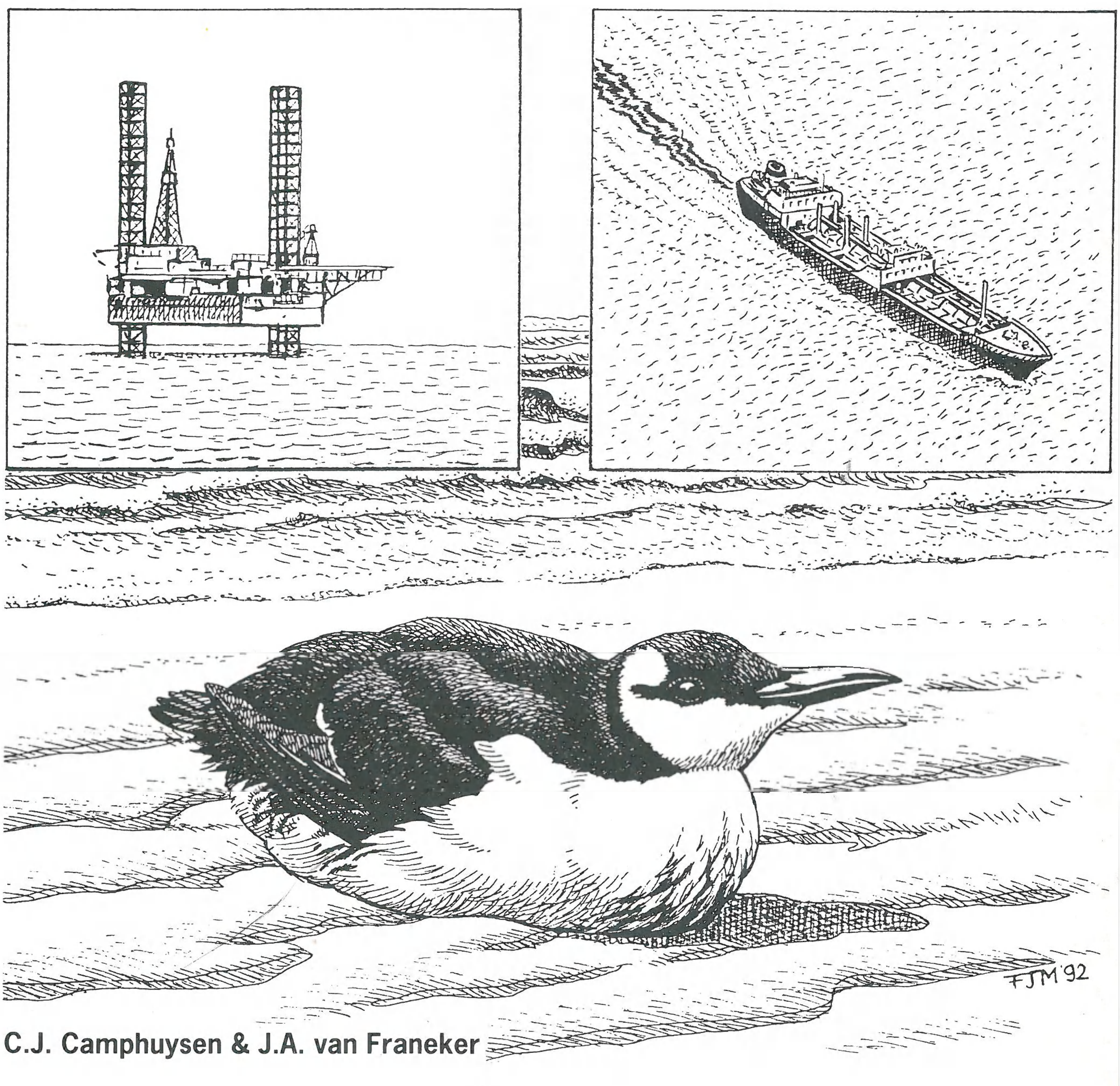
Technisch rapport Vogelbescherming **10**

The value of beached bird surveys in monitoring marine oil pollution

Proposal for a European Beached Bird Survey (EBBS) to monitor the effectiveness of policy measures to reduce oil pollution at sea



C.J. Camphuysen & J.A. van Franeker

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Proposal for a European Beached Bird Survey (EBBS) to monitor the effectiveness of policy measures to reduce oil pollution at sea

C.J. Camphuysen & J.A. van Franeker
Zeist, 1992

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SUMMARY

Motivation Large numbers of oiled seabirds have littered the North Sea shores for almost a century. Governments have responded to the continuous problem of oil pollution at sea by a series of international treaties, the most recent one of which came into force in 1983 (Annex I of the International Convention for the Prevention of Pollution from Ships, MARPOL). However, beached bird surveys over the past decades, could not detect significant improvements as a consequence of these policy measures.

In 1990, the International Maritime Organization, at the 30th session of the Marine Environment Protection Committee, concluded that it was difficult to fully assess the degree of (non-) compliance with MARPOL regulations, one of the reasons being that there is a lack of worldwide efficient monitoring.

In that same year, the Third International Conference on the Protection of the North Sea in The Hague discussed further measures to reduce oil pollution on the North Sea. In the Final Declaration of the Conference it was also decided:

"to investigate the possibilities of using beached oil pollution victims among seabirds and coastal birds as indicators for the effectiveness of the actions in this Declaration under the headings "Pollution from Ships" and "Pollution from Offshore Installations""

In Annex 5 of the Declaration this decision was specified by requesting consideration of the indicator value of the percentage of oil polluted birds on the total of beached birds, and consideration of the possibilities to intensify chemical analysis of oil samples from beached birds.

The declaration reflects the strong political interest in ways of monitoring oil pollution levels at sea. An objective means of evaluating the effectiveness of policies is urgently required. Possible indicators of trends in marine oil pollution could for example be: the number of oil slicks observed during aerial surveillance; the quantities of oil delivered to port reception facilities; and the occurrence of oiled birds on beaches. "The Value of Beached Bird Surveys in Monitoring Marine Oil Pollution" has been written in response to the decisions from the Final Declaration with regards to oiled seabirds. The project was initiated by the Netherlands Society for the Protection of Birds, together with the Working Group Beached Bird Surveys of the Dutch Seabird Group (NZG/NSO) and the Dutch Working Group North Sea Foundation. The Dutch Ministry of Agriculture, Nature Management and Fisheries funded analysis of data by NZG/NSO and writing of the report.

Monitoring oil pollution In the report, data from beached bird surveys from both the Netherlands and many other European countries are looked upon from the viewpoint of an oil monitoring system that can be used in policy (Chapter 6). First of all, it is shown that all oiling observed on birds definitely originates from illegal discharges and not from legal ones. Examples of factors influencing the numbers of dead oiled seabirds on beaches show that densities (numbers per km) are unreliable for monitoring changes in oil pollution at sea. However, it is shown that the percentage of birds that is oil contaminated (the "oil-rate") is not influenced in such a way by these factors. Within a bird species, in the same region and over an extended period of time, oil-rates are remarkably constant in spite of fluctuating densities of birds on beaches. More important however, are examples of local areas where policy measures to reduce oil-pollution are closely followed by oil-rates among beached birds. In Shetland

and Orkney, the establishment of oil-terminals was associated with strong increases in oil-rates of local seabirds, but subsequent policy measures against discharges by visiting tankers were also immediately visible in reduced oil-rates. In the Baltic, oil-rates apparently dropped considerably since the region became a "Special Area" under MARPOL Annex I in 1983, but further data need to be collected. Along the German North Sea coast oil-rates dropped significantly in recent years after an experiment to provide free oil reception facilities to ships visiting German harbours. This strong downward trend is definitely not visible on Dutch or Danish coasts, where oil-rates remain as high as they have been for several decades. When looking in more detail at the Dutch situation there are indications that oil pollution in nearshore areas may have declined. Evidence from bird species living further offshore indicates much less improvement on open sea: only a very slight and insignificant decline may start to show, but overall oil-rates in this area are still extremely high. There are different ways of looking at oil-rates when presenting monitoring results. Frequency distributions of monthly figures for oil-rates (see figures 4.5, 4.6) seem a particular useful way of presenting annual updates of the effectivenes of measures to reduce illegal oil discharges.

Chemical analysis of oil samples Identification of sources of oil pollution is of evident importance if effective policy measures are to be taken. A systematic oil sampling programme in 1990-92 associated with beached bird surveys in Denmark, Germany and the Netherlands has shown the value of the combination of these activities. The large majority of oils originated from "operational" (but illegal) discharges of mainly fuel oils from ships. Crude oil discharges from tankers were only a common phenomenon near Northern Denmark. The sampling programme also showed to be able to signal and monitor other types of harmful pollution as indicated by findings of dead birds fouled with non-mineral oils and chemical substances such as Dodecylphenol.

Aerial surveillance When comparing the use of beached bird surveys in monitoring oil pollution to that of aerial surveillance, it has to be concluded that the methods are complementary. Bird surveys are less practical in summer due to for example the cleaning of beaches, but aerial surveys are increasingly inaccurate during windy conditions in winter. Aerial surveys can give some sort of quantitative impression of oil slicks at sea, but a large proportion of incidents is missed as flights are severely restricted in time and space; birds may give a less direct, but much more integrated index of actual oil pollution at sea. The reliability of a monitoring system strongly depends on its ability to detect trends against a long-term series of baseline data. Beached bird surveys, as compared to aerial surveillance or data on quantities of oil delivered to shore, have an evident advantage in having a much longer series of such baseline data for a monitoring programme. Furthermore, contrary to other monitoring methods, beached bird surveys are suitable to monitor effects of oil pollution as well.

Monitoring the effects of oil pollution: seabird mortality An oil monitoring system should not only look at the scale of oil pollution, but also has to be concerned with the environmental effects of that pollution. Beached bird surveys do have the potential to investigate the scale of oil induced seabird mortality and to relate this to population levels. Chapter 7 of the report discusses the complexity of this type of research. As indicated before, densities of bird corpses on beaches fluctuate strongly under the influence of a variety of factors. Detailed investigations, such as dissections may be needed to separate oil induced mortality from deaths by other causes. To relate the mortality of birds to particular populations, it is necessary to investigate the origins and sex- and age-distributions of birds killed by oil (e.g. by ringing studies, morphological investigations and dissections). Furthermore, the data will have to be

looked at in the framework of other seabird studies such as on their distribution and feeding habits at sea and on their reproduction in the colonies. Mainly from the example of the Guillemot this section of the report shows how beached bird surveys in combination with all such other information can reach conclusions on the population effects of mortality induced by oil. The same studies can also signal and monitor other, or additional causes of mortality.

