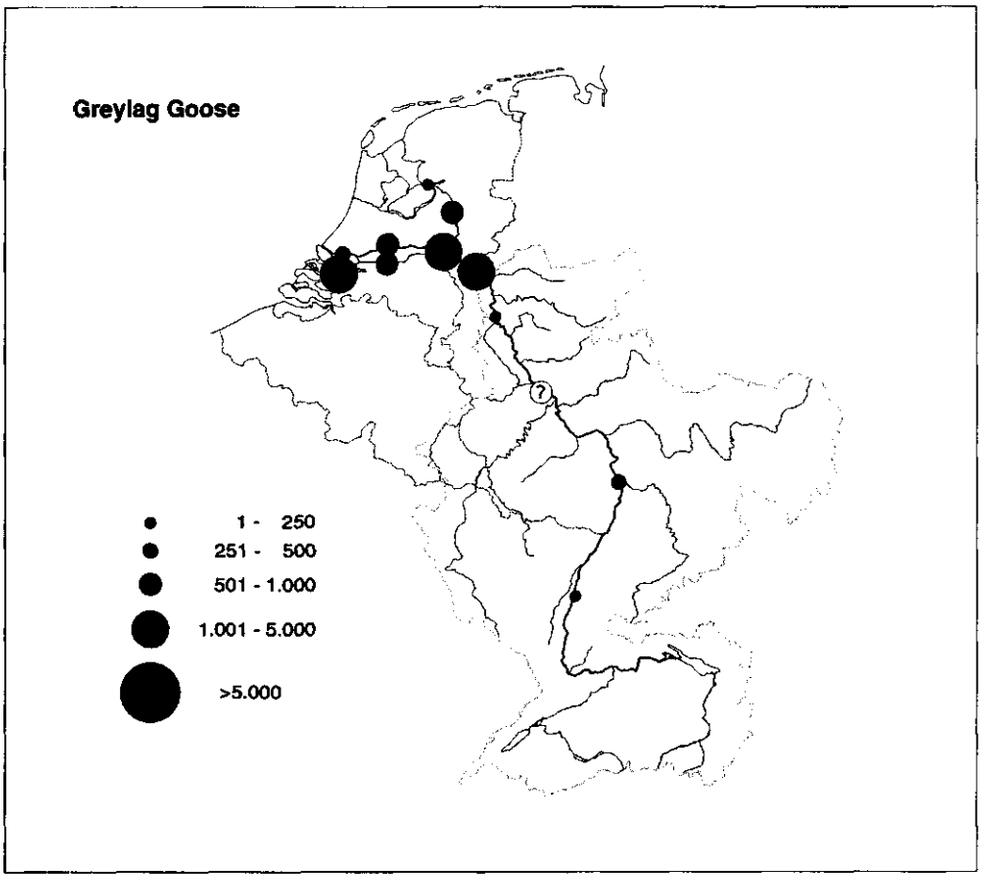



Figure 13. Distribution of Greylag Goose in the Rhine Valley in January 1995 (cf. Figure 5).

**Barnacle Goose** *Branta leucopsis*

Barnacle Geese originally breed along the shores of the Barents Sea in the Russian arctic. Since the 1980s, an increasing population has settled in the Baltic. Most birds of these two populations winter in The Netherlands and in the German Wadden Sea. The population was estimated at 120,000 birds, but this estimate is due to be reviewed since the population has continued to increase.

As the wintering range of Barnacle Geese includes the western fringe of the Dutch Niederrhein area, it is not surprising that most observations of the species originate from this area while it is accidentally seen along the other stretches. The largest part of the population in the Niederrhein area is found in the Biesbosch-Haringvliet area, where they feed almost exclusively on the former saltmarshes of the Haringvliet estuary. Numbers here build up from October onwards and reach a maximum in December/January.

The January 1995 count resulted in 21,773 Barnacle Geese, of which 21,133 (97%) were present in the Biesbosch-Haringvliet area (Figure 14). The results of the survey in 1995 just exceed the maximum numbers seen in that area in 1990-94 (average 11,419; range 5,658-18,092; data SOVON Ganzen- en Zwanenwerkgroep).

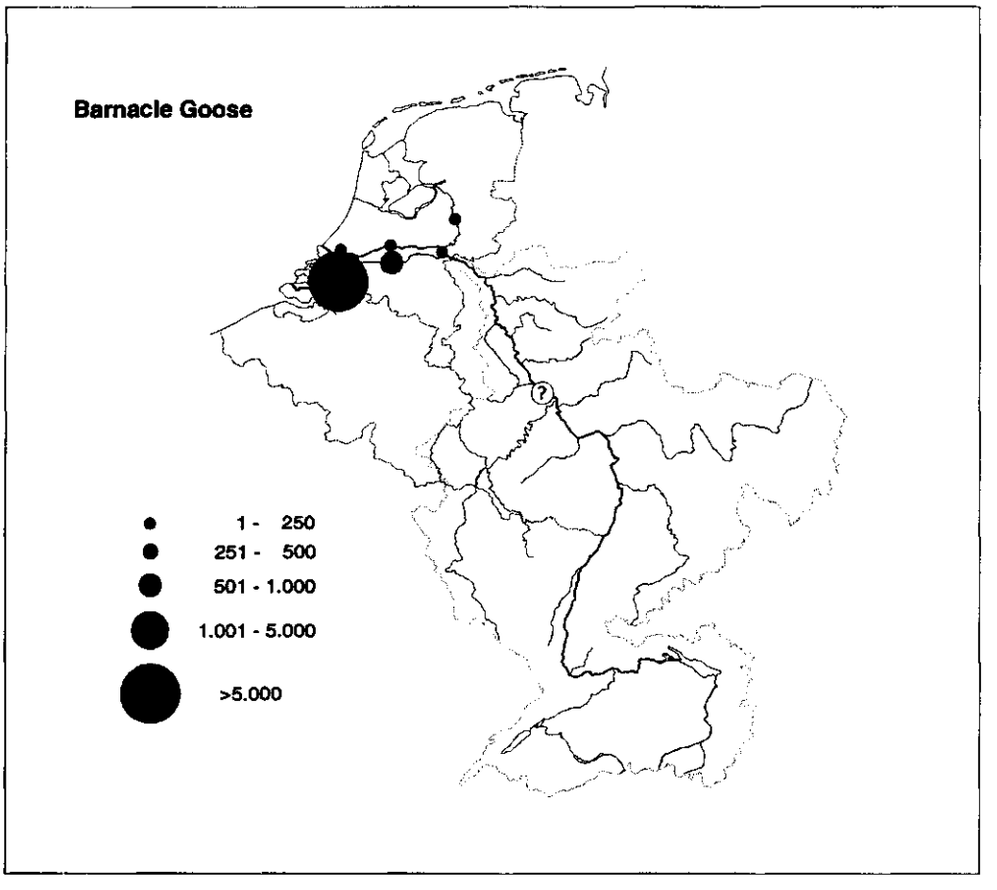
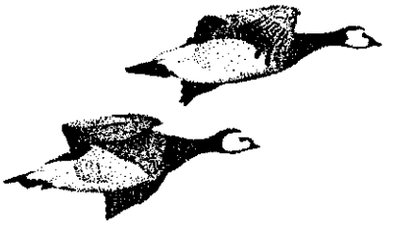



Figure 14. Distribution of Barnacle Goose in the Rhine Valley in January 1995 (cf. Figure 5).



**Egyptian Goose** *Alopochen aegyptiacus*

This species originally does not breed in western Europe, but has been introduced by man. Free-living populations have established especially in England and in The Netherlands (Lensink 1996). Numbers and distribution are still expanding.

Egyptian Geese have bred in the Rhine Valley since the late 1970s (Lensink 1996) and have expanded their breeding range fast in the 1980s and 1990s. The main concentration is still found along the Dutch part of the Niederrhein. In The Netherlands the species is mainly resident (Lensink 1996). Peak numbers are generally counted in September/October, when moulting sites are abandoned, and in December. The species feeds in various habitats within the floodplain.

A total of 702 Egyptian Geese was seen during the survey in January 1995 (Figure 15). Most of these were counted in the Dutch part of the Niederrhein, especially along the Waal (230), Nederrijn (185) and IJssel (147). These counts support the ongoing increase in these areas.

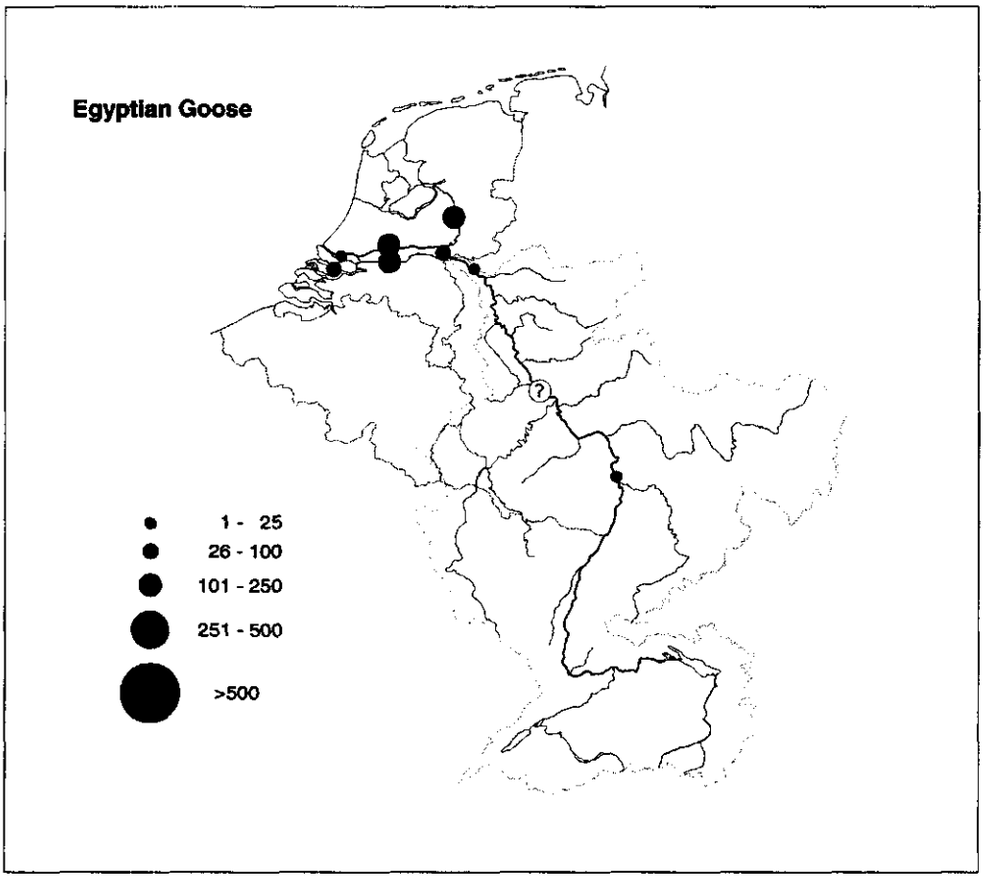



Figure 15. Distribution of Egyptian Goose in the Rhine Valley in January 1995 (cf. Figure 5).

**Wigeon** *Anas penelope*

Wigeons breed in large parts of northern and northeastern Europe. In winter they are mainly distributed over coastal areas in western Europe and to a lesser extent also the Mediterranean. Wintering populations in the Mediterranean are declining, but those in northwestern Europe have increased over the past 20 years. The population was estimated to be 750,000 but as it is still increasing, amounts to about 1,250,000 by now.

The species is a regular winter visitor to all stretches within the Rhine Valley. High numbers are counted in the Niederrhein area, where Wigeons are among the most abundant birds observed during winter. The wintering population generally builds up rapidly in October and reaches maximum levels from December to March (peak in January). Compared to other stretches, areas in the Niederrhein hold relatively large numbers in February/March. The overall increasing population trend is reflected by numbers present all over the Rhine Valley. Wet pastures in the floodplain are clearly preferred as feeding habitat. High watertables and consequently flooded forelands usually result in increases. In some areas the species is known to feed mainly during night, gathering in e.g. gravel pits, side-channels and sheltered parts of the river during daytime. Feeding flocks at night may also go for suitable feeding areas at a greater distance from the river.

During the 1995 January count 95,594 Wigeon were recorded, of which 93,840 (98%) along the Niederrhein (Figure 16). Major strongholds here were situated in the area of Biesbosch-Haringvliet (31,557) and Waal (25,294). Among the other stretches of the river, the count of 1,264 Wigeon at the southern Oberrhein is remarkable and fits in the fast increasing pattern which has been observed in this area (Table 8). Numbers at the Bodensee were about average; those in The Netherlands largely exceeding the population level established in the 1980s, but comparable to that in recent years.

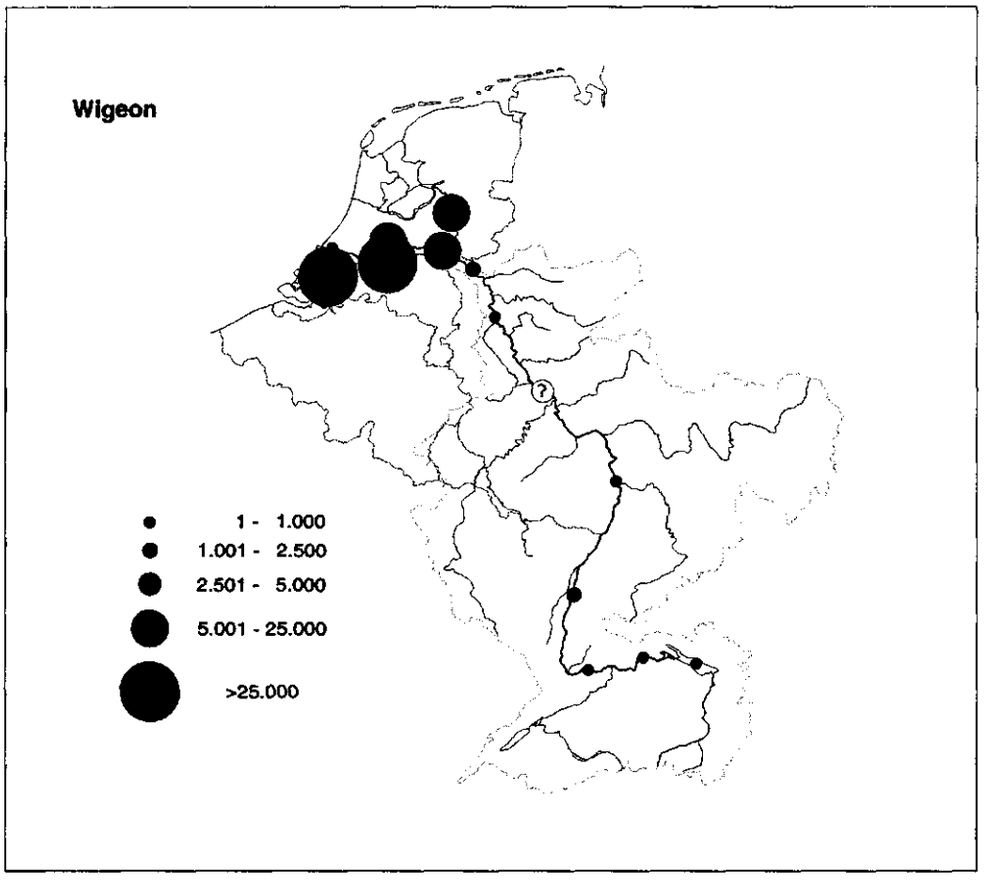



Figure 16. Distribution of Wigeon in the Rhine Valley in January 1995 (cf. Figure 5).

Table 8. Numbers of Wigeon in the Rhine Valley in January. Average, minimum (min.), maximum (max.) and period are given as well as the number counted in January 1995. For survey areas taken into account see Table 4. Sources: [1] Bauer *et al.* 1995; [2] Andres *et al.* 1994; [3] data from various sources stored at SOVON Vogelonderzoek Nederland.

| Site / Source | Average | Min. | Max. | Period | January '95 |
|---|---|---|---|---|---|
| Bodensee[1] | 142 | | | 1977-86 | |
| | 276 | 144 | 396 | 1988-92 | 235 |
| Oberrhein[2] | 409 | 15 | 942 | 1977-91 | 1,263 |
| Niederrhein[3] | 36,338 | 5,611 | 91,897 | 1980-94 | 92,478 |

**Gadwall** *Anas strepera*

Gadwall is originally a species breeding in the eastern fringe of Europe, but has expanded its breeding range in the last century and is now breeding scattered in the larger part of western Europe. Wintering populations are mainly found in northwestern Europe. The breeding range and numbers are still expanding. The northwest European population is estimated at 25,000 birds, but has further increased.

Breeding Gadwall are found in all parts of the Rhine Valley, though still in relatively small numbers. However, the population is still increasing. This trend also applies to migrants and wintering birds, which are found in highest numbers in November-December (Bodensee, Germany/Switzerland), December-January (Oberrhein, France) or November/December (Niederrhein, Netherlands). These patterns imply that, except for the French Oberrhein, numbers present during mid-winter are much smaller than the number of migrants. Waterbodies situated in the Dutch Delta (Biesbosch-Haringvliet) usually have maximum numbers already in August/September. Gadwall are found in various habitats within the floodplain, but prefer relatively stagnant and eutrophicated waters such as small ponds and old side-channels. They seem to be especially attracted by algae on artificial river banks (*Bangia* and *Cladophora* sp.), as well as *Enteromorpha* sp. and macrophytes such as *Chara* sp.

The January 1995 count yielded 9,814 Gadwall (Figure 17). Except for the Hochrhein, numbers were more or less equally distributed among the different stretches. Marked concentrations were found at the Bodensee (2,749), southern Oberrhein (3,485) and Biesbosch-Haringvliet (1,231). Elsewhere, the numbers counted were lower and within the same range. The results for the Bodensee equal the average in the past 10 years; those for the French Oberrhein and the Dutch Niederrhein are among the highest counts made so far (Table 9).

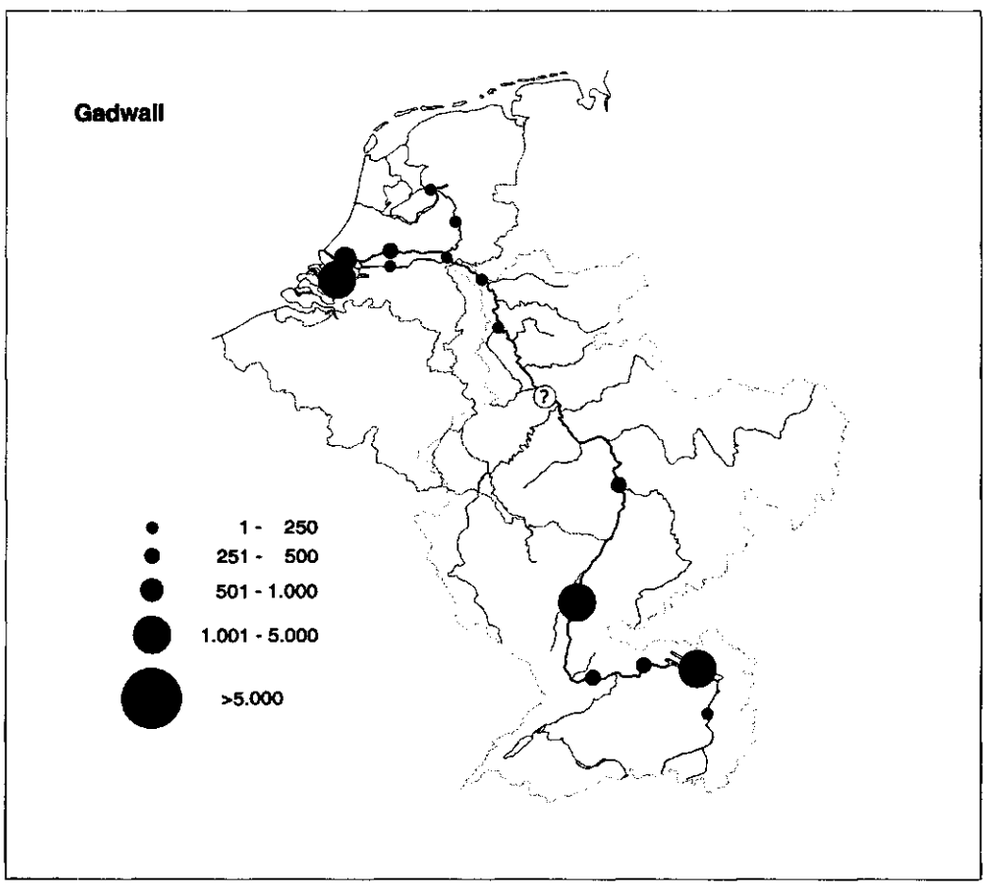



Figure 17. Distribution of Gadwall in the Rhine Valley in January 1995 (cf. Figure 5).

Table 9. Numbers of Gadwall in the Rhine Valley in January. Average, minimum (min.), maximum (max.) and period are given as well as the number counted in January 1995. For survey areas taken into account see Table 4. Sources: [1] Bauer *et al.* 1995; [2] Andres *et al.* 1994; [3] data from various sources stored at SOVON Vogelonderzoek Nederland.

| Site / Source | Average | Min. | Max. | Period | January '95 |
|---|---|---|---|---|---|
| Bodensee[1] | 1,258 | | | 1977-86 | |
| | 2,747 | 1,010 | 5,679 | 1988-92 | 2,749 |
| Oberrhein[2] | 1,940 | 531 | 4,984 | 1977-91 | 3,485 |
| Niederrhein[3] | 760 | 42 | 2,430 | 1980-94 | 2,649 |

**Teal** *Anas crecca*

The breeding range of Teal comprises most European countries but has its strongholds in northern and eastern Europe. Large wintering populations are mainly found in the North Sea countries. Severe winters may force many birds wintering in northwestern Europe to move in southern directions. The north-west European population is estimated at 400,000 birds. No major changes seem to have occurred in this population in the past decades.

Small numbers of Teal are breeding in most stretches within the Rhine Valley. Locally a decline in breeding numbers is reported, but in general no clear trend has been noticed yet. Larger numbers are seen on migration and in winter. In the Dutch Niederrhein most birds are present in autumn, from September to December (maximum in November). A similar pattern has been established for the Bodensee (maximum in November), but at the southern Oberrhein high counts of Teal are made in December/January. However, these patterns can vary, as the species shows a clear preference for very shallow riverbanks or mudflats and therefore is very sensitive to changes in the watertable. Wintering numbers are dependent on winter conditions and do not show any significant trend.

In January 1995 10,084 Teal were present in the Rhine Valley (Figure 18). In general, large numbers (5,506) were seen in the Niederrhein area. Largest concentrations were recorded from standing or slow-flowing waters such as the Bodensee (2,399) and the Biesbosch-Haringvliet area (2,105). These sites have extensive areas of shallow water where Teal filter the sediment for seeds. High numbers were also seen at the southern Oberrhein (1,460). The numbers observed correspond to those seen in previous years (Table 10).

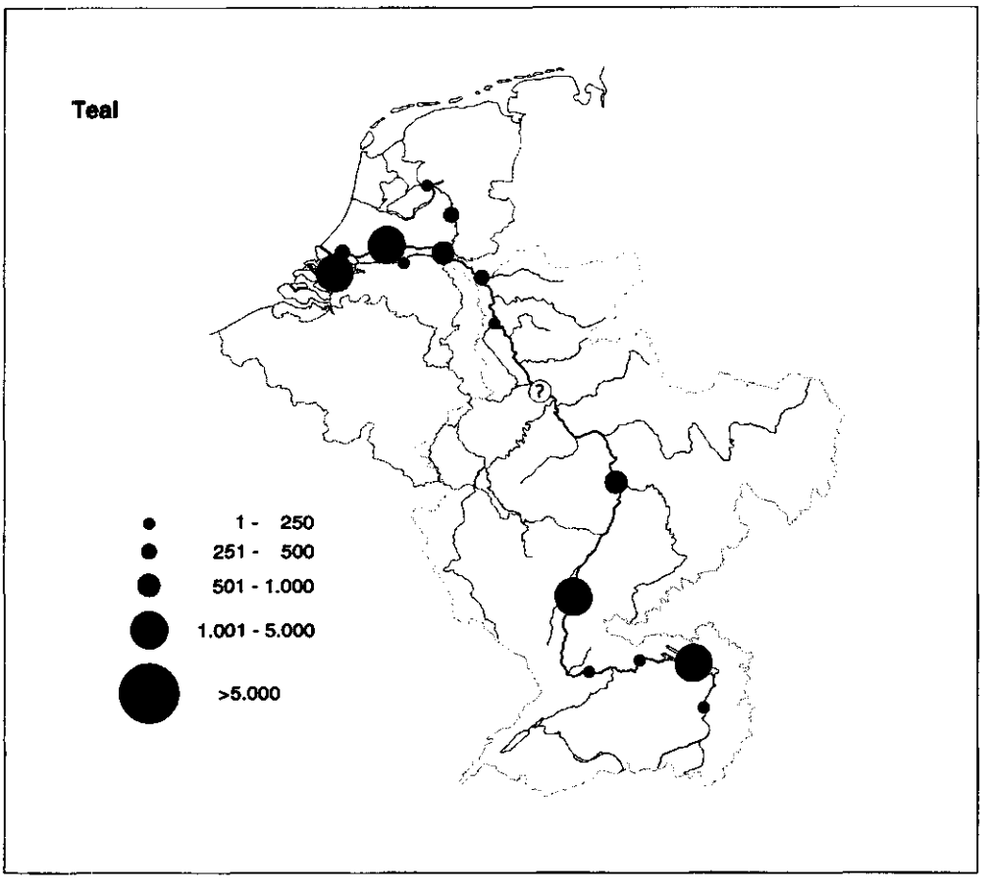



Figure 18. Distribution of Teal in the Rhine Valley in January 1995 (cf. Figure 5).