Developments in beached bird surveys Over the past decades, the character of beached bird surveys has changed considerably from individuals reporting oil victims on a local beach, to regionally, nationally and later internationally co-ordinated censuses with increasingly refined and standardized methods (Chapter 8). The current status of beached bird survey programmes in Western Europe is summarized in Chapter 9, together with a bibliography of published results from these programmes. The decisions from the North Sea Conference in the Hague may mark another significant change: the start of a European monitoring system of marine oil pollution and seabird mortality to be used to measure and improve the effectiveness of policy decisions. In Chapter 10 it is concluded that beached bird surveys can be a useful monitoring system if an internationally coordinated survey scheme is further developed.

European Beached Bird Survey To achieve the aim of an adequate oil pollution monitoring system for use in policy decisions, chapter 11 of the report proposes a European Beached Bird Survey (EBBS). The EBBS would annually provide national and supra-national authorities in Western Europe with an updated policy document on the effectiveness of their actions to reduce marine oil pollution. The objectives of such a programme require strong international co-ordination and partly, the input of professional researchers. Traditionally, volunteer activities will have to provide the broad basic data for an EBBS, but more detailed investigations, including the sampling of oil for chemical analysis, needs to be conducted by professionals in well defined smaller study areas. Specific proposals of how an EBBS should be structured are put forward. Financial implications of three different scenarios for an EBBS are calculated. The scenarios range from an EBBS with full volunteer input plus an adequate number of professional study areas to a single mid-winter count by volunteers and very limited professional activity in a few study areas. Also the reasons for, and implications of, the inclusion of different sea areas in the proposals are clarified. It is recommended that a European Beached Bird Survey be established over most of Western Europe and the Balctic, in which the level of volunteer or professional activity depends on regional situations and the relevance for the overall monitoring objective of the programme. The estimated cost of such a programme would be between 1.5 and 2 million ECU per annum. About half of this budget needs to be raised nationally, part of which is already available in existing survey programmes. The other half of the budget will have to be sollicited from international bodies or other funding agencies. An interim international co-ordinator should further prepare the structure and financial background of an EBBS to start in late 1995, shortly after the next International Conference on the Protection of the North Sea.

SAMENVATTING

Aanleiding Al bijna een eeuw bezoedelen grote aantallen beoliede zeevogels de kusten van de Noordzee. Regeringen hebben dit hardnekkige probleem van olievervuiling op zee aangepakt door middel van een aantal internationale verdragen. Het meest recente verdrag werd in 1983 van kracht (Annex I van MARPOL). Tellingen van olieslachtoffers gedurende de afgelopen decennia brachten echter geen opmerkelijke verbeteringen aan het licht als mogelijk gevolg van dergelijke beleidsmaatregelen.

In 1990 werd op de 30e zitting van het "Marine Environment Protection Committee" van de "International Maritime Organization" geconcludeerd dat het moeilijk was om vast te stellen in hoeverre de MARPOL regels worden nageleefd. Eén van de genoemde redenen was het ontbreken van efficiente monitoring systemen. Eveneens in 1990 werden tijdens de derde Noordzee Ministers Conferentie in Den Haag verdere maatregelen besproken om olievervuiling op de Noordzee terug te dringen. In de slotverklaring werd daarnaast besloten om:

"te onderzoeken in hoeverre olieslachtoffers onder zee- en kustvogels te gebruiken zouden zijn als maatstaf voor de effectiviteit van de maatregelen in de slotverklaring ten aanzien van vervuiling door schepen en offshore installaties."

In Annex V van de Slotverklaring werd dit punt verder uitgewerkt door te vragen om een nadere beschouwing van waarde van het percentage met olie besmette exemplaren onder aangespoelde vogels en om het nagaan van de mogelijkheden voor intensievere chemische analyse van oliemonsters van gestrande vogels. De slotverklaring weerspiegelt de grote politieke interesse in meetsystemen van olievervuiling op zee. Een objectieve maatstaf om de effectiviteit van beleidsmaatregelen te meten, is dringend gewenst. Als mogelijke indicatoren van de mate van olievervuiling op zee zou men kunnen kijken naar bijvoorbeeld het aantal tijdens luchtbewaking waargenomen olievlekken, de bij haven-ontvangst-installaties ingeleverde hoeveelheden afvalolie, of beoliede vogelslachtoffers op stranden.

Dit rapport, getiteld "The Value of Beached Bird Surveys in Monitoring Marine Oil Pollution", is samengesteld als antwoord op de Slotverklaring van de Ministersconferentie voor wat betreft beoliede zeevogels. Het project ontstond op initiatief van Vogelbescherming Nederland in samenwerking met de Werkgroep Stookolieslachtoffer-tellingen van de Nederlandse Zeevogelgroep (NZG/NSO) en de Werkgroep Noordzee. Het ministerie van Landbouw, Natuurbeheer en Visserij bekostigde de gegevensanalyse door NZG/NSO en de samenstelling van dit rapport.

Monitoren van olievervuiling In dit rapport worden olieslachtoffergegevens uit zowel Nederland als vele andere Europese landen geanalyseerd met als oogmerk een voor het beleid bruikbaar olie monitoring systeem (Hoofdstuk 6). Een belangrijke eerste constatering is dat alle op vogels waarneembare olieresten het gevolg moeten zijn van illegale lozingen. Legale lozingen leiden niet tot waarneembare vervuiling op de veren. Verschillende factoren beïnvloeden de aantallen dode vogels op het strand en door middel van voorbeelden wordt duidelijk dat "dichtheden" van dode vogels (aantal per km) ongeschikt zijn om veranderingen in olievervuiling op zee te kunnen meten. Vervolgens wordt echter aangetoond dat het percentage beoliede exemplaren onder de aangespoelde vogels (oliebesmettings-percentage; "oil-rate") niet op een dergelijke wijze door de verschillende factoren wordt beinvloed. Oliebesmettings-percentages blijken opmerkelijk constant over langere tijdsperioden bij een bepaalde vogelsoort in een bepaald gebied, ondanks het optreden van sterke fluctuaties in de dichtheden van die vogels op het strand.

Belangrijker zijn echter de voorbeelden van locale situaties waar beleidsmaatregelen tot het terugdringen van olievervuiling nauw werden gevolgd in de oliebesmettings-percentages van gestrande vogels. Vestiging van olie-terminals op de Shetland en Orkney eilanden ging gepaard met sterke toenames in de oliebesmettings-percentages van de locale zeevogels. Daaropvolgende beleidsmaatregelen tegen illegale lozingen van de bezoekende olietankers waren echter ook onmiddelijk zichtbaar in teruglopende oliebesmettings-percentages onder de vogels. In de Oostzee lijkt de mate van oliebesmetting van vogels drastisch te zijn teruggelopen sinds het gebied in 1983 een "Special Area" werd onder Annex I van het MARPOL verdrag. Een nadere analyse is noodzakelijk. Zeer recent zijn langs de Duitse Noordzeekust de olie-besmettings percentages opmerkelijk gedaald na een experiment waarbij in Duitse havens aan schepen de mogelijkheid werd geboden om olieresten gratis af te geven. In Nederland en Denemarken is deze neerwaartse trend niet aanwezig en oliebesmettings-percentages liggen onveranderd op een hoog niveau. Bij een meer gedetailleerde analyse van de situatie in Nederland blijken er aanwijzingen te zijn dat de olievervuiling nabij de kust mogelijk is afgenomen. Oliebesmettings-percentages van vogels die verder van de kust leven laten echter zien dat er op open zee veel minder verbetering is opgetreden: mogelijkerwijs zijn de eerste tekenen zichtbaar van een zeer lichte, maar niet significante afname in oliebesmettings-percentages. Over het geheel genomen blijft het oliebesmettings-percentage in het Nederlandse gebied nog altijd extreem hoog. Er zijn verschillende mogelijkheden om oliebesmettings-percentages te gebruiken bij het presenteren van monitoring resultaten. Frequentie verdelingen van maandgemiddeldes voor oliebesmetting (zie figuur 4.5, 4.6) lijken een bijzonder geschikte methode om jaarlijkse overzichten te presenteren van de resultaten van beleidsmaatregelen die beogen illegale olielozingen te doen afnemen.

Chemische analyse van oliemonsters Het zal zonder meer duidelijk zijn dat het identificeren van bronnen van olievervuiling uiterst belangrijk is om effectieve beleidsmaatregelen te kunnen treffen. Een systematisch olie bemonsterings programma door Deens, Duits en Nederlands olieslachtoffer onderzoek in de jaren 1990-92 heeft duidelijk de waarde van dit soort gecombineerd onderzoek bewezen. Verreweg de meeste oliemonsters bleken afkomstig te zijn van "operationele" doch illegale lozingen van vooral resten van brandstofolien door schepen. Lozingen van ruwe olie door olietankers werden alleen bij noord Denemarken vaker aangetroffen. Vondsten van vogels die waren besmeurd met niet-minerale oliën en chemicaliën zoals Dodecylphenol toonden aand dat een dergelijk bemonsterings programma ook in staat is om andere schadelijke vervuilingen te signaleren en te monitoren.

Luchtbewaking kustwachtvliegtuig Wanneer olieslachtoffertellingen en tellingen van vlekken uit de lucht door de kustwacht worden vergeleken op hun waarde voor een oliemonitoring systeem, dan luidt de conclusie dat beide methodes elkaar aanvullen. Vogeltellingen zijn slechter uitvoerbaar in de zomer, onder meer als gevolg van schoonmaakacties op stranden, terwijl vliegtuigtellingen juist in de winter onnauwkeurig zijn omdat hardere wind olievlekken snel onzichtbaar maakt. Observaties vanuit vliegtuigen geven een soort van kwantitatieve indruk van de hoe-veelheid olievlekken op zee, maar een groot aantal olielozingen blijft onontdekt omdat het vliegtuig slechts een beperkte tijd in de lucht is en een beperkt gebied kan bestrijken. Beoliede vogels geven misschien een wat minder directe, maar veel meer integrale indruk van de feitelijke olievervuiling op zee. De betrouwbaarheid van een monitoring systeem is sterk afhankelijk van de mate waarin geobserveerde trends kunnen worden vergeleken met lange tijdseries van basisgegevens. In dit opzicht hebben olieslachtoffertellingen een duidelijke voordeel ten opzichte van andere methoden zoals luchtbewaking of registratie van hoeveelheden in havens afgegeven afvalolie. Bovendien hebben olieslachtoffer-tellingen ten opzichte van andere methodes het voordeel dat zij niet alleen olievervuiling kunnen monitoren, maar ook de effecten daarvan.

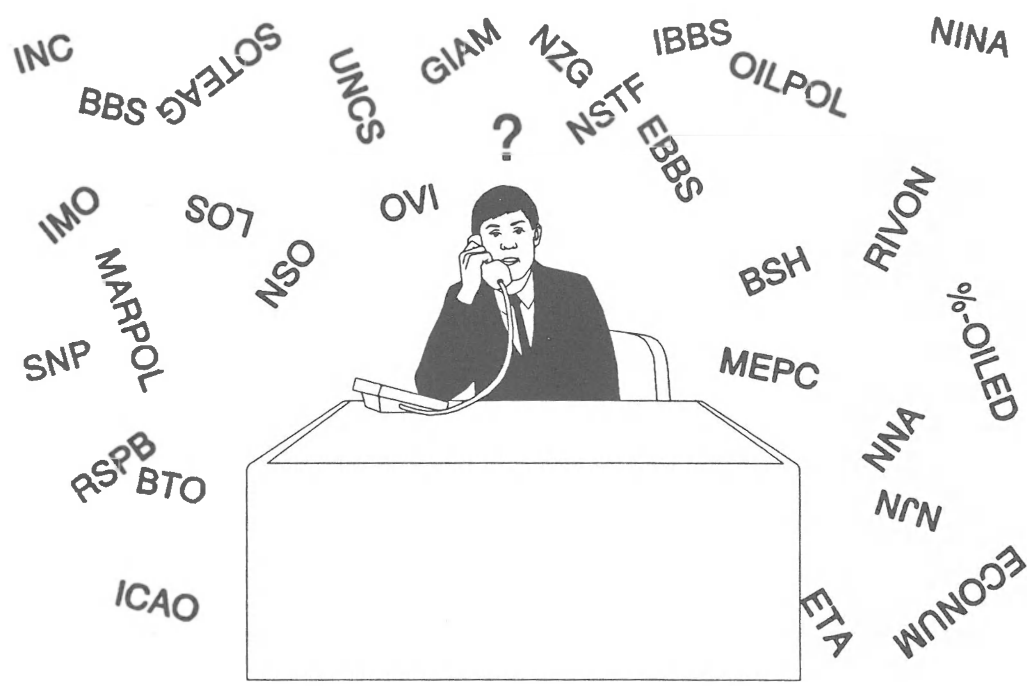
Monitoren van effecten van olievervuiling: zeevogelsterfte Een oliemonitoring-systeem zou niet alleen rekening moeten houden met de mate van olievervuiling, maar ook met de milieueffecten daarvan. Olieslachtoffertellingen hebben de mogelijkheid om de niveaus van vogelsterfte door olie te onderzoeken en deze in verband te brengen met de populatie ontwikkelingen van deze vogels. Hoofstuk 7 van het rapport geeft een nadere discussie van dergelijk complex onderzoek. Zoals reeds aangegeven, schommelen de dichtheden van dode vogels op de kusten onder invloed van een groot aantal factoren. Doelgerichte bijzondere onderzoekingen, zoals autopsie van kadavers, kunnen noodzakelijk zijn om sterfte als gevolg van olie te kunnen onderscheiden van sterfte door andere oorzaken. Om verbanden te kunnen leggen tussen de sterfte van vogels en de ontwikkelingen in bepaalde broedpopulaties is het noodzakelijk om de herkomst en de geslachts- en leeftijdsverdelingen van olieslachtoffers nader te onderzoeken (bv. door ringonderzoek, morfologische studies en autopsies). De gegevens zullen tevens beschouwd moeten worden in het licht van andersoortig zeevogelonderzoek aan bijvoorbeeld verspreiding en fourageergedrag op zee en aan de broedbiologie in de kolonies. Vooral aan de hand van voorbeelden betreffende de Zeekoet laat dit deel van het rapport zien hoe olieslachtoffer-tellingen in combinatie met dergelijk aanvullend onderzoek tot degelijke conclusies kan leiden ten aanzien van de populatie effecten van door olie veroorzaakte sterfte onder zeevogels. Middels hetzelfde onderzoek is het ook mogelijk om andere, of bijkomende oorzaken van zeevogelsterfte te signaleren en te monitoren.

Ontwikkelingen in olieslachtoffer-onderzoek In de loop van de afgelopen tientallen jaren heeft het karakter van olieslachtoffer onderzoek zich sterk ontwikkeld (hoofd-stuk 8). Van individuele waarnemers die verslag deden van olieslachtoffers op een bepaald strand heeft een ontwikkeling plaatsgevonden naar regionale, nationale en later internationale gecoördineerde tellingen met steeds betere en meer gestandaardiseerde methodes. De huidige status van het olieslachtoffer onderzoek in West Europa is samengevat in hoofdstuk 9, waarin tevens een literatuuroverzicht is opgenomen van gepubliceerde resultaten. De besluiten van de Noordzee Ministers Conferentie kunnen een nieuwe mijlpaal betekenen: de aanzet tot een Europees monitoring systeem van olievervuiling en zeevogelsterfte op grond waarvan beleids-maatregelen getoetst en verbeterd kunnen worden.

European Beached Bird Survey Om het doel van een voor beleidsbeslissingen geschikt monitoring systeem te kunnen bereiken wordt in hoofdstuk 11 voorgesteld te komen tot een Europees olievogel monitoringprogramma: "European Beached Bird Survey" (EBBS). Nationale en supra-nationale overheden in West Europa zouden jaarlijks door een EBBS kunnen worden voorzien van een bijgewerkt beleidsdocument betreffende de effectiviteit van de maatregelen tot terugdringing van olievervuiling op zee. De doelstellingen van het EBBS programma vereisen een sterke internationale coördinatie en deels ook de inzet van professionele onderzoekers. Als vanouds zullen gecoördineerde vrijwilligers activiteiten de algemene basis vormen van de EBBS. Meer specialistische onderzoekingen, waaronder het verzamelen van oliemonsters voor chemische analyses, zouden uitgevoerd moeten worden door beroepskrachten in kleinere speciale studie gebieden. Gerichte voorstellen over de structuur van de EBBS worden beschreven en de financiële gevolgen van een drietal verschillende scenario's zijn berekend. De scenario's bestrijken de mogelijkheden van een EBBS met een grote inzet van vrijwilligers en een geschikt aantal beroepskrachten in speciale studiegebieden, tot de minimale mogelijkheid van één enkele jaarlijkse telling door vrijwilligers en een zeer beperkte professionele inzet in een klein aantal studiegebieden. Ook de redenen voor, en de gevolgen van, het al dan niet opnemen van verschillende zeegebieden in de EBBS worden toegelicht. Aanbevolen wordt om te komen tot een Europees monitoring programma over een groot deel van West Europa en de Oostzee, waarbinnen het niveau van inzet van vrijwillige en professionele krachten kan fluctueren afhankelijk van regionale omstandigheden en de waarde voor de monitoring doelstelling. De kosten van een dergelijk programma zouden naar schatting tussen de 1,5 en 2 miljoen ECU per jaar bedragen. Ongeveer de helft van dit budget zou in de verschillende landen nationaal moeten worden opgebracht: een deel daarvan is reeds nu aanwezig in bestaande nationale programma's. De andere helft van het budget aangevraagd moeten worden bij internationale instanties of andere mogelijke subsidiegevers. Een tussentijdse internationale coördinator zou de verdere voorbereidingen moeten treffen voor de inhoudelijke en financiële structuur van een EBBS die dan in het najaar van 1995, kort na de vierde Noordzee Ministers Conferentie, van start zou moeten gaan.

ABBREVIATIONS AND TERMS

BBS	Beached Bird Surveys: counts of bird corpses on the beach
BSH	Bundesamt für Seeschiffart und Hydrographie (Hamburg, Germany)
BTO	British Trust for Ornithology (Thetford, England)
Coastal	Coastal zone; usually within 20km from the coast, not being tidal flats or estuarine areas. Coastal species spend the winter in the coastal zone, or roost on land but feed at sea near the coast.
Density	See n/km
Dissections	Autopsies of collected bird corpses, to assess age, sex, physical condition at the time of death, stomach contents, etc.
EBBS	European Beached Bird Survey; working title for future monitoring project as proposed in this report, including monthly beached bird surveys between November and April, detailed investigations and oil sampling. Should be the follow-up of the IBBS
EcoNum	Groupe d'Etudes en Ecologie Numérique et Statistique Appliquée à l'Environnement (Bailleul, France)
ECU	European Currency Unit (about Dfl 2,25)
ETA	Eesti Teaduste Akadeemia (Tartu, Estonia)
GIAM	Grupo Iberico de Aves Marinas (Vigo, Spain)
IBBS	International Beached Bird Survey: annual count of bird corpses on beaches in February/March in Western Europe (in effect since 1972; see also NBBS, see chapter 8)
IBN	Instituut voor Bos- en Natuuronderzoek (Institute for Forestry and Nature Research), formerly named RIVON and RIN
ICAO	Inspeccion Costera de Aves Orilladas (organized by GIAM, Spain)
IMO	International Maritime Organization, London
INC	Institute of Nature Conservation (Hasselt, Belgium)
Inshore	Tidal flats, estuarine areas. Inshore species are only rarely found swimming at sea, but rather in brackish or fresh water. Many inshore species escape to coastal waters in severe winters.
LOS	Latvian Ornithological Society (Salaspils, Latvia)