Table 10. Numbers of Teal in the Rhine Valley in January. Average, minimum (min.), maximum (max.) and period are given as well as the number counted in January 1995. For survey areas taken into account see Table 4. Sources: [1] Bauer *et al.* 1995; [2] Andres *et al.* 1994; [3] data from various sources stored at SOVON Vogelonderzoek Nederland.

| Site / Source | Average | Min. | Max. | Period | January '95 |
|---|---|---|---|---|---|
| Bodensee[1] | 1,871 | | | 1977-86 | |
| | 3,953 | 2,110 | 5,484 | 1988-92 | 2,399 |
| Oberrhein[2] | 1,383 | 504 | 2,095 | 1977-91 | 1,460 |
| Niederrhein[3] | 3,389 | 94 | 6,266 | 1980-94 | 5,168 |

**Mallard** *Anas platyrhynchos*

Mallards breed all over Europe. The species is mainly sedentary. Only northern and eastern populations may migrate to western Europe in winter. In northwestern Europe, no major changes in population level have occurred over the last 20 years. The size of the population is estimated at 5,000,000 birds.

Mallards are among the most common breeding birds in the Rhine Valley. Moreover, the species is abundant in the non-breeding season. High numbers are observed between November and February. Peak counts are usually made in December or January. There are no significant differences in this pattern between the various areas in the Rhine Valley. Overall, the population trend is stable. Severe winter conditions sometimes cause an increase of the population present in the Rhine, as many other inland waterbodies freeze. The species is found in various habitats, but may be especially attracted by flooded forelands, which often result in an influx. Mainly in autumn, birds also feed at night on (often just harvested) fields which can be situated up to tens of kilometres away from the river.

During the January 1995 survey 105,372 Mallards were counted (Figure 19). The species' adaption to various environments results in a distribution pattern which shows almost no pronounced concentrations. Only numbers at the Hochrhein were relatively small. Among the highest counts were the Bodensee (12,909), southern Oberrhein (14,596) and the Biesbosch-Haringvliet area in the Dutch Niederrhein (25,838). Numbers on the Bodensee and the Dutch Niederrhein were consistent with those observed in the past (Table 11). The count of the southern Oberrhein was among the lowest ever made between 1977-94.

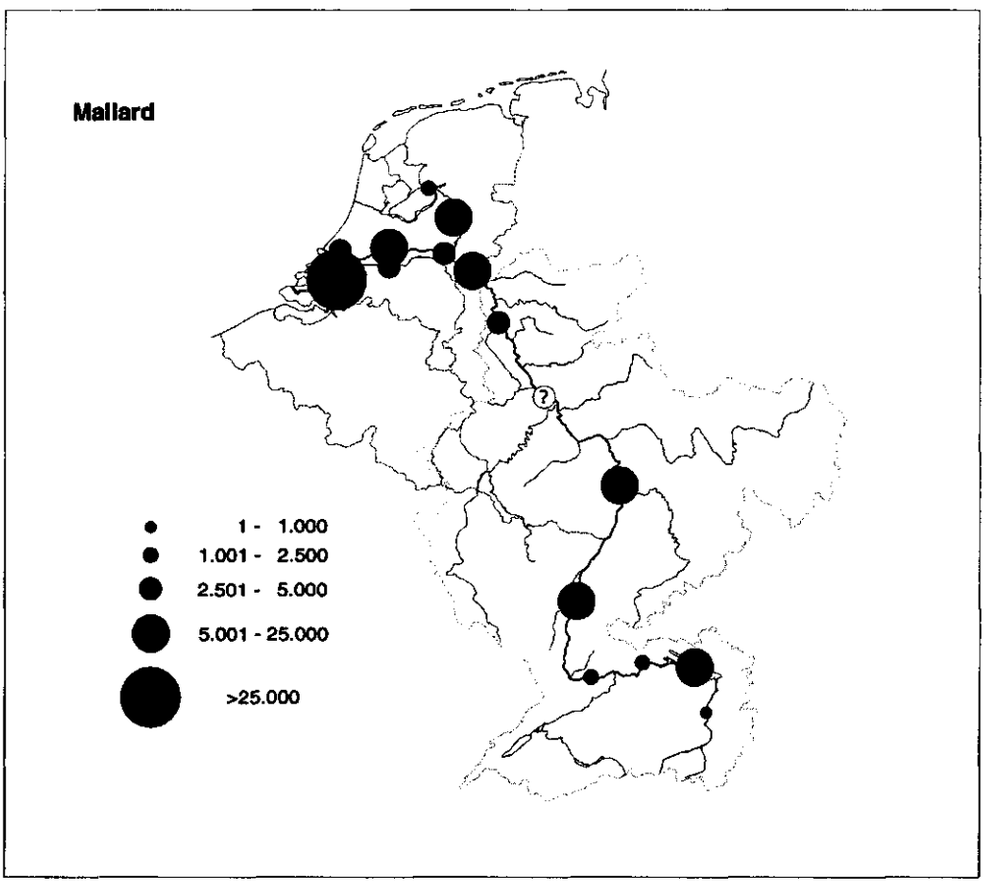



Figure 19. Distribution of Mallard in the Rhine Valley in January 1995 (cf. Figure 5).

Table 11. Numbers of Mallard in the Rhine Valley in January. Average, minimum (min.), maximum (max.) and period are given as well as the number counted in January 1995. For survey areas taken into account see Table 4. Sources: [1] Bauer *et al.* 1995; [2] Andres *et al.* 1994; [3] data from various sources stored at SOVON Vogelonderzoek Nederland.

| Site / Source | Average | Min. | Max. | Period | January '95 |
|---|---|---|---|---|---|
| Bodensee[1] | 18,269 | | | 1977-86 | |
| | 16,074 | 12,323 | 20,993 | 1988-92 | 12,909 |
| Oberrhein[2] | 39,866 | 19,010 | 64,533 | 1977-91 | 14,596 |
| Niederrhein[3] | 52,719 | 27,408 | 135,880 | 1980-94 | 53,098 |

**Red-crested Pochard** *Netta rufina*

The Red-crested Pochard occurs in Europe in two separate breeding populations. The southwest and central European population, to which the birds in the southern Rhine Valley belong to, is estimated to be 20,000 birds. This population breeds mainly in southwest Europe and migrates northward up to Switzerland in winter. Wintering numbers in Switzerland have increased in the 1990s. Another, much smaller population breeds scattered in northwestern Europe (Netherlands, Germany). Recently, increasing numbers have been reported here also (Netherlands, Van der Winden *et al.* 1994). This pattern coincides with local improvements of water quality and consequently higher biomass of aquatic vegetation, especially stoneworths such as *Chara* sp. and *Nitellopsis obtusa* (Ruiters *et al. 1994*).

The Bodensee is the only area holding a main population of Red-crested Pochard within the Rhine Valley. This population concentrates at the Untersee. The breeding population has gradually increased during the last century. Besides breeding birds, this area is also of exceptional importance for birds moulting their body-feathers. Up to 9,000 birds have been observed in autumn (September 1961). Nowadays this population consists of about 4,000 birds (maximum 5930 in October 1991, OAG Bodensee). Numbers of moulting Red-crested Pochards are closely related to the biomass of stoneworths *Chara* sp. Recently, an increase in the population has become apparent, which is a result of improved water quality and expanding vegetation of *Chara* (cf. situation in The Netherlands). The seasonal pattern is dominated by moulting birds between September and November. Wintering numbers are relatively small. The species is rare in other parts of the Rhine Valley.

The January 1995 survey resulted in 2,992 Red-crested Pochard (Figure 20). This population was highly concentrated at the Bodensee (2,959). Downstream numbers become rapidly smaller. Only 1 bird was seen at the (German) Niederrhein. This distribution pattern fits in the pattern which had been established so far. The count of nearly 3,000 wintering Red-crested Pochard on the Bodensee corresponds to the rapid increase of wintering numbers on other Swiss lakes. Maximum values in January for the Bodensee in the 1980s and the beginning of the 1990s were about 350 individuals (Table 12).

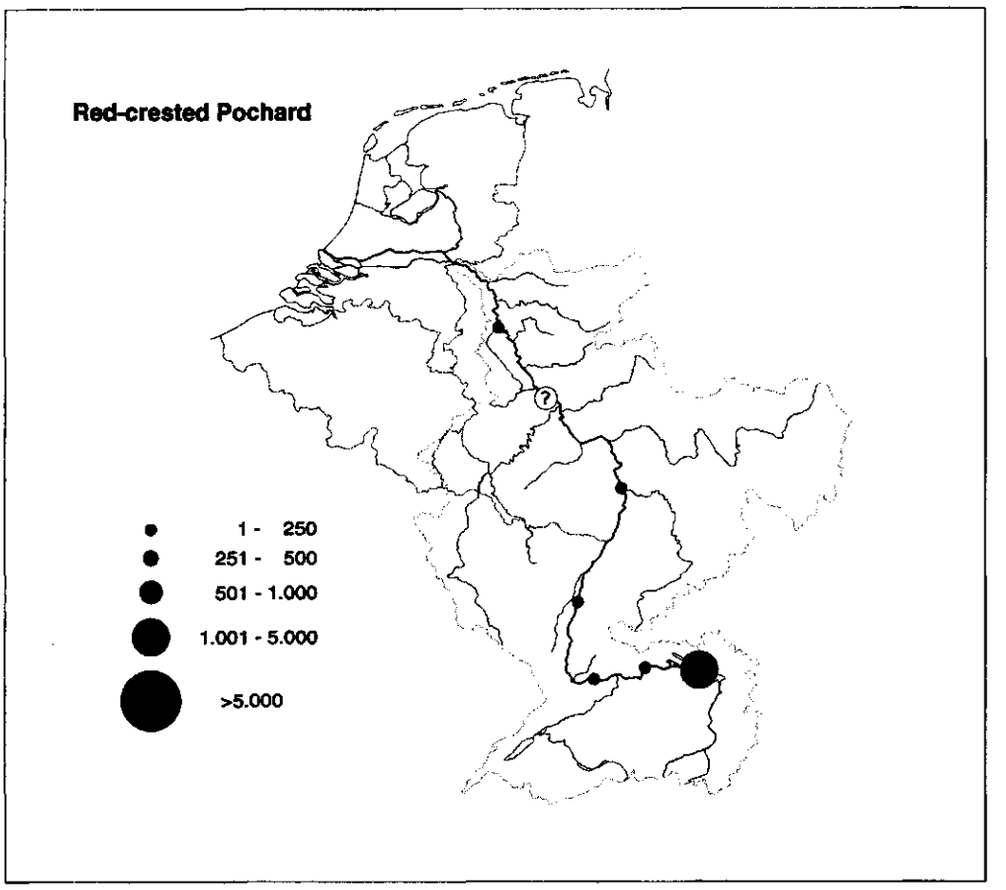



Figure 20. Distribution of Red-crested Pochard in the Rhine Valley in January 1995 (cf. Figure 5).

Table 12. Numbers of Red-crested Pochard in the Rhine Valley in January. Average, minimum (min.), maximum (max.) and period are given as well as the number counted in January 1995. For survey areas taken into account see Table 4. Sources: [1] Bauer *et al.* 1995; [2] Andres *et al.* 1994; [3] data from various sources stored at SOVON Vogelonderzoek Nederland.

| Site / Source | Average | Min. | Max. | Period | January '95 |
|---|---|---|---|---|---|
| Bodensee[1] | 333 | | | 1977-86 | |
| | 167 | 60 | 355 | 1988-92 | 2,959 |
| Oberrhein[2] | 4 | 0 | 9 | 1977-91 | 1 |
| Niederrhein[3] | 1 | 0 | 6 | 1980-94 | 0 |

**Pochard** *Aythya ferina*

The Pochard is originally known as a breeding bird from eastern Europe and central Asia which has expanded its breeding range into central and western Europe during the past two centuries. These birds mainly winter in central and western Europe and the Mediterranean. In harsh winters, central Europe seems to be a refuge for many birds which regularly winter in northwestern Europe. The northwestern European population is estimated at about 350,000 birds. Over a longer time span there has been a decline, but recent population estimates suggest that this the population is stabilising now.

Pochard breed scattered and in low numbers all over the Rhine Valley. However, large numbers are present in the non-breeding period. The seasonal pattern is different for various areas within the Rhine Valley. On the Bodensee numbers are relatively high in autumn and decrease after a peak in November. At the southern Oberrhein and the Niederrhein maximum population levels are reached in December/January. Pochard have especially benefitted by the settlement of Zebra Mussels *Dreissena polymorpha*, one of their main food resources, along the Rhine since the 1960s. At e.g. the Bodensee, numbers rose steeply in the early 1970s, after the exponential increase of *Dreissena* biomass in this area (Suter 1982, see also Figure 27). Also the reservoirs built along the Oberrhein in the 1970s, have resulted in temporarily higher numbers of Pochard. Here, they were attracted by a large biomass of *Tubifex*. In the 1980s, however, numbers along the Oberrhein have shown a fast decline. In the Dutch Niederrhein exceptionally high numbers were present in the 1970s and beginning 1980s, but have dropped to a lower level and remained rather stable since then. This temporary increase was caused by a large daytime roost in the Haringvliet area, where birds fed on seeds of Eelgrass *Zostera marina* at a neighbouring salt water lake (Boudewijn 1989).

The count in January 1995 yielded 60,317 Pochard (Figure 21). Most of these concentrated on the Bodensee (37,658), which ranks among the most important wintering sites for the species. Elsewhere, remarkable numbers were found at IJssel (4,631) and Lake Ketelmeer (2,708), both situated in the Dutch Niederrhein area. The concentration at Lake Ketelmeer is part of the large population at Lake IJsselmeer. In comparison to other recent counts, the numbers at Bodensee were quite large in 1995 while those along the southern Oberrhein confirm the ongoing decline here (Table 13). At the Dutch Niederrhein numbers in January 1995 were comparable to previous winters.

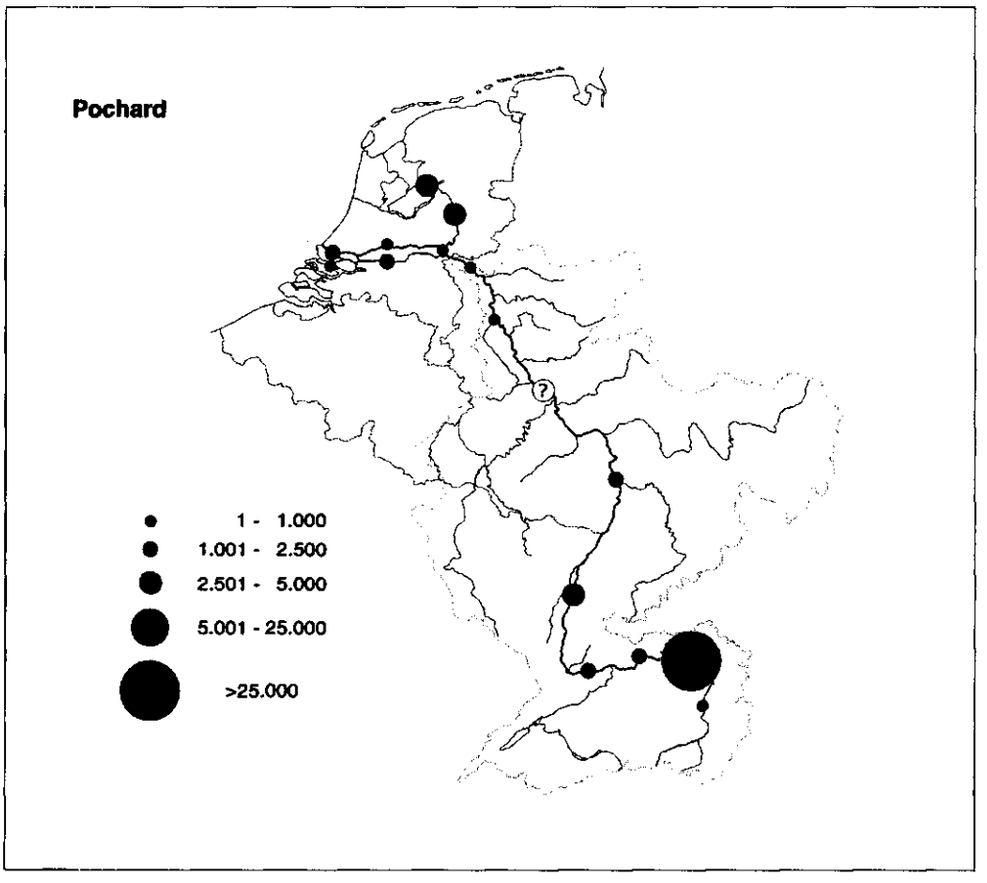



Figure 21. Distribution of Pochard in the Rhine Valley in January 1995 (cf. Figure 5).

Table 13. Numbers of Pochard in the Rhine Valley in January. Average, minimum (min.), maximum (max.) and period are given as well as the number counted in January 1995. For survey areas taken into account see Table 4. Sources: [1] Bauer *et al.* 1995; [2] Andres *et al.* 1994; [3] data from various sources stored at SOVON Vogelonderzoek Nederland.

| Site / Source | Average | Min. | Max. | Period | January '95 |
|---|---|---|---|---|---|
| Bodensee[1] | 19,291 | | | 1977-86 | |
| | 20,397 | 8,518 | 29,399 | 1988-92 | 37,658 |
| Oberrhein[2] | 13,663 | 5,023 | 27,544 | 1977-91 | 3,435 |
| Niederrhein[3] | 18,346 | 10,240 | 47,429 | 1980-94 | 12,846 |

**Tufted Duck** *Aythya fuligula*

Like Pochard, Tufted Duck too has undergone an expansion of the breeding range into western Europe. It now breeds in nearly all (north)west and central European countries. The wintering range comprises mainly northwest and central Europe and the Mediterranean. All these populations have shown long-term increases. Recently a decreasing, but not statistically significant, trend in the number of central European winter visitors has become apparent, which, however, coincides with growing populations elsewhere in the wintering range. The northwest European population is estimated at 750,000 birds.

Tufted Ducks breed all over the Rhine Valley. In autumn numbers gradually build up to a maximum between December and February (Oberrhein, Niederrhein). At the Bodensee there is a rapid increase from September onwards, and usually the highest counts are made here in November. Like in Pochard, the invasion of Zebra Mussels *Dreissena polymorpha* in western Europe in the 1960s has resulted in a marked increase in Tufted Duck numbers (see also Figure 27). Besides, Tufted Ducks have responded to the creation of reservoirs along the Oberrhein (cf. Pochard), but in contrast to Pochard, seem to be able to maintain higher population levels for a longer time. Compared to the Pochard, Tufted Ducks are more specific *Dreissena* consumers (e.g. Suter 1982, De Leeuw 1991) and also have a better diving performance which enables them to exploit food resources at greater depth.

Tufted Duck was one of the most abundant species during the count in January 1995, showing its presence with an impressive number of 132,688 individuals (Figure 22). By far the largest concentration was found on the Bodensee (69,856). High numbers were also present along Oberrhein (15,495) and Niederrhein stretches (41,614). In the latter area the birds mainly concentrated at Lake Ketelmeer (12,370) and the area of Biesbosch, Hollandsch Diep and Haringvliet (14,199). This distribution pattern is mainly dominated by areas holding a large biomass of *Dreissena* (Bodensee, Hollandsch Diep/Haringvliet, Lake Ketelmeer). Moreover, the reservoirs along the Oberrhein still attract high numbers. In most areas, the figures for January 1995 are in the range of numbers which have been established in the past decade (Table 14).

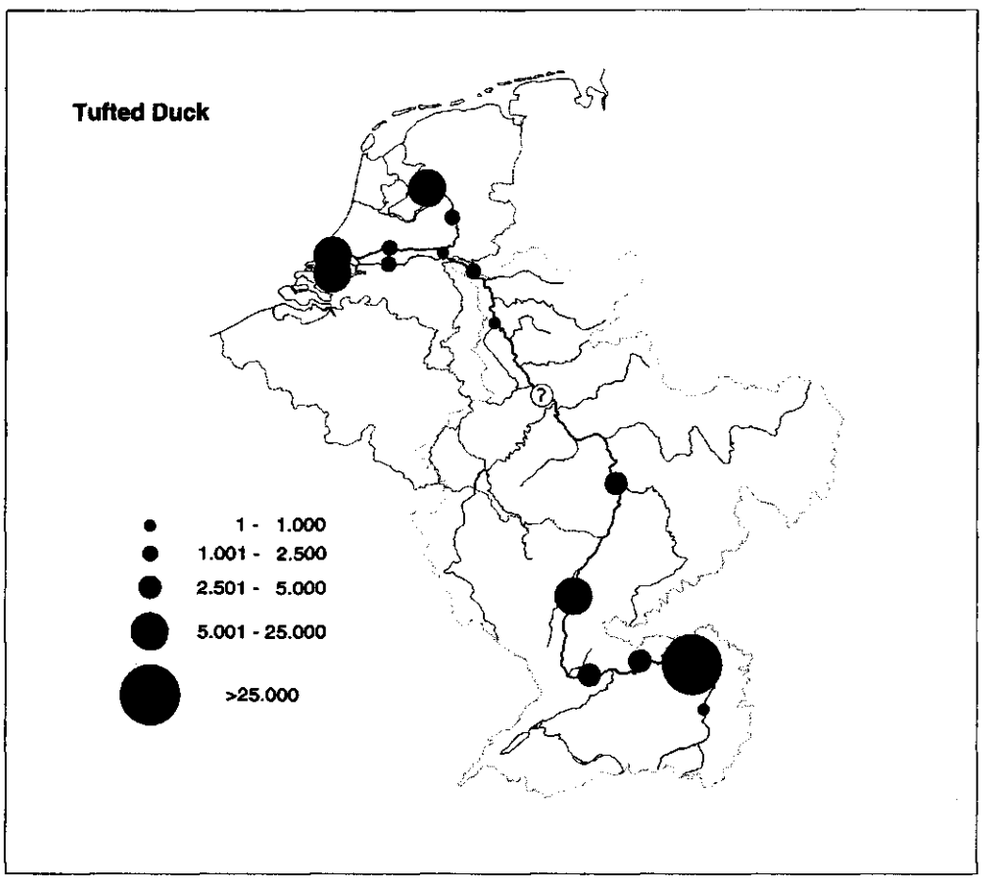



Figure 22. Distribution of Tufted Duck in the Rhine Valley in January 1995 (cf. Figure 5).

Table 14. Numbers of Tufted Duck in the Rhine Valley in January. Average, minimum (min.), maximum (max.) and period are given as well as the number counted in January 1995. For survey areas taken into account see Table 4. Sources: [1] Bauer *et al.* 1995; [2] Andres *et al.* 1994; [3] data from various sources stored at SOVON Vogelonderzoek Nederland.

| Site / Source | Average | Min. | Max. | Period | January '95 |
|---|---|---|---|---|---|
| Bodensee[1] | 41,464 | | | 1977-86 | |
| | 44,063 | 24,035 | 71,408 | 1988-92 | 69,856 |
| Oberrhein[2] | 22,894 | 12,517 | 37,165 | 1977-91 | 11,917 |
| Niederrhein[3] | 32,330 | 10,400 | 52,589 | 1980-94 | 39,912 |

**Goldeneye** *Bucephala clangula*

Goldeneye breed in Fenno-Scandinavia and northern Russia. Also some scattered breeders are found in central and western Europe. Their wintering sites are mainly situated along the shores of the Baltic and North Sea, as well as in central Europe and Balkan. The wintering populations in northwestern Europe have increased over the last decades, whereas those in central Europe have remained stable. Both populations together number about 300,000 birds.

In the Rhine Valley Goldeneye are frequently observed in small numbers in the breeding season, but reports of breeding birds are scarce. In winter the species is numerous between November and March with a peak occurrence in January. This pattern is the same for the different areas within the Rhine Valley, except for the Oberrhein, which also holds high numbers in February. Also Goldeneye has benefitted from the development in *Dreissena* biomass, but less pronounced than Pochard and Tufted Duck. Goldeneye do not entirely depend on *Dreissena*, but also feed extensively on other small molluscs and invertebrates like e.g. crustaceans and insect-larvae (Suter 1982, De Leeuw 1991). Both at Niederrhein and Oberrhein, numbers have tended to increase during the last 10 years, which supports the overall trend in the northwestern European population.

During the 1995 January survey 8,267 Goldeneye were observed (Figure 23). Bodensee and Oberrhein are situated within the central European wintering range, and therefore the largest concentrations were found here: 6,425 and 957 birds respectively. In other stretches only small numbers were present. Wintering areas in e.g. The Netherlands are mainly coastal (Delta, IJsselmeer, Wadden Sea), and relatively small numbers occur inland in the Niederrhein area. The results of the count in January 1995 generally match the numbers during previous counts (Table 15).

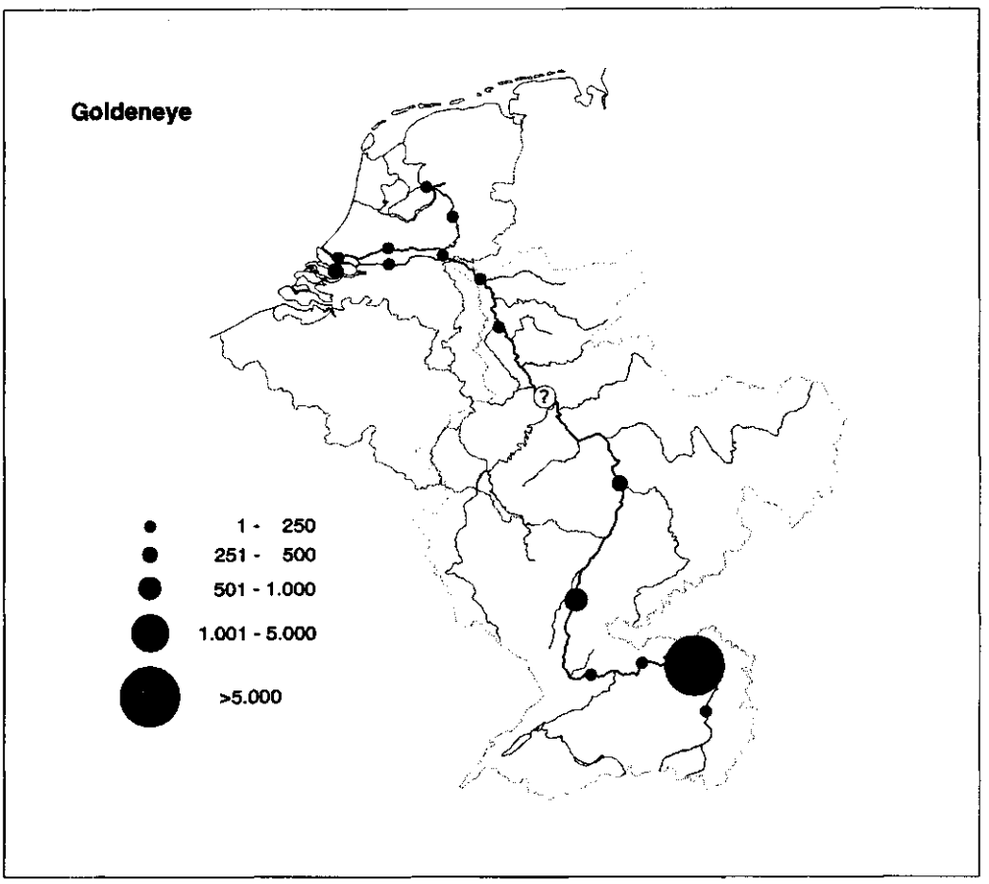



Figure 23. Distribution of Goldeneye in the Rhine Valley in January 1995 (cf. Figure 5).