MARPOL 73/78	International Convention for the Prevention of Pollution from Ships (MARPOL; London 1973 and protocol (London 1978)). MARPOL has five annexes, dealing with oil (Annex I), liquid chemicals in bulk (II), packaged chemicals (III), sanitary discharges (IV), and garbage (V). Annex I., Oil, entered into force on 2 Oct 1983
MEPC	Marine Environment Protection Committee of the International Maritime Organization, London
NBBS	National Beached Bird Survey: annual national count of bird corpses on beaches in February/March in a country (see also IBBS, see chapter 8)
NINA	Norsk Institutt for Naturforskning (Trondheim, Norway)
NIOZ	Nederlands Instituut voor Onderzoek der Zee (Netherlands Institute for Sea Research)
NJN	Nederlandse Jeugdbond voor Natuurstudie (Youth organization for nature research)
n/km	Density, or number of bird corpses per kilometre of beach surveyed; used in calculating seasonal patterns, regional distribution, annual differences, and used for extrapolations (density x total beach length = estimated absolute number present)
NNA	Norddeutsche Naturschutz Akademie (Schneverdingen, Germany)
NSO	Nederlands Stookolieslachtoffer Onderzoek (Dutch Beached Bird Survey), currently a working group of the Dutch Seabird Group (see NZG)
NZG	Nederlandse Zeevogelgroep (Dutch Seabird Group)
Oil analysis	Chemical analysis of oil samples to identify the type and source
Oiled/Oil-fouled	Live bird or corpse of a bird showing oil in its plumage
Oil incident	A spillage of oil at sea
OILPOL 1954	International Convention for the Prevention of Pollution of the Sea by Oil (OILPOL; London 1954, enforced 1958, amended in 1962 and 1969)
Pelagic	Oceanic; of the open sea. Pelagic birds are those which prefer a marine habitat beyond the coastal zone and normally visit land only to breed
OVI	Oil Vulnerability Index; System to indicate the vulnerability of different seabird species to oil pollution
%-oiled	Proportion of corpses showing oil-fouling in a sample usually taken from the Beached Bird Surveys
RIN	Rijksinstituut voor Natuurbeheer (Research Institute for Nature Conservation) nowadays named IBN
RIVON	Rijksinstituut voor Veldbiologisch Onderzoek ten behoeve van het Natuurbehoud (Institute for Field Biological Research for Nature Management), later called RIN, nowadays named IBN
RSPB	Royal Society for the Protection of Birds (Sandy, UK)
seaduck	*Mergus* spp., Goldeneye *Bucephala clangula*, Scaup *Aythya marila*, Long-tailed Duck *Clangula hyemalis*
SNP	Serviço Nacional de Parques (Lisboa, Portugal)
SOTEAG	Shetland Oil Terminal Environmental Advisory Group (Shetland)
Subregion	Part of coastline, studied as one unit (see chapter 8.2)
Study area	Selected subregion in which during an EBBS monitoring programme detailed investigations take place and where birds and oil are sampled systematically (see chapter 8.2 and 11.1)
UNCS	Union nationale des centres de soins pour la faune sauvage (rehabilitation centres in Northern France; see Raevel 1992a)
Wreck	Mass mortality of seabirds, usually with unknown cause, often coinciding with an influx of the species and/or with adverse weather circumstances. In these wrecks, large numbers of incapacitated seabirds are found on land

1. INTRODUCTION

Mass mortality of seabirds caused by floating oil at sea is at least known since the beginning of this century. It is particularly because of these oiled birds that chronic oil pollution at sea and oil incidents have received worldwide attention. Several recently published studies indicate that measures to reduce oil pollution at sea have not resulted in a significant reduction in numbers of oiled seabirds on most European beaches during the last five decades (Andrews & Standring 1979, Becker & Schuster 1980, Hanssen 1982, Stowe 1982a, Debout 1984, Bargain *et al.* 1986, Jacobsen 1987, Camphuysen 1989a, Christensen 1989, Skov *et al.* 1989, Raevel 1990, Skov 1991, Vauk *et al.* 1991, Averbeck *et al.* 1992, Camphuysen 1992b, Partridge & Stratford 1992, Arcos in prep.). At the 18th European Conference of the International Council for Bird Preservation (Aachen 1992) oil pollution was once more identified as one of the more important man-induced threats to seabirds (Camphuysen *et al.* 1992).

Beached bird surveys have clearly indicated that measures under both OILPOL (enforced 1958) and MARPOL 73/78 Annex I (enforced 1983) did not lead to a substantial reduction in the number of casualties, at least not in many parts of the North Sea and in The Channel area. As a result, ornithologists and naturalists kept on ringing the bell, claiming that the oil pollution problem was still there. Since the measures under OILPOL and MARPOL 73/78 aimed at a substantial reduction in the amount of oil spilled or discharged at sea, the question arose whether the attempts had actually failed (or had merely compensated for the growth of ship traffic), or whether beached bird survey results were meaningless. But even although the measures were aiming at a reduction in the amount of oil spilled rather than at a reduction in the number of seabirds suffering from oil, a cleaner sea simply means less oiled corpses on the beach: in other words a reduction in the risk to become oil contaminated. At the 30th session of the Marine Environment Protection Committee of the International Maritime Organization in September 1990, it was concluded that it is difficult to fully assess the degree of non-compliance with MARPOL 73/78 because there is (1) a lack of worldwide efficient monitoring, (2) difficulty in identifying the source of oil spillage and (3) a lack of worldwide port state control actions (Anonymous 1990).

There are some disagreements with respect to the value of counts of stranded oiled seabirds as indicators of oil pollution at sea. The interpretation of data obtained by beached bird surveys is considered difficult, because other causes of death and factors like wind and temperature, fluctuations in wintering populations all contribute to fluctuations in numbers being reported on the beach. However, over the years, results prove to be rather consistent and supporters of this sort of work have demonstrated the differences between clean sea areas and more polluted seas from surveys on beaches. A recent study once more concluded that beached bird survey results illustrated that the effectiveness of measures to eliminate or reduce oil pollution (in the Southern North Sea) was at least doubtful (Camphuysen 1989a). Results of this study were briefly discussed at the Third International Conference on the Protection of the North Sea in The Hague, the Netherlands, and it was there decided to investigate the possibilities of using beached oil pollution victims as indicators for the effectiveness of measures to reduce oil pollution at sea. Considering the urgent need for an efficient monitoring system to assess the degree of (non-)compliance with MARPOL 73/78, beached bird surveys may provide a relatively cheap monitoring programme covering large areas. The decision of North Sea governments was implemented by the Dutch Ministry of Agriculture, Nature Management and Fisheries, which funded the half year project *Oiled Seabirds and Oil Pollution; The value of Beached Bird Surveys to assess the effect of measures meant to reduce oil pollution at sea*, that resulted in this report.

Beached bird surveys have been carried out in many European countries during the last three to four decades. Unfortunately, despite the organization of a so-called 'International Beached Bird Survey' (IBBS; mid-winter national surveys), there was little co-ordination between national programmes and little structural data exchange. Within this project, the opportunity was taken to make an inventory of various national beached bird programmes in Europe, and to contact all national co-ordinators. To explore the possibilities for future international co-operation, three workshops have been organized (Rijswijk 1991, Copenhagen 1991, Glasgow 1992), in which methods, complications and results were discussed, and future standards were set. With this publication, a review is presented of beached bird surveys in Europe, from the Mediterranean and North Africa (Canary Islands) to the Barents Sea, from the Atlantic seaboard to the Eastern Baltic. Moreover, a large set of data had to be re-analysed. With this project, the Dutch Beached Bird Survey files (Nederlands Stookolieslachtoffer-Onderzoek (NSO), 1969-90), were made available for this purpose. It was checked whether or not there were any obvious changes during the last twenty years in the risk for seabirds and coastal birds to become oiled. Moreover, it was analyzed in what way the Dutch situation matches that in other North Sea states and what was known about the Baltic, the (Western) Mediterranean and the Atlantic seaboard. Some of the more illustrative results are picked out of the large number of data to show the value of beached bird surveys. A bibliography provides baseline data for any future project dealing with oil pollution and seabird mortality.

Finally, having discussed the possibilities for a monitoring programme for beached birds in Europe, a proposal is put forward to assess the effectiviness of current or future measures to eliminate the oil problem by means of counts of stranded seabirds, coupled with detailed investigations, oil sampling and oil analysis. This report hopes to demonstrate clearly the value of beached bird surveys in monitoring oil pollution and thus to trigger policy decisions leading to the establishment of a European Beached Bird Survey (EBBS).

Acknowledgements The project 'Oiled Seabirds and Oil Pollution' would not have been successful without the help of many people, all over Europe. Participants in three workshops were very co-operative during the respective sessions, but also when back home. Questionnaires were completed and special requests for information were usually honoured. As a result, an overview of BBS activities, as published in this report, became available. We would particularly like to thank, for their co-operation and enthusiasm: Francisco Arcos, Christiane Averbeck, Bill Bourne, Jan Durinck, José Pedro Granadeiro, Martin Heubeck, Alexey Kurochkin, Vilju Lilleleht, Erik Meek, Wlodzimierz Meissner, Eduard R. Osieck, Pascal Raevel, Jane Sears, Kolbjørn Skipnes, Henrik Skov, Gediminas Vaitkus, which were of great help with the compilation of the bibliography, as included in chapter 7. Rinse Wassenaar (Vogeltrekstation, Heteren) provided recoveries of Guillemots in the Netherlands ringed abroad (figure 5.5).

Throughout the preparation of the report, members of the supervising committee, Klaas Jan Bolt and Theo Kramer, both of the Ministry of Transport and Public Works, Wim Lammers, of the Ministry of Agriculture, Nature Management and Fisheries, Rob Gerits, of the Foundation Working Group North Sea, formed a stimulating team, providing the essential feedback during writing and the analysis of data. Leen de Jong, initiator of the project at Vogelbescherming Nederland, and his successor Eric Wanders are thanked for the trust they had in the outcome of the work and the freedom of working, even although the presentation of the final draft was delayed quite a bit. Gerard Steinhaus is thanked for running the administration and solving financial complications.

Martin and Nancy Heubeck are thanked for their hospitality in Shetland in spring 1992. Bob Furness is gratefully acknowledged for hospitality and excellent local arrangements before and during the Glasgow workshop in March 1992. Last but not least we would like to thank the numerous volunteers for their contributions to beached bird surveys in the past decades. We hope that this report will be a stimulus to continue such work in a future EBBS.

2. PROJECT OBJECTIVES

At the Third International Conference on the Protection of the North Sea in Den Haag, the Netherlands, 7-8 March 1990, oil pollution from ships in the North Sea was discussed. In the Final Declaration of this conference it was concluded that control and enforcement were to be improved and that all ships were to be deterred from contravening the requirements of MARPOL 73/78. Under 'Protection of habitats and species' (39.3), it was concluded that, to give further protection to marine wildlife in the North Sea, important gaps in knowledge had to be tackled, including:

To investigate the possibilities of using beached oil pollution victims among seabirds and coastal birds as indicators for the effectiveness of the actions in this Declaration under the headings "Pollution from Ships" and "Pollution from offshore installations"

Annex 5 of the Final Declaration further reads:

(1) To collaborate on research initiatives with the assistance of the North Sea Task Force: (1.4) an investigation in which way beached sea- and coastal birds can be used as an indicator to assess and compare the effectiviness of policy decisions made on the reduction of oil pollution, and to this end: (i) consider how far the percentage of oil polluted birds on the total of beached birds can be used as an indicator; (ii) consider possibilities to intensify chemical analysis of oil samples taken from beached indicator species for comparison with detected oil spills.