Table 15. Numbers of Goldeneye in the Rhine Valley in January. Average, minimum (min.), maximum (max.) and period are given as well as the number counted in January 1995. For survey areas taken into account see Table 4. Sources: [1] Bauer *et al.* 1995; [2] Andres *et al.* 1994; [3] data from various sources stored at SOVON Vogelonderzoek Nederland.

| Site / Source | Average | Min. | Max. | Period | January '95 |
|---|---|---|---|---|---|
| Bodensee[1] | 5,237 | | | 1977-86 | |
| | 5,494 | 4,819 | 6,161 | 1988-92 | 6,425 |
| Oberrhein[2] | 629 | 135 | 1,187 | 1977-91 | 685 |
| Niederrhein[3] | 361 | 88 | 845 | 1980-94 | 527 |

**Goosander** *Mergus merganser*

Breeding Goosander can be found all over northern Europe and northern Russia. Some isolated populations also occur in eastern and central Europe (e.g. in the Alps). The species' main wintering areas are found in the Baltic, as well as in the North Sea area. The northwest European population level fluctuates but seems to be stable on a longer term and is estimated at 150,000 birds.

In the Rhine Valley the only reports of breeding Goosanders originate from the area of the Bodensee. This area also holds a small moulting population in autumn. Wintering Goosanders are mainly present from December to March. Numbers usually reach maximum values in January and/or February. Compared to other wintering species, Goosanders tend to be present in relatively large numbers in late winter. The pattern in the various stretches within the Rhine Valley supports the general trend. Peak numbers heavily depend on winter conditions in the northern range of the winter area. As a piscivorous species, Goosander prefer river stretches with rather high water transparency. It is also attracted to reservoirs, gravel pits and other large waterbodies (e.g. Bodensee, Lake Ketelmeer, see below). As in Great Crested Grebe, Goosander at the Bodensee suffered from the low stocks of cyprinid fish *Cyprinidae* after 1980/81.

In January 1995 1,834 Goosander were counted in the Rhine Valley (Figure 24). Larger concentrations were found among all river stretches, e.g. 430 on the Bodensee, 206 at the southern Oberrhein and 314 at Lake Ketelmeer as well as 228 in the Biesbosch-Haringvliet area, both situated in the Niederrhein area. Low numbers were found along the Hochrhein. In consideration of the rather mild weather conditions in 1994/95, the numbers of Goosanders seen in January 1995 are consistent with those in the past decades (Table 16). Peak counts made in previous years almost invariably refer to cold winters.

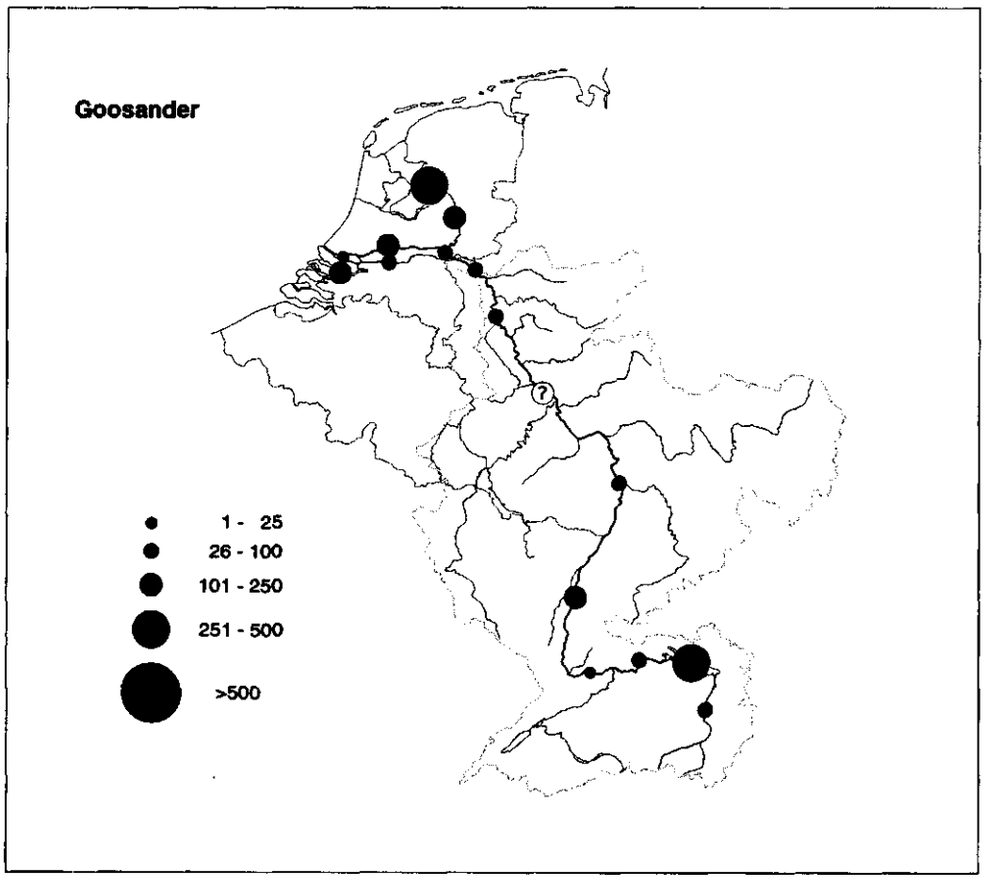



Figure 24. Distribution of Goosander in the Rhine Valley in January 1995 (cf. Figure 5).

Table 16. Numbers of Goosander in the Rhine Valley in January. Average, minimum (min.), maximum (max.) and period are given as well as the number counted in January 1995. For survey areas taken into account see Table 4. Sources: [1] Bauer *et al.* 1995; [2] Andres *et al.* 1994; [3] data from various sources stored at SOVON Vogelonderzoek Nederland.

| Site / Source | Average | Min. | Max. | Period | January '95 |
|---|---|---|---|---|---|
| Bodensee[1] | 549 | | | 1977-86 | |
| | 622 | 336 | 978 | 1988-92 | 430 |
| Oberrhein[2] | 444 | 159 | 1,519 | 1977-91 | 206 |
| Niederrhein[3] | 1,427 | 453 | 7,819 | 1980-94 | 942 |

**Coot** *Fulica atra*

Coots are breeding and wintering in the larger part of Europe. Populations in northern and eastern Europe are migratory and winter in western Europe. Overall, numbers have declined in the past decades, especially those wintering in central Europe and the western Mediterranean. Numbers in northwestern Europe seem to be stable. The most recent population estimate for northwestern Europe is 1,500,000.

In the Rhine Valley the Coot is an abundant breeding bird. Moreover birds gather to moult on the Bodensee. In the non-breeding period numbers gradually build up from September onwards and usually reach a maximum in January. Numbers tend to be high into March. On the Bodensee the population already peaks in November. Numbers here are relatively low after January. In most areas numbers of Coots slightly decline or remain stable. Numbers may fluctuate due to severe winters. Coots are omnivores. Especially on the Bodensee they feed on *Dreissena*. Here, the species also increased after the settlement of *Dreissena* (cf. Pochard, Tufted Duck) and consequently became also numerous in mid-winter (Suter 1982). However, it is only able to exploit the most shallow areas. Consolidation of the *Dreissena* biomass and competition by diving ducks like Tufted Duck, which have a better diving performance (Suter 1982, De Leeuw 1991), resulted in decreasing Coot numbers. In other parts of the Rhine Valley, Coot behave as herbivores and are mainly dependent on aquatic vegetation and grass. The species can be observed in dense flocks foraging in the forelands and slopes of river dikes.

Coots were among the most numerous species during the January survey in 1995 (Figure 25). The count resulted in 134,544 birds. Except for the Hochrhein, these were more or less uniformly distributed along the different stretches of the river. The largest stronghold was found at the Bodensee (58,400). Others were the southern Oberrhein (9,015) and the Niederrhein branches of IJssel (19,236), Nederrijn (14,624) and Waal (7,779). On the Bodensee, the number of Coots was higher than during previous counts in the 1980s (Table 17), but in close harmony with those given by Suter (1982) for the 1970s. The population size in the Dutch Niederrhein was within the range of numbers counted earlier, but that of the French Oberrhein confirms the overall declining trend which has become apparent here in the 1980s.

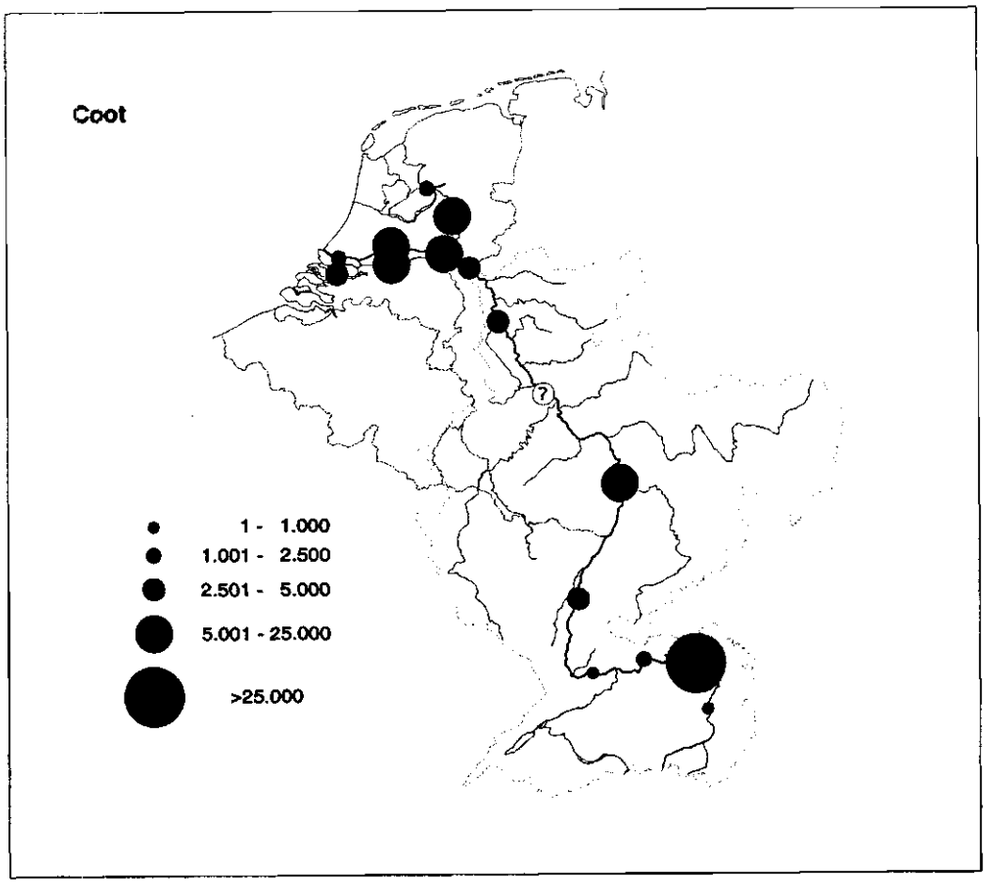



Figure 25. Distribution of Coot in the Rhine Valley in January 1995 (cf. Figure 5).

Table 17. Numbers of Coot in the Rhine Valley in January. Average, minimum (min.), maximum (max.) and period are given as well as the number counted in January 1995. For survey areas taken into account see Table 4. Sources: [1] Bauer *et al.* 1995; [2] Andres *et al.* 1994; [3] data from various sources stored at SOVON Vogelonderzoek Nederland.

| Site / Source | Average | Min. | Max. | Period | January '95 |
|---|---|---|---|---|---|
| Bodensee[1] | 32,283 | | | 1977-86 | |
| | 40,368 | 33,149 | 44,599 | 1988-92 | 58,400 |
| Oberrhein[2] | 10,045 | 4,633 | 15,558 | 1977-91 | 4,282 |
| Niederrhein[3] | 68,558 | 37,409 | 177,740 | 1980-94 | 55,488 |

# 4 Discussion & conclusions

## 4.1 The Rhine Valley in an international context

So far, several national reviews have been made for various areas in the Rhine Valley with respect to wetlands of international importance (Marti & Schifferli 1987, Grimmett & Jones 1989, Langeveld 1989, ZWFD 1993, Andres *et al.* 1994, Van den Tempel & Osieck 1994). An important tool in such assignments is the so-called 1% level. This threshold level was put forward in the Convention of Ramsar (1971), which gives a number of criteria to highlight the importance of wetlands. It implies the importance of an area when at least 1% of the flyway population of a species is present at some time. These population estimates are derived from the International Waterfowl Census of Wetlands International (current estimates are given by Rose & Scott 1994). Another criterion which is used, is that of the presence of at least 20,000 waterbirds in an area, regardless of the species.