In response to the Final Declaration, the project *Oiled Seabirds and Oil Pollution: The value of beached bird surveys to assess the effect of measures meant to reduce oil pollution at sea* was initiated by the Netherlands Society for the Protection of Birds, together with the Working Group Beached Bird Surveys of the Dutch Seabird Group (NZG/NSO) and the Foundation Working Group North Sea. Funding for the project was received from the Ministry of Agriculture, Nature Management and Fisheries. Basic questions for the project were:

- Is there a link between the number of oiled seabirds on the beach and the occurrence of oil pollution at sea?
- How should results of beached bird surveys be treated, or how should these surveys be carried out in future, to find trends in the occurrence of oil pollution at sea?
- Are there, looking at recent beached bird survey results, any trends in this respect?
- Could an intensified programme of oil sampling and chemical analysis of samples taken from beached indicator species contribute to a reduction in the amounts of oil spilled or discharged at sea and thus to a future reduction in numbers of oiled seabirds?
- Are there possibilities for a European, co-ordinated monitoring project for beached birds.

In a later phase, the new (Dutch) policy aim to reduce illegal discharges from ships with 25% by 1994 and with 100% by 2010 became part of the discussions (Milieubeleidsplan voor de Scheepvaart, 1991-94; Anonymous 1991a). The need to monitor the realization of such plans again emphasized the basic question in this report:

- Can beached bird surveys be used to assess the effectiveness of measures to reduce oil pollution at sea?

3. METHODS

It took two years from the first ideas on an international monitoring programme for beached (oiled) seabirds in Europe to this report. The first step was the organization of a workshop in which various aspects were discussed and information was exchanged. This workshop was a gathering of an international group of people from governmental bodies, research institutes and volunteer organizations (NZG/NSO workshop, April 1992, Rijswijk). Here the idea for European co-operation was first launched and briefly discussed. A questionnaire had been distributed to find out which of the countries were interested to join a European programme. The results of this workshop were published as proceedings in a special issue of the NZG periodical *Sula* (Camphuysen & van Franeker 1991).

The project "Oiled Seabirds and Oil Pollution", commissioned by the Netherlands Society for the Protection of Birds and funded by the Netherlands Ministry of Agriculture, Nature Management and Fisheries, started in October 1991. The next international meeting on which the proposals for a European beached bird survey could be discussed was convened by Ornis Consult Ltd and held in Copenhagen, Denmark, on 30 November/1 December 1991. This meeting, in fact the first where virtually all European national co-ordinators actually met eachother, was in the first place meant to discuss methods of another European project, the International mid-winter beached bird survey (IBBS), and to set standards for data collection and data exchange. However, there was time for discussion of the new plans for co-operation within a more extensive future scheme (European Beached Bird Survey, EBBS).

At the same time, the Dutch national late-winter surveys ((NBBS 1965-91) were re-analysed, as data transfer from the organisers to the international database and vice versa had led to many errors in earlier publications. In Copenhagen it was suggested that more countries should undertake a re-analysis, in order to check their own, but also the IBBS database. Any future monitoring programme would have to rely on firm baseline data over as many years as possible. During the project, the Dutch re-analysis was actually completed and published in three internal reports (Camphuysen 1991a, 1992ab) and one review paper (Camphuysen in press). Moreover, an analysis of monthly systematic surveys in the best studied Dutch subregion (Noord-Holland, 1969-91) was performed and published as an internal report (Camphuysen 1992c).

The next step into the project was an extensive literature study. General accounts on seabird mortality and marine oil pollution, and on biomonitoring were collected, but the first aim was to produce a list of papers dealing with beached bird surveys in Europe, oil sampling, chemical analysis of oil samples and on dissections of seabirds. Drafts of this list were circulated under national co-ordinators and several specialists, together with another questionnaire to obtain a better idea of current activities in the various countries. This led to an annotated bibliography, in which a review is given of activities and results in Europe since about 1945, and which is published as chapter 9 in this report.

The draft proposals were distributed together with descriptions of the objectives of a future monitoring programme. On 30 March 1992, on a workshop in Glasgow convened by NZG/NSO as part of the project, goals, methods, procedures, structure and budgets were discussed, an informal steering committee was formed. General agreement was reached on the value of a European monitoring programme for beached oiled birds. The final phase of the work was to compile this report in which all collected information, conclusions, recommendations and proposals are presented.

4. MONITORING CHANGES IN MARINE OIL POLLUTION

Marine oil pollution became visible through oiled seabirds washing ashore in the very beginning of this century (e.g. Verwey 1915, Anonymous 1922, Wild 1925). Since then, strandings of oiled seabirds have been used to demonstrate the ongoing oil-induced seabird mortality and, hence, the chronic pollution of the seas with oil (Brouwer 1953, Brown 1959, Mörzer Bruijns 1959, Goethe 1961, Tanis & Mörzer Bruijns 1962, Joensen 1972ab, Vauk & Pierstorff 1973, Bourne & Bibby 1975, Joensen & Hansen 1977, Kuyken 1978, Andrews & Standring 1979, Becker & Schuster 1980, Vauk & Reineking 1980, Stowe 1982a, Vauk 1984, Camphuysen 1989a, Christensen 1989). Seabirds have often been used as indicators of changes in the marine environment, or changes in levels of marine pollution (e.g. Coulson *et al.* 1972, Jensen *et al.* 1972, Vauk 1978, Clark 1979, Brown 1982, Goede & de Bruin 1984, Boersma 1986, Brothers & Brown 1987, Furness 1987, Gilbertson *et al.* 1987, Boudewijn & Dirksen 1990). The success of a monitoring programme depends on the selection of environmental parameters to be measured, the statistical validity of the measurements, the choice of analytical techniques, the comparability of analytical results over time and between research groups (Risebrough *et al.* 1980, NRC 1985). In this chapter, methods are discussed to identify trends in marine oil pollution, focussing on beached bird surveys. The value of these surveys and the need for (oil) sampling and chemical analysis of samples coupled with these surveys is evaluated, in comparison to results of aerial surveillance for oil slicks at sea.

4.1 Beached birds as indicators of oil pollution at sea

Basically, any object on which oil is found to stick easily, thrown into the sea and recovered on the beach can be used as an indicator of oil pollution. However, the object should be recovered soon after being dumped into the sea, and many, many of these 'experiments' are needed to obtain a reliable sample size. So, preferably the object should disintegrate rather rapidly, so that it will either wash ashore on a nearby beach or get lost, and there should be an unlimited supply. When we compare plastic bottles, overabundant items in the marine environment, or corpses of birds, of which large populations are an inexhaustible resource, both have their specific advantages or disadvantanges. Oil sticks easily on both. However, a bottle will not easily fall apart, but rather remain unchanged for years. Hence, theoretically, a bottle dropped into the sea at Peninsula Valdés in South America could show up on a beach near Murmansk in Russia (cf. Groen 1974), collecting oil all the time. Corpses of birds get predated or fall apart within few weeks and are more useful to give information on the situation nearby. Although certain drift experiments with corpses have demonstrated that corpses máy drift over considerable distances (Bibby 1981), it is obvious that the majority does not. Plastic bottles are entering the marine environment in comparatively large quantities near human concentrations, spreading out randomly over the world's oceans. Different species of birds have specific distribution patterns from which additional information may be obtained (pelagic, coastal and inshore species). A mass stranding of oiled Eiders *Somateria mollissima* indicates an oil slick near the coast, probably within 20 km from land, while mass strandings of pelagic seabirds indicate the presence of oil on greater distances from the coast. Different changes in oil rates of coastal as compared to pelagic species indicate different trends in oil pollution in different sea areas. Apparently, surveys of stranded seabirds are an excellent mean to study marine oil pollution. If coupled with systematic oil sampling and chemical analysis of samples (4.2), beached bird surveys provide information on source, scale, distribution and effect of marine oil pollution at relatively low cost. The possibilities for using beached bird survey data to assess the scale of oil pollution are discussed below.

Oiled beached seabirds indicating illegal discharges

When beached bird surveys are to be used to assess the effectiveness of measures to eliminate illegal discharges of oil (as in 'Milieubeleidsplan voor de Scheepvaart' of the Netherlands' government; Anonymous 1991a), we need to distinguish between oil from accidents at sea, and from legal and illegal discharges. Under MARPOL 73/78 Annex 1, fuel oil discharges from ships in excess of 100 ppm and oil discharges from tankers over 60 l/nm are illegal. From investigations of the Bundesamt für Seeschiffart und Hydrographie (BSH), we know that a spill must have a minimum thickness of 0.1×10^{-6} m to be visible (a silvery sheen under favourable light conditions; Dahlmann in litt.). Calculations as given below show that 'visible' spills at sea must be the result of a discharge in excess of what is allowed under MARPOL 73/78 (Dahlmann in litt.).

When supposing a 'small, barely visible spill' behind a ship, not being an oil tanker, of for example 5x2 m (i.e. 10 m^2), the calculated volume of oil in that slick is $1 \times 10^{-6} m^{-3}$. According to MARPOL 73/78 regulation 9, the ship is proceeding en route (suppose at a speed of 10 knots, i.e. about 1800 m per hour, discharging an oil/water mixture with a pumping rate of 2 tonnes per hour). Such a ship needs 2.8×10^{-4} hour to cover a distance of 5 m. During this time, $5.6 \times 10^{-4} m^{-3}$ oil/water mixture could have been discharged. The maximum (legal) oil content of oily water discharges in the North Sea is 100 ppm. Hence, during this time, $5.6 \times 10^{-8} m^{-3}$ oil could have been discharged legally. In contrast, the 'small, barely visible spill' consisted of $1 \times 10^{-6} m^{-3}$ oil, i.e. about 18 times the allowed amount. Even if the assumptions are changed, for example a speed of 5 knots and a pumping rate of 5 tonnes per hour (both unrealistic), the thesis given above is proved. Furthermore, a spill of the above mentioned size would never lead to visible oil in the feathers of birds and would have no physical effect on birds.

The MARPOL 73/78 regulation for the cargo of oil tankers is a maximum of 60 l/nm to be discharged. The BSH has tested oil films resulting from such discharges during field experiments. Their task was the determination of the film thickness. Immediately after the discharge, white teflon nets were put on the spill, which absorbed a definite area. The thickness was found to be about 4 x 10^{-6} m. There were no visible traces of oil on the teflon nets. This means that even (legal) discharges from tankers cannot lead to black, visible traces of oil in the feathers of birds.

We may conclude that all birds washing ashore with visible traces of oil in their feathers have encountered oil slicks which resulted from accidents or illegal discharges (Dahlmann in litt.). Black traces of oil in the feathers of stranded birds must originate from a slick with a thickness in the 'mm range' and, hence, more than 10,000 times the allowed amount, according to the above calculations. Of accidents at sea, the oil type should be reported and known by the (local) authorities. Oil samples from the accident and from stranded birds or beaches can be used to link incident and stranding. These data lead to the conclusion that surveys of beaches for stranded oiled seabirds are very useful to prove that illegal discharges (commonly) occur.