For many species the Rhine Valley harbours numbers of international importance as numbers of 18 species exceeded the 1% level in January 1995 (Table 18). For Bewick's Swan, White-fronted Goose, Barnacle Goose, Wigeon, Gadwall, Red-crested Pochard, Pochard and Tufted Duck even more than 10% of the total flyway-population was present in the area. Concentrations of these species mainly occur in the Bodensee area (considered here as part of the Alpenrhein) and the Niederrhein. These were also the areas where the highest number of species was observed during the survey (see Table 3). Hochrhein and Oberrhein rank lower in international relevance, but note that numbers of species like Gadwall, Pochard and Tufted Duck in virtually all sections of the Rhine represent populations of international importance.

Langeveld (1990) has given a review of so-called Important Bird Areas (IBAs) in the Rhine Valley. Such areas are considered of major importance to the conservation of Europe's avifauna, for breeding birds as well as migrants and wintering birds (see also Grimmett & Jones 1989). Within the Rhine Valley 29 IBAs can be found (40 when taken into account that some areas cross borders of different countries). Most of them are situated in the areas of the Niederrhein, Oberrhein and Bodensee (Table 19). Only 5 areas are currently also officially designated as Ramsar Sites: part of the Biesbosch area in The Netherlands, the lower Niederrhein and Oberrhein between Eltville-Bingen in

Germany and 2 parts of the Bodensee area in Germany and Austria (see also Marti & Schifferli 1987, ZWFD 1993, Van den Tempel & Osieck 1994). Besides, two sites in Switzerland have been included in the Swiss Federal Inventory of Waterbird reserves of international importance (Ermatinger Becken and Untersee-Ende/Stein am Rhein). Only 7 of the areas have been included in the list of Special Protection Areas (SPAs), which has been set up for the conservation of wild birds in the EU member states. Both the numbers of waterbirds present in the Rhine Valley and the number of areas qualifying for special conservation status show that the floodplain of the river Rhine plays a major role in the annual cycle of many species of waterbirds on a population level. Moreover, to many species the area serves as a winter refuge when other important waterbodies like the Baltic and Lake IJsselmeer (The Netherlands) are covered with ice.

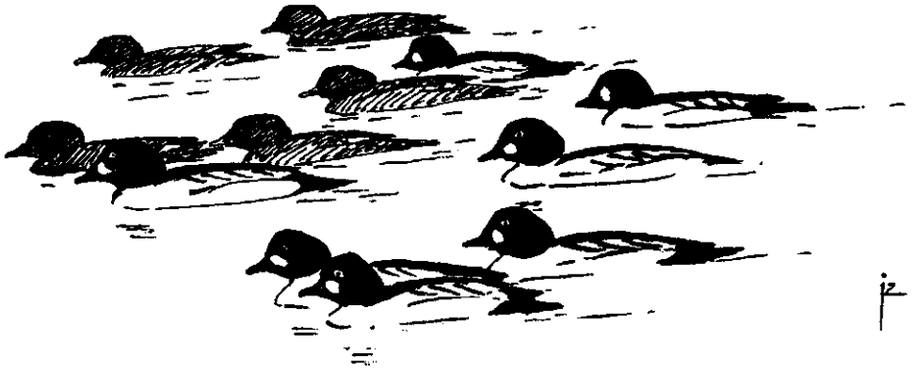


Table 18. International importance of the different Rhine stretches according to 1% levels and based on the results of the survey in January 1995 (+ exceeding 1% level). The 1% levels are taken from Rose & Scott 1994. Note that some of the 1% levels are currently under review due to increase of the population. The Mittelrhein was not taken into account in the survey. Alpenrhein includes the Bodensee.

| | 1% level | Alpen-rhein | Hoch-rhein | Ober-rhein | Nieder-rhein |
|---|---|---|---|---|---|
| Red-throated Diver | 750 | | | | |
| Black-throated Diver | 1,200 | | | | |
| Little Grebe | 1,000 | | | | |
| Great Crested Grebe | 1,000 | + | | | |
| Red-necked Grebe | 330 | | | | |
| Slavonian Grebe | 50 | | | | |
| Black-necked Grebe | 1,000 | | | | |
| Cormorant | 2,000 | | | + | + |
| Mute Swan | 1,800 | | | | |
| Bewick's Swan | 170 | | | | + |
| Whooper Swan | 250 | + | | | + |
| Bean Goose | 3,000 | | | | + |
| White-fronted Goose | 4,500 | | | | + |
| Greylag Goose | 1,200 | | | | + |
| Canada Goose | - | | | | |
| Barnacle Goose | 1,200 | | | | + |
| Egyptian Goose | - | | | | |
| Shelduck | 2,500 | | | | |
| Wigeon | 7,500 | | | | + |
| Gadwall | 250 | + | + | + | + |
| Teal | 4,000 | | | | + |
| Mallard | 20,000 | | | + | + |
| Pintail | 700 | | | | |
| Shoveler | 400 | | | | |
| Red-crested Pochard | 200 | + | | | |
| Pochard | 3,500 | + | | + | + |
| Ferruginous Duck | 500 | | | | |
| Tufted Duck | 7,500 | + | | + | + |
| Scaup | 3,100 | | | | |
| Eider | 20,000 | | | | |
| Long-tailed Duck | 20,000 | | | | |
| Common Scoter | 8,000 | | | | |
| Velvet Scoter | 2,500 | | | | |
| Goldeneye | 3,000 | + | | | |
| Smew | 150 | | | | + |
| Red-breasted Merganser | 1,000 | | | | |
| Goosander | 1,500 | | | | |
| Coot | 15,000 | + | | | + |
| Number of species exceeding 1% level | | 8 | 1 | 5 | 15 |
| Total number of species observed[1] | | 33 | 19 | 28 | 31 |

[1] see Table 3.

Table 19. Important Bird Areas (IBAs) in the Rhine Valley and areas which (partly) have been designated as RAMSAR Sites, according to the Ramsar Convention (RAMSAR) and/or Special Protection Areas (SPA), according to the EC/Wild Bird Directive (after Langeveld 1990, added with river IJssel from Van den Tempel & Osieck 1994).

| Important Bird Area | RAMSAR | SPA |
|---|---|---|
| *Alpenrhein & Bodensee:* | | |
| Ruggelerriet (LI) | | |
| Bodensee, Vorarlberger Rheindelta (A) | + | |
| Bodensee, Konstanzerbucht (CH/D) | | + |
| Bodensee/Untersee Ende & Rhein up to Bibermühle (CH/D) | | |
| Bodensee/Untersee, Hornspitze (D) | | + |
| Bodensee/Untersee, Radolfzeller Aachmündung & Mettnau (incl. Markelfinger Winkel) (D) | | + |
| Bodensee/Untersee, Wollmatinger Riet, Ermatinger Becken, Giehrenmoos & Gnadensee-ost (D) | + | + |
| Bodensee/Untersee, Schachenerbucht (D) | | |
| *Hochrhein*: | | |
| Aarestau, Klingnau (CH) | | |
| *Oberrhein*: | | |
| Rhine & Grand Canal d'Alsace, Village Neuf-Chalampé/ Haltingen-Neuenburg (F/D) | | |
| Rhine & Grand Canal d'Alsace, Chalampé-Biesheim/ Neuenburg-Breisnach (F/D) | | |
| Rhine & Grand Canal d'Alsace, Schoenau-Daubensand/ Weisweil-Nonnenweiher (F/D) | | |
| Rhine, Robertsau-Dalhunden/ Auenheim/Kehl-Greffern (F/D) | | |
| Rhine, Dalhunden-Munchhouse/ Greffern-Murgmündung (F/D) | | |
| Hördter Rheinaue (D) | | |
| Isultheimer Hof: Ludwig See & Im Schacher (D) | | |
| Lampertheimer Altrhein (D) | | + |
| Kühkopf-Knoblauchsaue (D) | | + |
| Gimbsheim-Eicher Altrhein & Fischsee (D) | | + |
| Rheinauen Eltville-Bingen (D) | + | |
| *Niederrhein:* | | |
| Wesel/Xanten-Emmerich/Hüthum (D) | + | |
| Gelderse Poort (NL) | | |
| IJssel, Deventer-Ketelmeer (NL) | | |
| Ketelmeer (NL) | | |
| Rijn, Heteren-Amerongen (NL) | | |
| Waal, Ewijk-Waardenburg (NL) | | |
| Biesbosch (NL) | + | |
| Hollandsch Diep (NL) | | |
| Haringvliet (NL) | | |

## 4.2 Trends

Herbivorous waterbirds largely dominate the avifauna of the Rhine Valley. Many of the species involved have shown increases over the past two decades (Table 20, see also Wigeon and Gadwall in Figure 26), some of which recently seem to have stabilised. The population growth in herbivores, such as swans, geese and some ducks has not only been noticed in the Rhine Valley, but applies also to the overall populations of these species in northwestern Europe (e.g. Monval & Pirot 1989, Rose 1995). This pattern often is attributed to the various protective measures (e.g. hunting ban) which have been taken in the course of the 1960s and 1970s, especially for geese (e.g. Ebbinge 1991). On the other hand, Van Eerden *et al.* 1996 have argued that changes in agricultural practice have improved the carrying capacity of the feeding habitat in winter. This development will also apply to the situation in the Rhine Valley, as many of the herbivores depend heavily on the pastures in the forelands.

Table 20. General trends in waterbird populations in the international Rhine Valley since the late 1970s (see also species accounts in 3.2). + increasing, - decreasing, = stable or trend scattered. Species are ranked according to food preference (non-breeding period). Note that Coot is classified as a herbivore, but does also feed on *Dreissena* (Bodensee, Suter 1982).

| *Herbivores* | trend | *Piscivores* | trend | *Benthivores* | trend |
|---|---|---|---|---|---|
| Mute Swan | + | Little Grebe | = | Pochard | - |
| Bewick's Swan | + | Great Crested Grebe | + | Tufted Duck | = |
| Whooper Swan | + | Cormorant | + | Goldeneye | +/- |
| Bean Goose | =/- | Goosander | = | | |
| White-fronted Goose | + | | | | |
| Greylag Goose | + | | | | |
| Barnacle Goose | + | | | | |
| Egyptian Goose | + | | | | |
| Wigeon | + | | | | |
| Gadwall | + | | | | |
| Teal | = | | | | |
| Mallard | = | | | | |
| Red-crested Pochard | + | | | | |
| Coot | = | | | | |

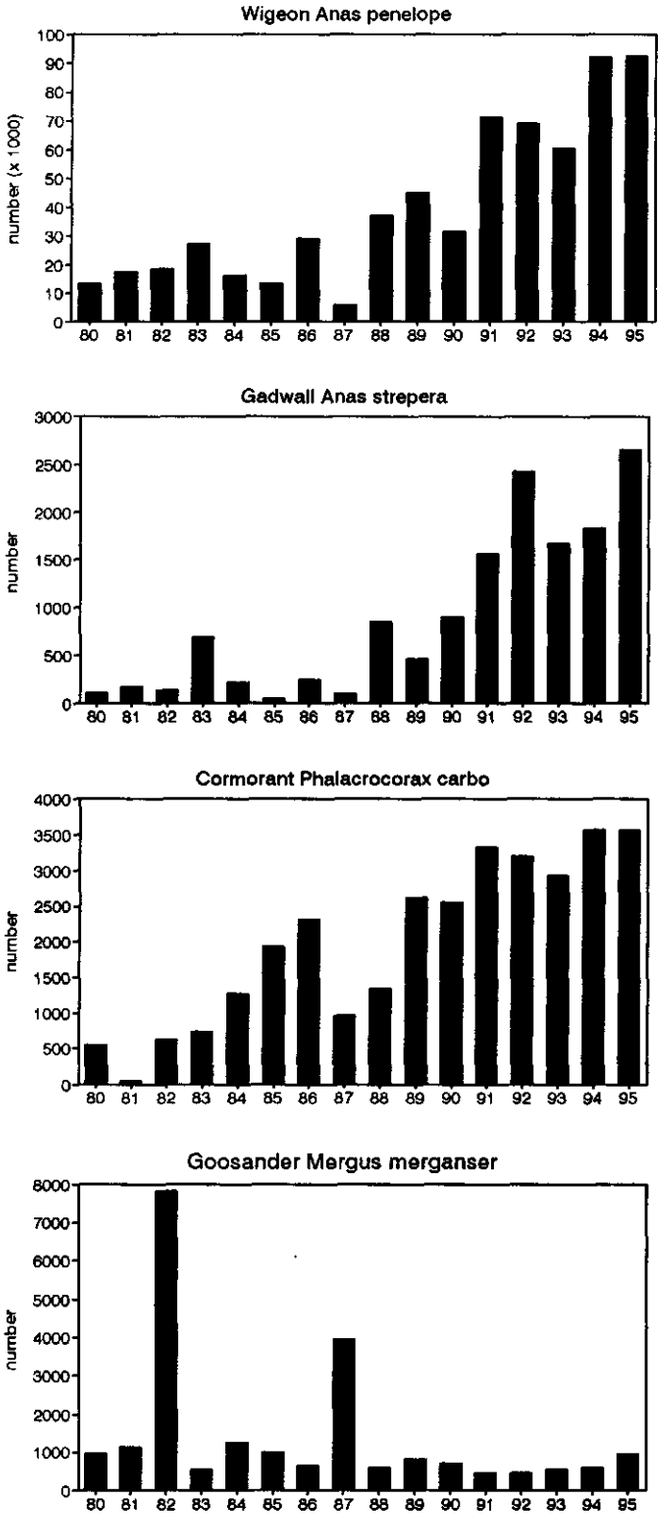



Figure 26. Examples of trends in some herbivorous and piscivorous waterbirds (Wigeon/Gadwall and Cormorant/Goosander respectively). The data refer to January counts in the Dutch Niederrhein area between 1980-95 (data stored at SOVON Vogelonderzoek Nederland).

In fact, only two of the herbivorous species observed in the Rhine Valley, can be regarded as true aquatic feeders: Gadwall and Red-crested Pochard. Gadwall have shown a westward expansion of their breeding range in the past century (Cramp & Simmons 1977), which resulted in an overall increase in northwestern Europe (see Figure 26). Although this development coincides with local declines in the original breeding range (Rose 1995), the eutrophication of European fresh waterbodies is thought to have largely contributed to the increasing numbers of Gadwall (Cramp & Simmons 1977). This species seems to feed predominantly on 'macro'-algae, especially those connected to artificial river banks.

Red-crested Pochard, on the other hand, responded different to eutrophication. In e.g. the Bodensee area close links have been observed between the occurrence of Red-crested Pochard and the amount of stoneworths, especially *Chara* sp. (Schuster *et al.* 1983). As the water quality deteriorated by eutrophication in the course of the 1960s, the fields of stoneworth declined, after which autumn numbers of Red-crested Pochard dropped to lower values. Improvements in water quality and consequently expanding fields of stoneworth, have recently resulted in rapid increasing Red-crested Pochard numbers (Bauer *et al.* 1995). A similar pattern has also been established in some Dutch waterbodies (Ruiters *et al.* 1994). These examples show that management measures concerning water quality may affect closely related species in a different way.

Among the benthivores, both Pochard and Tufted Duck have shown long-term increases in western European waterbodies in the last century, which are the result of a westward expansion of their breeding range (Cramp & Simmons 1977). However, in the past two decades numbers of Pochard have declined while the rising trend in numbers of Tufted Duck has levelled off (Rose 1995). Goldeneyes wintering in northwestern Europe have also shown an increase in the past decades whereas those wintering in central Europe remained stable. Especially numbers of Pochard and Tufted Duck wintering in the Rhine Valley have benefitted from the settlement of Zebra Mussels *Dreissena polymorpha* in the area by the end of the 1960s. Suter (1982) has shown for the Bodensee the reaction of these species to the development of *Dreissena* biomass (Figure 27). The exponential growth in *Dreissena* biomass coincided with a steep increase in numbers of Pochard and Tufted Ducks in the entire Bodensee area. Moreover they tended to stay well into midwinter (especially Tufted Duck). When the *Dreissena* biomass decreased in the second half of the 1970s, Tufted Duck numbers still increased in late autumn, but as the (lower) available biomass of

*Dreissena* consequently was depleted earlier, the birds had to leave parts of the area already after November. In Pochard this pattern is even more pronounced. Numbers of this species did not further increase in the course of the 1970s, while their peak occurrence was always well ahead of that of Tufted Duck. Compared to Tufted Duck, the diving performance of Pochard is less developed (De Leeuw 1991) and the available biomass of *Dreissena* will therefore be depleted earlier as a result of competition by Tufted Duck. The settlement of an abundant stock of *Dreissena* in the Bodensee area was also followed by an increase in numbers of Coot. Although chiefly vegetarian in large parts of the Rhine Valley, Coots do feed extensively on Zebra Mussels in the Bodensee area, but have to compete with Tufted Duck and Pochard which are better divers. Another example of the link between benthivores and biomass of *Dreissena* was found in the Delta of the river IJssel (Figure 28). Here, numbers of benthivores rose rapidly in the 1980s as the biomass of *Dreissena* increased (data RIZA, Noordhuis *et al.* in prep). An important development concerning benthivores which recently has become apparent, is the massive invasion of the amphipod *Corophium curvispinum* in the Rhine ecosystem. This species outnumbers other macro-invertebrates important to birds, like e.g. *Gammarus tigrinus*, *Dreissena polymorpha* and *Hydropsyche contubernalis*, and moreover competes with some of them for food (Van den Brink *et al.* 1993). Such a development is expected to have an impact on the entire food web and thus will also affect the occurrence of diving ducks.

Like some herbivores, a number of fish eating species (Great Crested Grebe, Cormorant) has also increased as a result of the eutrophication of fresh waterbodies. By means of eutrophication, fish biomass in many cases has increased while the species composition has changed to small, short living and early maturing fish like Perch *Perca fluviatilis* and Ruffe *Gymnocephalus cernuus* and/or cyprinid species such as Bream *Abramis brama* and Roach *Rutilus rutilus* (e.g. De Nie 1995). The most striking population trend is the exponential increase of the population of Cormorants in northwestern Europe (Figure 26), which between 1978-1993 has shown an annual growth rate of 16% (Van Eerden & Gregersen 1995). Only recently this trend has changed and numbers have remained stable or even declined. In the Rhine Valley an interplay of fish stocks and the population of some piscivores became apparent in the Bodensee area in 1980/81 and 1981/82 where reduced stocks of cyprinid fish *Cyprinidae* resulted in a marked decline in numbers of e.g. Great Crested Grebe and Goosander. Numbers in the latter species, however, also depend on winter conditions in the northern range of the wintering area (see marked increases in the cold winters of 1981/82 and 1986/87 in Figure 26).

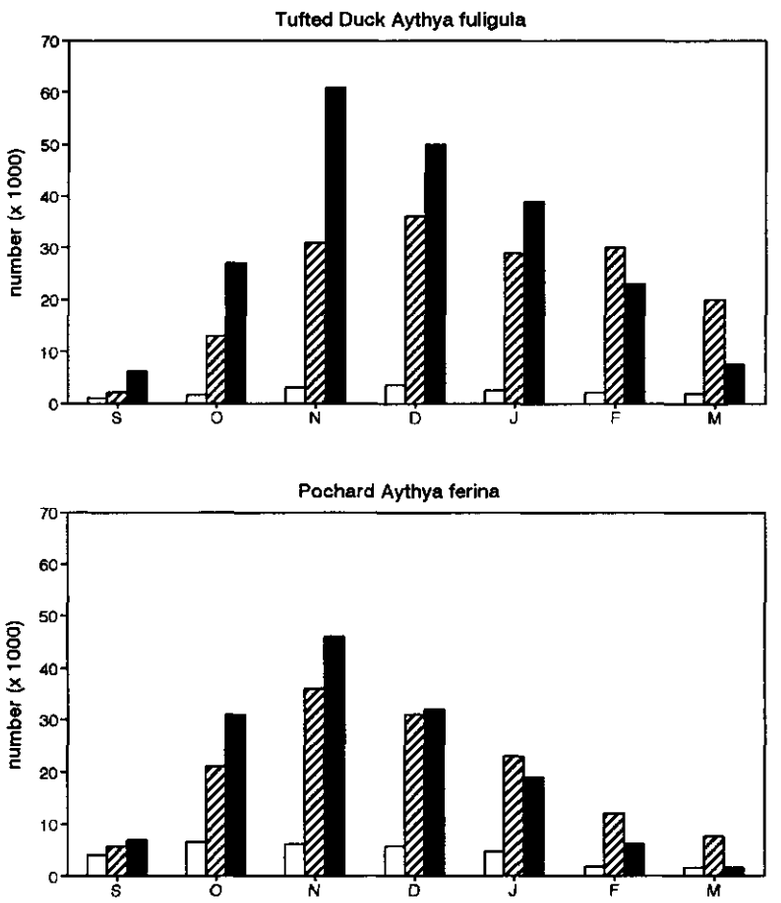



Figure 27. Seasonal pattern (average/month) of Tufted Duck and Pochard on the Bodensee before the settlement of Zebra Mussels *Dreissena polymorpha* (1962/63-1968/69, white), during exponential increase of *Dreissena* biomass (1969/70-1974/75, shaded) and after consolidation of *Dreissena* biomass on a lower level (1975/76-1980/81, black). Redrawn after Suter 1982.

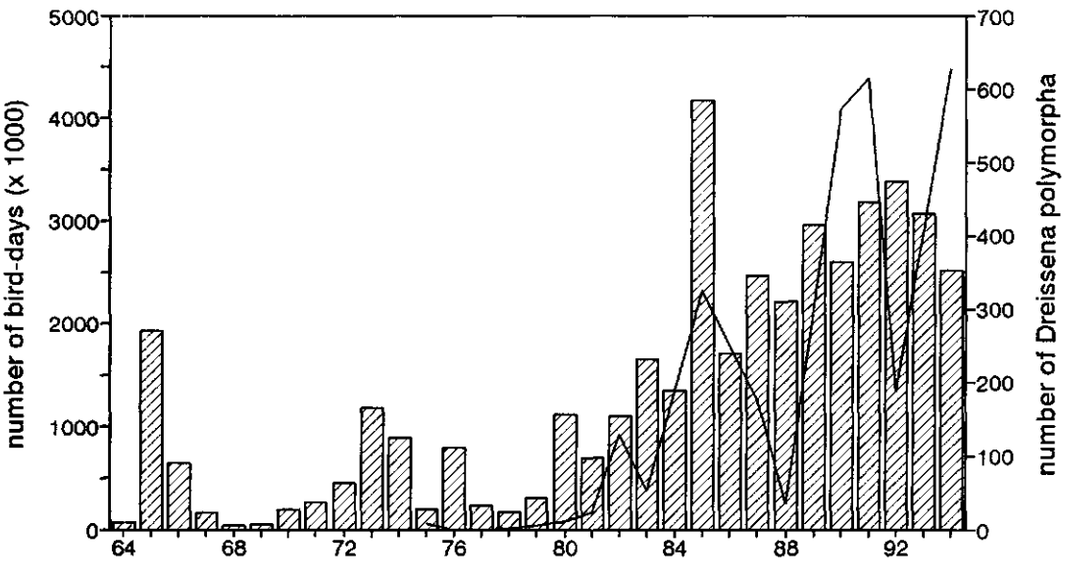
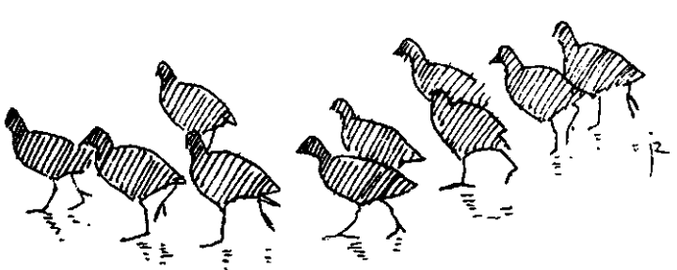



Figure 28. Occurrence of Tufted Duck, Pochard and Coot in the delta of the river IJssel and the development in biomass of Zebra mussels *Dreissena polymorpha*. The presence of birds is expressed by the total number of bird-days (monthly number of birds * days per month) from July till June of each year (July 1964-June 1965 etc.). The data on *Dreissena* refer to samples at 8 sites along the river IJssel and show the average number of mussels for a group of 5 stones. Data from RIZA (Noordhuis *et al.* in prep.).



## 4.3 Monitoring of waterbirds in the Rhine Valley in a future prospect

With this report, a first attempt has been made to review the status of waterbirds in the international Rhine Valley. Until now, data had only been processed on a national level. During the internationally coordinated survey in January 1995, several species were present in numbers of international importance. Moreover, their seasonal pattern, distribution and trends in numbers in the past decades have revealed a strong correlation with other environmental parameters, such as the available biomass of macro-invertebrates and fish and the occurrence of macrophytes. In this report several examples of such an interplay have been given. Birds in general have a top position in food webs and therefore prove to be excellent biological indicators of processes on lower trophic levels, especially when considered on a longer term, as year to year fluctuations due to other reasons such as weather and conditions elsewhere in the distribution range may be ruled out then. Besides, counts of birds are highly accurate in quantitative terms and methodology. For this reason, bird data are also highly effective in evaluating management measures taken.

Currently, schemes of waterbird counts are running in all countries bordering the Rhine. In fact, during the larger part of the non-breeding season, almost the entire area is already covered by monthly counts. A monitoring programme to be set up for the entire Rhine Valley should include these counts as well. Being a pilot-study, for this report only results of the January 1995 survey have been processed. However, regarding differences in seasonal patterns between the various areas within the Rhine Valley as well as the impact of food availability on annual cycles (see e.g. Figure 27), it must be stressed that the value of the data will be much enhanced by including all available counts. In a second stage, also data on breeding birds can be taken into account, but in contrast to the waterbird census, no international network of coordinated breeding bird surveys which emphasises on the entire Rhine Valley has been set up yet. However, research on breeding birds has proven to be effective in pointing out pollution by chemical compounds, which accumulate in the birds' food. In a study on Cormorants in the Niederrhein area in The Netherlands e.g. close links were found between the contamination of feeding areas by heavy metals and chlorinated hydrocarbons and the low breeding success in nearby colonies (Boudewijn & Dirksen 1995, Dirksen *et al.* 1995).