Numbers of birds found dead

Numbers of corpses found during beached bird surveys fluctuate in response to a number of parameters, some of them being obvious, others hidden. Observer effort is corrected for, by using the number of corpses per kilometer surveyed (n/km or 'density'). Double counting of corpses is avoided by removing (e.g. Britain; Stowe 1982a) or marking (e.g. The Netherlands; Camphuysen 1989a) the corpses. Prolonged periods of onshore winds will increase the densities on the beach, while the reverse is also true. Extra mortality, following severe storms or very cold weather, will increase the numbers found, as will seabird 'wrecks' (extra mortality due to starvation), whether or not coupled with an influx of live birds. For example, in February in the Netherlands several species, most notably grebes, other seaduck and wildfowl, waders and Coot, were found in significantly higher densities in cold and severe winters (table 4.1). On the other hand, the table shows that variations in densities of most pelagic species (Fulmar *Fulmarus glacialis*, Gannet *Sula bassana*, Kittiwake *Rissa tridactyla*, auks) are independent of the severity of winter conditions. Generally speaking, the density is a very unstable figure in most species and most areas and should therefore be used only with great care. Detailed investigations are required to identify causes of trends and fluctuations in densities of beached birds (chapter 7).

Seasonal patterns

The risk for birds to become oil contaminated and die is critically influenced by seasonal and climatic factors. Many species are only exposed to marine oil pollution in winter, for they breed far inland (e.g. divers, grebes, scoters). Others, breeding in dense colonies in NW Europe, enter more heavily polluted areas only outside the breeding season (e.g. Kittiwake, auks). For example in the Southern North Sea, Guillemots *Uria aalge* are essentially winter visitors (Tasker *et al.* 1987). The relationship between numbers at sea (expressed as number of birds per km^2) and densities on the beach in the Netherlands (n/km) is striking, particularly when acknowledging that there is some delay between the death of a bird and its subsequent discovery in a BBS (at sea Jan-Dec versus densities Feb-Jan; Rs 0.72, n= 12, P< 0.01, figure 4.1). Low ambient temperatures slow down the disintegration of both oil and corpses, and thus further contribute to the phenomenon that oiled seabird strandings are typically a winter event in many Western European countries.

Table 4.1 Relationship between severity of a winter (IJnsen-index) and densities (ln(n/km)) in four subregions in the Netherlands, national surveys February 1965-91. * = P< 0.05, ** = P< 0.01. *** = P< 0.001, I = Delta area, III = Noord-Holland, IV = Texel and Vlieland, VI = Waddensea area (after Camphuysen in press).

Subregion	I		III		IV		VI	
df	22		24		23		16	
Species/species group	Rs	sign.	Rs	sign.	Rs	sign.	Rs	sign.
Divers *Gavia* spec.	0.51	*	0.44	*	0.52	**	-0.05	n.s.
Grebes *Podiceps* spec.	0.67	***	0.73	***	0.69	***	0.60	**
Fulmar *Fulmarus glacialis*	-0.17	n.s.	-0.19	n.s.	-0.11	n.s.	-0.14	n.s.
Gannet *Sula bassana*	0.13	n.s.	0.19	n.s.	-0.13	n.s.	0.29	n.s.
Eider *Somateria mollissima*	0.11	n.s.	0.37	n.s.	0.24	n.s.	0.10	n.s.
Scoters *Melanitta* spec.	0.50	*	0.49	*	0.40	*	0.30	n.s.
Other seaduck	0.66	***	0.68	***	0.57	**	0.48	*
Other wildfowl	0.70	***	0.66	***	0.64	**	-0.05	n.s.
Waders Scolopacidae	0.59	**	0.73	***	0.44	*	0.46	n.s.
Gulls *Larus* spec.	0.44	*	0.51	*	0.59	**	-0.01	n.s.
Kittiwake *Rissa tridactyla*	-0.19	n.s.	-0.01	n.s.	-0.10	n.s.	-0.24	n.s.
All auks Alcidae	-0.13	n.s.	0.01	n.s.	0.21	n.s.	-0.31	n.s.
Guillemot *Uria aalge*	-0.08	n.s.	0.08	n.s.	0.25	n.s.	-0.25	n.s.
Razorbill *Alca tarda*	-0.23	n.s.	-0.20	n.s.	0.05	n.s.	-0.45	n.s.
Coot *Fulica atra*	0.67	***	0.62	**	0.62	**	0.73	***
All birds	0.49	*	0.56	**	0.53	**	0.29	n.s.

Proportions oiled

A proportion of the corpses found in beached bird surveys is oil-fouled (%-oiled, or the oil rate). Wrecks of unoiled seabirds, perhaps resulting from severe weather or food shortage, may lower the %-oiled in certain areas in some years while densities increase considerably at the same time (e.g. Underwood & Stowe 1984, Camphuysen 1989). Trends in the %-oiled should therefore be examined carefully. Factors that should be considered are: species (offshore, inshore), significance, time span, and densities. However, when comparing beached bird survey results between different countries, it became apparent that major and rather constant differences in oil rates were found in the respective areas (e.g. Andrews & Standring 1979, Stowe 1982, Camphuysen 1989, Skov *et al.* 1989, Skov 1991). Hence, as a tool for measuring the 'state' of the bordering sea area, and to assess regional differences in marine oil pollution, the %-oiled, in combination with densities and species composition, can be considered very useful. Some species are more vulnerable to oil pollution than others. Gregarious species, such as most wildfowl, occurring in massive concentrations, can be severely hit by relatively small slicks of even light oil which have been discharged near the flocks (e.g. Swennen & Spaans 1970, Greenwood *et al.* 1971, Soikkeli & Virtanen 1972, Joensen 1978, Engelen 1987, Camphuysen *et al.* 1988). Species that spend much of their time on the surface of the water, and which are thought to dive to escape oil slicks (e.g. divers, grebes, scoters, auks) are at higher risk to become oil fouled than species spending much time on the wing, or escaping danger by taking off. As a result, some species are more useful in a monitoring programme for marine oil pollution than others. Some examples of regional and specific differences in oil rates are given below.

Regional differences in oil rates

The risk to become oiled is greater for birds in areas with heavily travelled shipping lanes and near offshore oil industry operations (NRC 1985). Indeed, relatively clean seas, such as the Atlantic seaboard and NW North Sea, produce low percentages of oiled birds on beaches, while rather polluted seas near large harbours, such as the

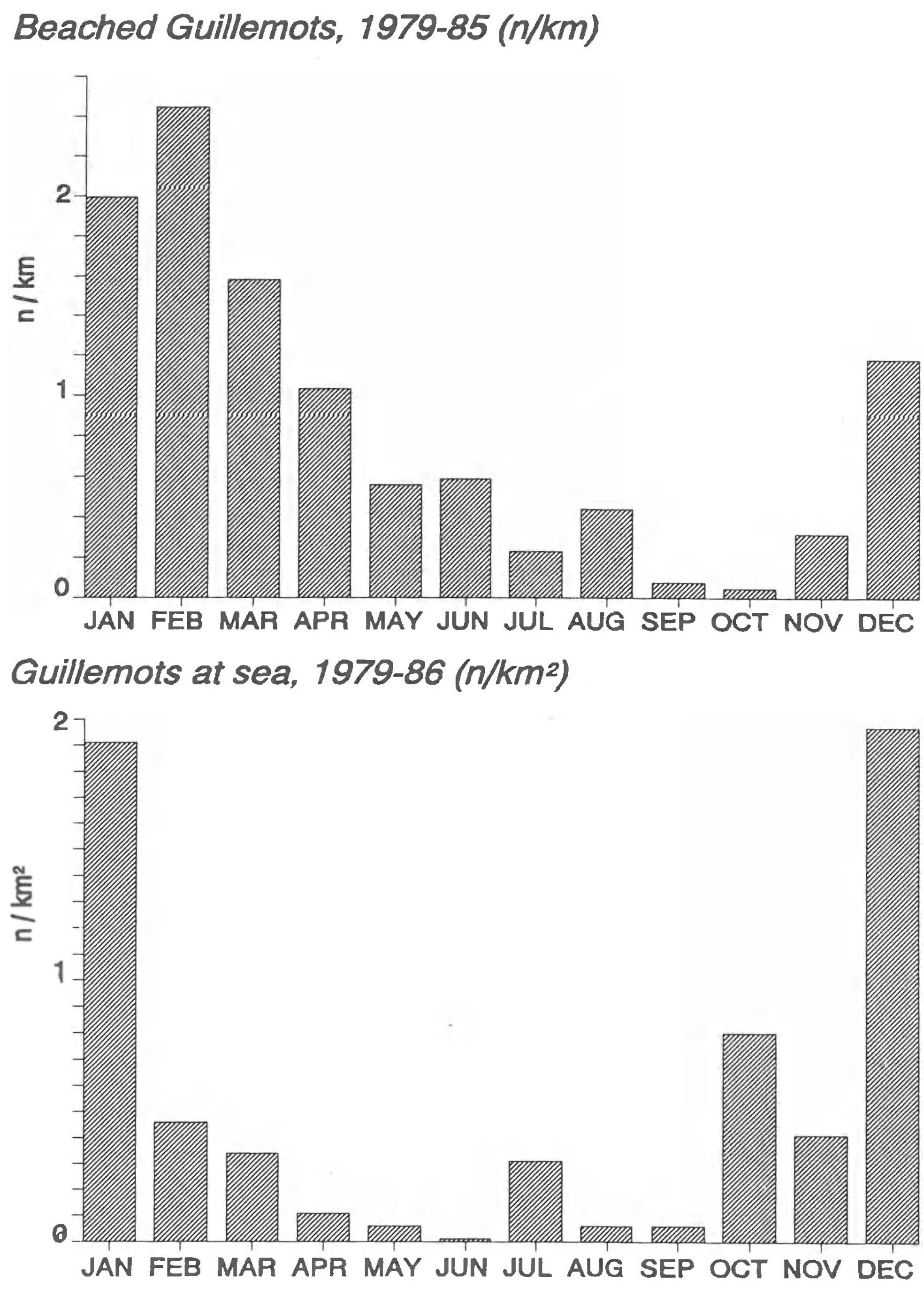


Figure 4.1 Guillemot *Uria aalge* densities on the beach in the Netherlands (NZG/NSO, 1979-85) and presence at sea in the Southern North Sea (Tasker et al. 1987, 1979-86).

Channel and the Southern North Sea, produce high percentages. Corpses may float considerable distances (Bibby 1981), but corpse disintegration is normally a rather rapid process (Camphuysen 1989) from which we may conclude that corpses on the tide-line tell us something about the sea washing these beaches. Generally speaking, in heavily polluted areas, the %-oiled is a high, rather stable figure in most species. Contrary, in relatively clean seas the %-oiled is generally low but unstable in response to incidents. This can be demonstrated by comparing the %-oiled over the last 10 years for Shetland (Atlantic, Northern North Sea), Rogaland, Southern Norway (NE North Sea), Denmark (Eastern North Sea), Germany (German Bight, SE North Sea), and The Netherlands (Southern North Sea). Obviously, there is a link between the occurrence of oiled seabirds on the beach and oil pollution at sea.

In figure 4.2-4.4, examples of regional differences in proportions oiled are given for Guillemots stranded on Shetland (winter 1979/80 to 1990/91), Orkney (1976/77-1990/91) and Noord-Holland, the Netherlands (1976/77-1990/91). Shown are the proportion oiled (top diagram) and the numbers stranded (bottom diagram; oiled birds shaded). The exceptionally high proportion oiled in the Netherlands compared to Orkney and Shetland is illustrated clearly. Interestingly, the opening of oil terminals on Flotta (Orkney) and Sullom Voe (Shetland) is clearly reflected in the relatively high oil rates during 1976/77-1979/80. In March 1979, a number of measures to reduce chronic oil pollution from tankers (illegal discharges), as well as to improve navigational safety were introduced (Heubeck 1991). The oil rate has been significantly lower ever since, both on Orkney and Shetland (Heubeck 1991, Heubeck *et al.* 1992).

In Shetland, used as an example of a relatively clean sea area, monthly oil proportions for Guillemots were mainly between 0 and 30% (figure 4.5, top diagram), while in the Netherlands, bordering this heavily polluted Southern North Sea, oil rates were normally between 70 and 100% (figure 4.5, bottom diagram). In a monitoring programme of oiled seabirds, if policy measures to reduce marine oil pollution were successful and would gradually take effect, one would expect a gradual shift from the Dutch type diagram to the Shetland type diagram (figure 4.6). When monthly oil proportions of Guillemots are compared with densities we note that in both regions, oil rates fell slightly when densities were comparatively high, but the correlation was not significant (figure 4.5, insets). It was expected that in years with high densities, thought to have been caused by seabird wrecks, the proportion oiled should have been significantly lower. When data were 'lumped' for entire winter periods, this was indeed the case. In Shetland, the strongest correlation occurred in the ten years with wrecks (Martin Heubeck in litt.)

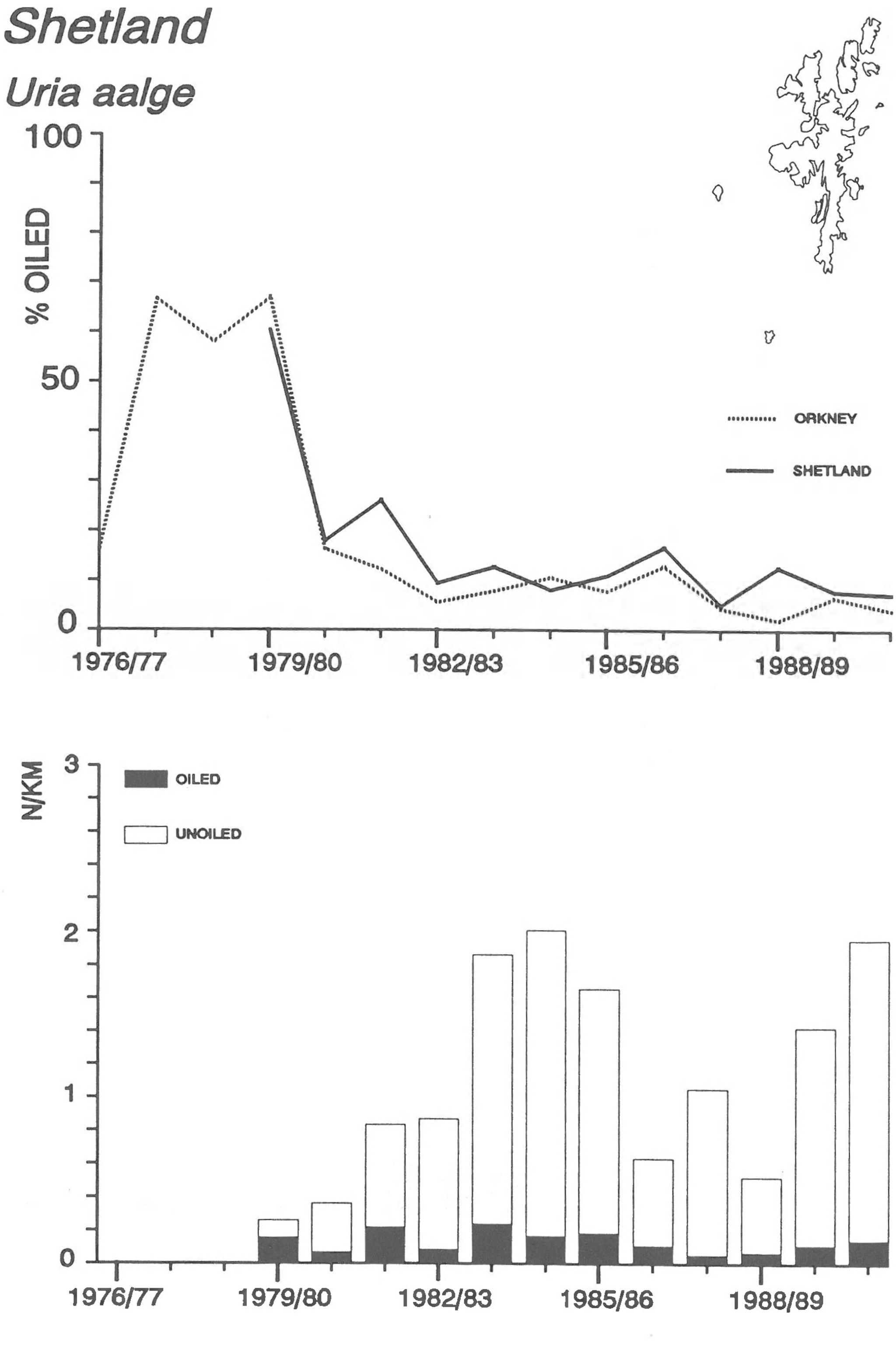


Figure 4.2 Oil rates and densities of Guillemots *Uria aalge* stranded in Shetland, winter 1979/80-1990/91 (data Martin Heubeck).

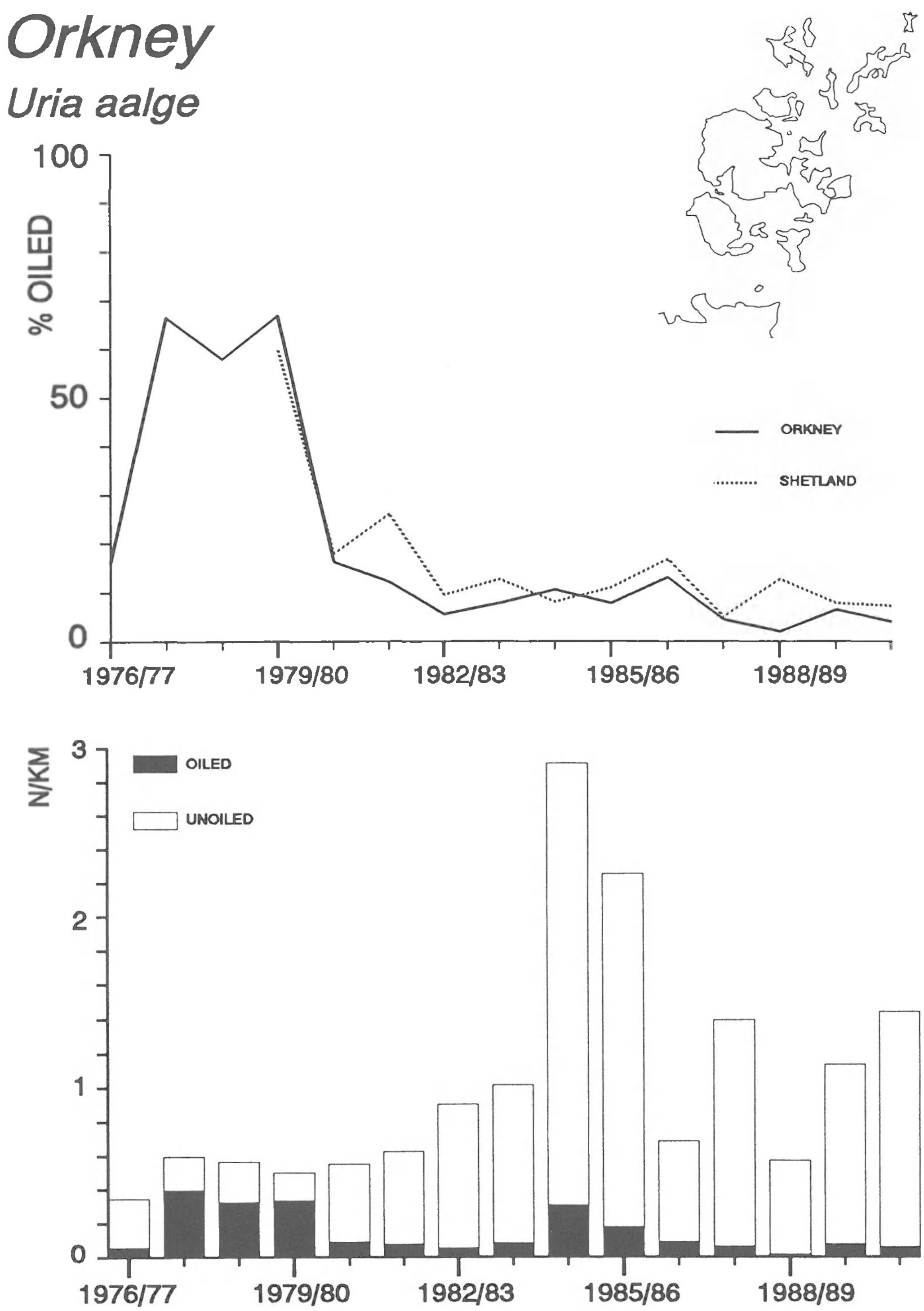


Figure 4.3 Oil rates and densities of Guillemots *Uria aalge* stranded in Orkney, winter 1976/77-1990/91 (data Erik Meek, RSPB).