Comparable to the situation in the international Rhine Valley, national surveys of both breeding and non-breeding birds recently have been put together in a joint monitoring project running in the international Wadden Sea (e.g. Fleet 1989). Under the supervision of the Trilateral Monitoring and Assessment Group of the Common Waddensea Secretariat (CWSS) in Wilhelmshaven, assessment methods have been standardised and annual surveys of breeding birds and counts of waterbirds are now being undertaken successfully (Fleet *et al.* 1989, Poot *et al.* 1996). Data processing and preparation of reports are shared by the participating national coordinators. The setup of this project has much enhanced the national efforts in coordinating such censuses and is an example of a fruitful cooperation between volunteers, NGOs and governmental bodies. Moreover, financial support from the national governments proved to be indispensable in providing a national coordinating body in each country, which is responsible for the organisation, data processing and publication of the results.

Such a cooperation could also apply to the waterbird surveys in the Rhine Valley, as the general structure in organisation of the fieldwork is highly comparable to the situation in the Wadden Sea. Furthermore, to implement bird census data in the ecological monitoring network of the International Rhine Commission, an evaluation of the bird censuses and closely related monitoring schemes like those of phytoplankton, macro-invertebrates and fish should be made with respect to the geographical scale and frequency in which they are conducted. Such an integrated monitoring scheme of the ecological parameters, will be very powerful in assessing trends and their underlying processes.

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Appendix 1. Numbers of waterbirds in the Rhine valley in January 1995, listed according to main survey areas. The Mittelrhein (D20) was not covered during the survey.

| species | S10 | S20 | S30 | S40 | F10 | D10 | D20 | D30 | D40 | N10 | N20 | N30 | N40 | N50 | N60 | N70 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Red-throated Diver | 0 | 9 | 0 | 0 | 7 | 1 | . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 21 |
| Black-throated Diver | 0 | 32 | 0 | 0 | 0 | 0 | . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 |
| Little Grebe | 10 | 800 | 285 | 73 | 344 | 72 | . | 14 | 17 | 4 | 11 | 0 | 1 | 15 | 18 | 42 | 1706 |
| Great Crested Grebe | 0 | 6638 | 35 | 122 | 728 | 1776 | . | 129 | 262 | 199 | 334 | 558 | 316 | 336 | 143 | 1008 | 12584 |
| Red-necked Grebe | 0 | 61 | 0 | 0 | 0 | 8 | . | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 71 |
| Slavonian Grebe | 0 | 4 | 0 | 0 | 0 | 0 | . | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 6 |
| Black-necked Grebe | 0 | 429 | 0 | 0 | 0 | 1 | . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 430 |
| Cormorant | 5 | 1295 | 335 | 186 | 1864 | 4580 | . | 243 | 313 | 326 | 661 | 574 | 436 | 353 | 207 | 999 | 12377 |
| Mute Swan | 6 | 1498 | 262 | 81 | 755 | 327 | . | 254 | 66 | 130 | 570 | 0 | 401 | 206 | 15 | 77 | 4648 |
| Bewick's Swan | 0 | 3 | 0 | 0 | 0 | 0 | . | 0 | 11 | 24 | 1782 | 3 | 454 | 596 | 0 | 6 | 2879 |
| Whooper Swan | 0 | 270 | 0 | 0 | 0 | 0 | . | 0 | 25 | 4 | 193 | 0 | 39 | 57 | 0 | 12 | 600 |
| Bean Goose | 0 | 0 | 0 | 0 | 1203 | 100 | . | 0 | 7306 | 183 | 3 | 381 | 212 | 436 | 0 | 162 | 9986 |
| White-fronted Goose | 0 | 0 | 0 | 0 | 7 | 0 | . | 0 | 113487 | 25942 | 54104 | 0 | 4141 | 18015 | 45 | 6623 | 222364 |
| Greylag Goose | 0 | 0 | 0 | 0 | 129 | 290 | . | 2 | 1647 | 1247 | 661 | 17 | 531 | 992 | 311 | 4776 | 10603 |
| Canada Goose | 0 | 17 | 0 | 0 | 0 | 0 | . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 |
| Barnacle Goose | 0 | 0 | 0 | 0 | 0 | 0 | . | 0 | 0 | 17 | 13 | 0 | 3 | 604 | 3 | 21133 | 21773 |
| Egyptian Goose | 0 | 0 | 0 | 0 | 0 | 2 | . | 0 | 9 | 78 | 147 | 0 | 185 | 230 | 8 | 43 | 702 |
| Shelduck | 0 | 11 | 0 | 2 | 1 | 0 | . | 0 | 6 | 6 | 22 | 0 | 16 | 18 | 8 | 101 | 191 |
| Wigeon | 0 | 235 | 186 | 26 | 1264 | 43 | . | 7 | 1355 | 5091 | 16013 | 0 | 14052 | 25294 | 471 | 31557 | 95594 |
| Gadwall | 7 | 2749 | 334 | 265 | 3485 | 285 | . | 14 | 26 | 104 | 42 | 12 | 405 | 119 | 736 | 1231 | 9814 |
| Teal | 27 | 2399 | 35 | 120 | 1460 | 537 | . | 5 | 333 | 721 | 445 | 155 | 1131 | 173 | 438 | 2105 | 10084 |
| Mallard | 644 | 12909 | 1489 | 1453 | 14596 | 11168 | . | 4566 | 5449 | 3541 | 7262 | 2432 | 6615 | 4457 | 2953 | 25838 | 105372 |
| Pintail | 1 | 226 | 0 | 0 | 19 | 2 | . | 0 | 18 | 48 | 8 | 0 | 7 | 11 | 2 | 190 | 532 |
| Shoveler | 0 | 316 | 1 | 0 | 5 | 7 | . | 2 | 0 | 0 | 5 | 0 | 43 | 8 | 7 | 70 | 464 |
| Red-crested Pochard | 0 | 2959 | 16 | 9 | 1 | 6 | . | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2992 |
| Pochard | 11 | 37658 | 1698 | 1337 | 3435 | 2167 | . | 401 | 764 | 738 | 4631 | 2708 | 947 | 1611 | 1609 | 602 | 60317 |
| Ferruginous Duck | 0 | 4 | 2 | 0 | 0 | 0 | . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| Tufted Duck | 38 | 69856 | 2566 | 3119 | 11917 | 3578 | . | 556 | 1146 | 665 | 1604 | 12370 | 2353 | 2291 | 6430 | 14199 | 132688 |
| Scaup | 0 | 136 | 1 | 1 | 11 | 1 | . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 156 |
| Eider | 0 | 29 | 0 | 0 | 5 | 0 | . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 35 |
| Long-tailed Duck | 0 | 1 | 0 | 0 | 0 | 0 | . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Common Scoter | 0 | 13 | 0 | 0 | 0 | 0 | . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| Velvet Scoter | 0 | 21 | 0 | 0 | 5 | 0 | . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 |
| Goldeneye | 4 | 6425 | 35 | 143 | 685 | 272 | . | 31 | 145 | 3 | 30 | 42 | 50 | 2 | 42 | 358 | 8267 |
| Smew | 0 | 13 | 1 | 0 | 27 | 23 | . | 3 | 78 | 45 | 85 | 32 | 50 | 64 | 45 | 58 | 524 |
| Red-breasted Merganser | 1 | 21 | 0 | 0 | 0 | 0 | . | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 47 | 70 | 140 |
| Goosander | 28 | 430 | 37 | 19 | 206 | 91 | . | 47 | 34 | 41 | 158 | 314 | 121 | 67 | 13 | 228 | 1834 |
| Coot | 5 | 58400 | 1422 | 517 | 4282 | 9015 | . | 2619 | 2796 | 6182 | 19236 | 1930 | 14624 | 7779 | 1710 | 4027 | 134544 |
| all species | 787 | 205867 | 8740 | 7473 | 46441 | 34352 | ? | 8894 | 135294 | 45339 | 108021 | 21528 | 47134 | 63736 | 15261 | 115526 | 864393 |

Appendix 2. Species names. Also indicated is the classification ('Type') according to which species have been categorised with respect to their main food. B Benthivore, H Herbivore and P Piscivore.

| Euring | Type | English | Latin | German | French | Dutch |
|---|---|---|---|---|---|---|
| 20 | p | Red-throated Diver | Gavia stellata | Sterntaucher | Plongeon catmarin | Roodkeelduiker |
| 30 | p | Black-throated Diver | Gavia arctica | Prachttaucher | Plongeon arctique | Parelduiker |
| 70 | p | Little Grebe | Tachybaptus ruficollis | Zwergtaucher | Grèbe castagneux | Dodaars |
| 90 | p | Great Crested Grebe | Podiceps cristatus | Haubentaucher | Grèbe huppé | Fuut |
| 100 | p | Red-necked Grebe | Podiceps grisegena | Rothalstaucher | Grèbe jougris | Roodhalsfuut |
| 110 | p | Slavonian Grebe | Podiceps auritus | Ohrentaucher | Grèbe esclavon | Kuifduiker |
| 120 | p | Black-necked Grebe | Podiceps nigricollis | Schwarzhalstaucher | Grèbe à cou noir | Geoorde Fuut |
| 720 | p | Cormorant | Phalacrocorax carbo | Kormoran | Grand Cormoran | Aalscholver |
| 1520 | h | Mute Swan | Cygnus olor | Höckerschwan | Cygne Tuberculé | Knobbelzwaan |
| 1530 | h | Bewick's Swan | Cygnus columbianus | Zwergschwan | Cygne de Bewick | Kleine Zwaan |
| 1540 | h | Whooper Swan | Cygnus cygnus | Singschwan | Cygne sauvage | Wilde Zwaan |
| 1570 | h | Bean Goose | Anser fabalis | Saatgans | Oie des moissons | Rietgans |
| 1590 | h | White-fronted Goose | Anser albifrons | Blässgans | Oie rieuse | Kolgans |
| 1610 | h | Greylag Goose | Anser anser | Graugans | Oie cendrée | Grauwe Gans |
| 1660 | h | Canada Goose | Branta canadensis | Kanadagans | Bernache du Canada | Canadese Gans |
| 1670 | h | Barnacle Goose | Branta leucopsis | Weisswangengans | Bernache nonnette | Brandgans |
| 1700 | h | Egyptian Goose | Alopochen aegyptiacus | Nilgans | Oie d'Egypte | Nijlgans |
| 1730 | b | Shelduck | Tadorna tadorna | Brandente | Tadorne de Belon | Bergeend |
| 1790 | h | Wigeon | Anas penelope | Pfeifente | Canard siffleur | Smient |
| 1820 | h | Gadwall | Anas strepera | Schnatterente | Canard chipeau | Krakeend |
| 1840 | h | Teal | Anas crecca | Krickente | Sarcelle d'hiver | Wintertaling |
| 1860 | h | Mallard | Anas platyrhynchos | Stockente | Canard colvert | Wilde Eend |
| 1890 | h | Pintail | Anas acuta | Spiessente | Canard pilet | Pijlstaart |
| 1940 | h | Shoveler | Anas clypeata | Löffelente | Canard souchet | Slobeend |
| 1960 | h | Red-crested Pochard | Netta rufina | Kolbenente | Nette rousse | Krooneend |
| 1980 | b | Pochard | Aythya ferina | Tafelente | Fuligule milouin | Tafeleend |
| 2020 | h | Ferruginous Duck | Aythya nyroca | Moorente | Fuligule nyroca | Witoogeend |
| 2030 | b | Tufted Duck | Aythya fuligula | Reiherente | Fuligule morillon | Kuifeend |
| 2040 | b | Scaup | Aythya marila | Bergente | Fuligule milouinan | Toppereend |
| 2060 | b | Eider | Somateria mollissima | Eiderente | Eider à duvet | Eidereend |
| 2120 | b | Long-tailed Duck | Clangula hyemalis | Eisente | Harolde de Miquelon | IJseend |
| 2130 | b | Common Scoter | Melanitta nigra | Trauerente | Macreuse noire | Zwarte Zeeëend |
| 2150 | b | Velvet Scoter | Melanitta fusca | Samtente | Macreuse brune | Grote Zeeëend |
| 2180 | b | Goldeneye | Bucephala clangula | Schellente | Garrot à l'oeil d'or | Brilduiker |
| 2200 | p | Smew | Mergus albellus | Zwergsäger | Harle piette | Nonnetje |
| 2210 | p | Red-breasted Merganser | Mergus serrator | Mittelsäger | Harle huppé | Middelste Zaagbek |
| 2230 | p | Goosander | Mergus merganser | Gänsesäger | Harle bièvre | Grote Zaagbek |
| 4290 | h | Coot | Fulica atra | Blässhuhn | Foulque macroule | Meerkoet |

PUBLICATIES EN RAPPORTEN VAN HET PROJECT "ECOLOGISCH HERSTEL RIJN EN MAAS"

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