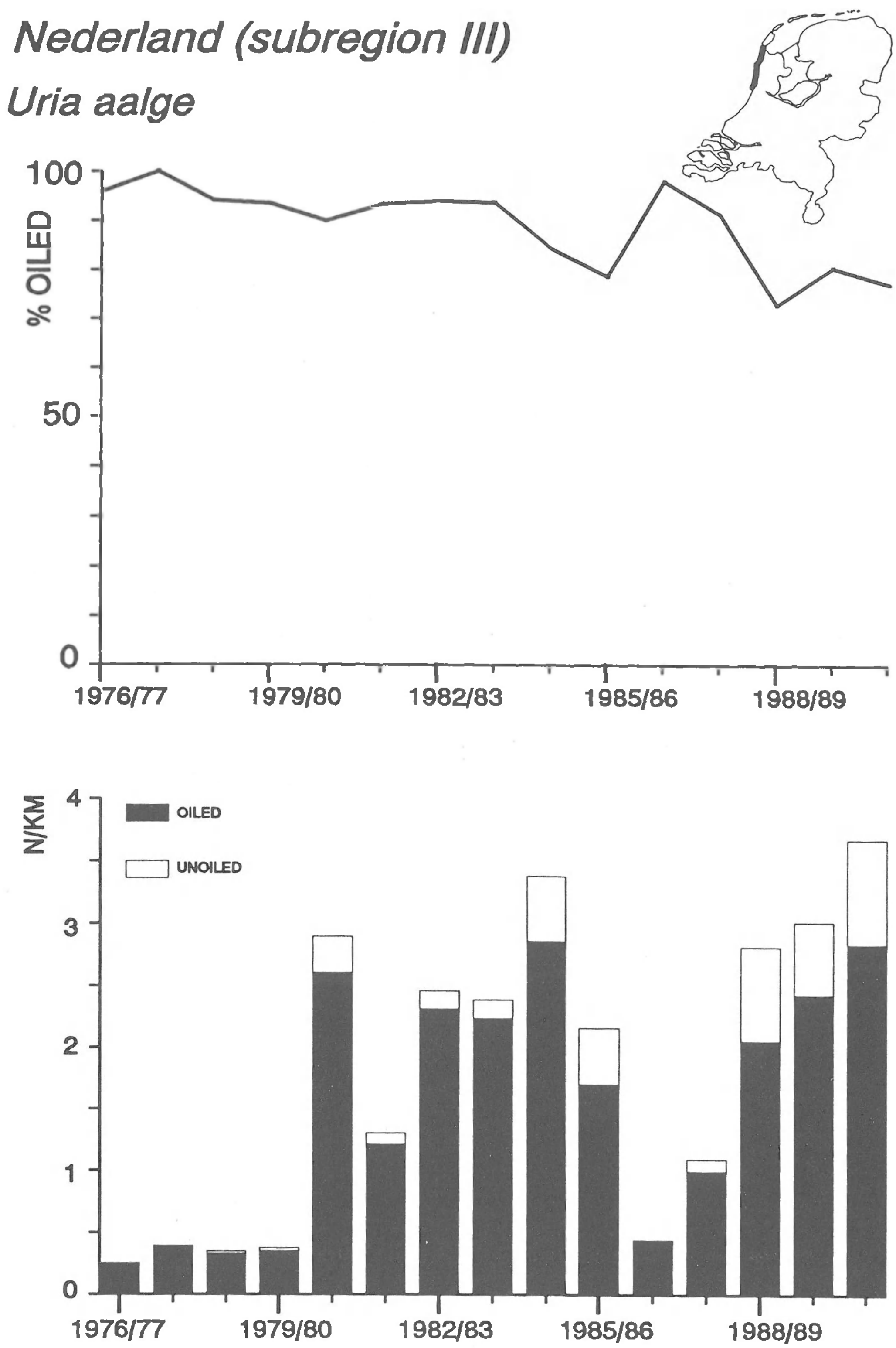


Figure 4.4 Oil rates and densities of Guillemots *Uria aalge* stranded in the Netherlands (III), winter 1976/77-1990/91 (data NZG/NSO C.J. Camphuysen).

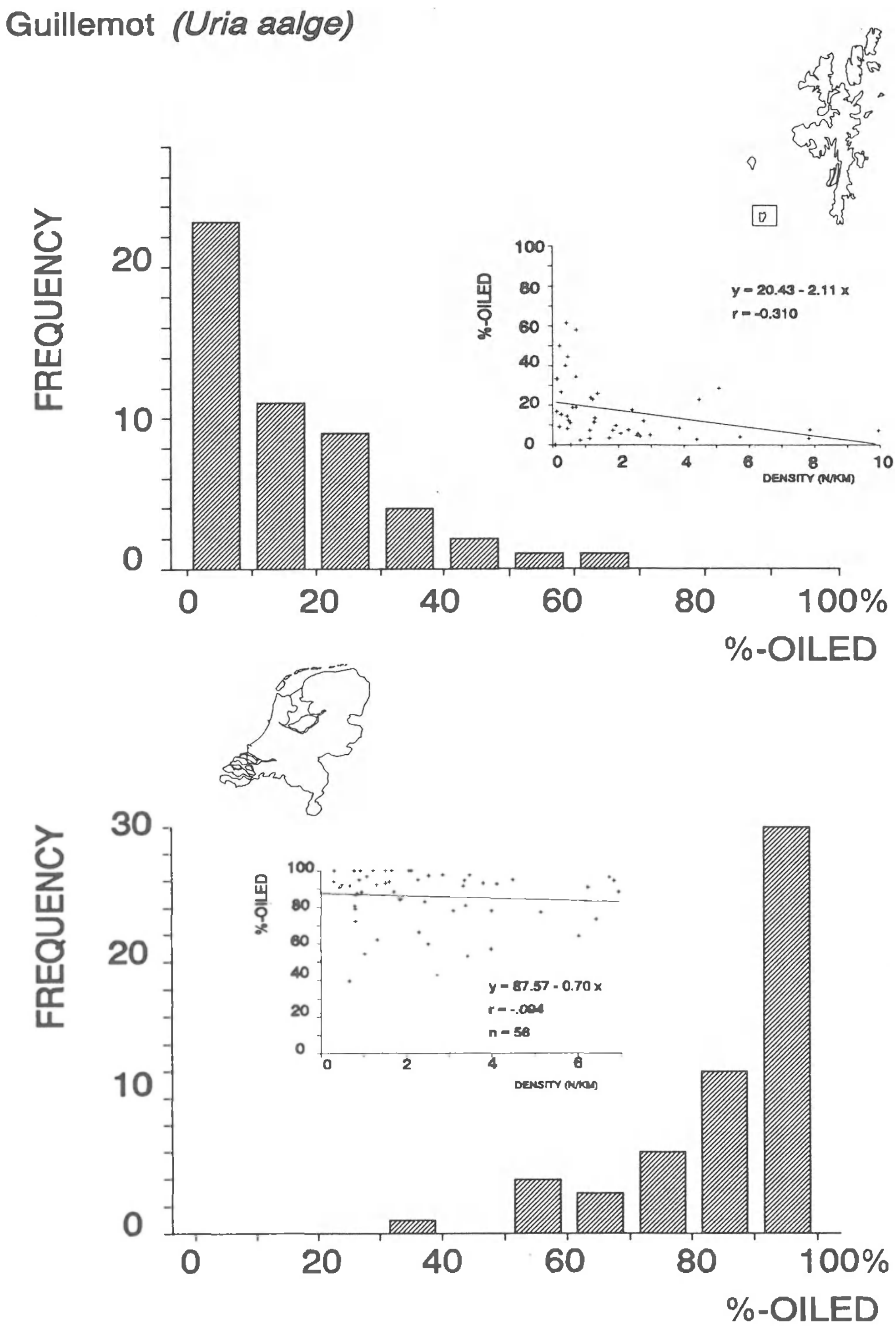


Figure 4.5 Frequency distribution of (monthly) oil rates in Guillemots *Uria aalge* in Shetland (top) and in the Netherlands (bottom), and monthly oil rates versus density (inset) (data SOTEAG, Martin Heubeck & NZG/NSO, Kees Camphuysen).

Table 4.2 Differences in the proportions oiled of beached auks (Razorbill *Alca tarda* and Guillemot *Uria aalge*) in winter in different areas around the North Sea.

Winter	Shetland[1]		Norway[2]		Denmark[3]		Germany[4]		Netherlands[5]	
	Alca	*Uria*	*Alca*	*Uria*	*Alca*	*Uria*	*Alca*	*Uria*	*Alca*	*Uria*
1978/79	-	-	-	-	-	-	-	-	89	94
1979/80	-	59	-	-	-	-	-	-	100	93
1980/81	-	21	-	-	-	-	-	-	98	90
1981/82	31	24	-	-	-	-	-	-	92	93
1982/83	12	18	-	-	-	-	-	-	91	94
1983/84	5	10	-	18	-	-	100	70	95	94
1984/85	33	11	-	30	93	79	94	80	93	85
1985/86	-	7	-	30	93	75	80	83	83	79
1986/87	-	33	-	40	98	89	78	85	89	98
1987/88	15	5	-	31	100	92	85	72	84	91
1988/89	21	13	-	44	95	65	93	66	89	73
1989/90	12	11	-	30	84	60	62	51	79	81
1990/91	6	8	-	18	80	68	35	36	71	77
1991/92	-	15	-	47	94	78	-	-	-	80

(1) From M. Heubeck in litt., Oct-Mar data; (2) K. Skipnes, unpublished data Rogaland; (3) H. Skov in litt.; Ornis Consult data February surveys; (4) C. Averbeck in litt.; (5) Camphuysen (1992), Nov-Apr data, Noord-Holland. - = no data or inadequate sample (n ≤ 10 corpses).

Specific differences in oil rates

Obviously, dispersed seabirds living far offshore, are at lower risk from oil slicks than gregarious birds, such as most wildfowl, in the coastal zone. However, mass strandings of auks indicate that also these birds are seriously at risk from 'minor' oil spills (Barrett 1979, Anker-Nilssen & Røstad 1981, Camphuysen 1981, 1989). Pelagic seabirds, like auks, which are swimming most of the time and which are thought to dive to escape oil slicks are at higher risk than species with a more aerial lifestyle (petrels, gulls). Aerial species like Fulmar, Gannet and Kittiwake roost at sea rather than on land. It is easy to see that the risk to become oil contaminated for these species increases considerably while they sleep on the water. Oil vulnerability indices (OVI's) have indicated the specific differences very clearly (King & Sanger 1979, Tasker & Pienkowski 1987, Camphuysen 1989). In these indices, factors like range, population, behaviour, proportion oiled, other mortality factors and exposure are incorporated. Of behaviour, important factors for vulnerable species are: roosting on water (rather than on land or shore), swimming while foraging (rather than walking on land or flying), escape by diving (rather than take off or swimming), a high tendency to flocking, a high nesting density and a high degree of specialization. Within the North Sea area, following these criteria, auks (5 species), divers (3 species), Eider, scoters (2 species), Fulmar, Gannet, Shag, Cormorant, and Kittiwake are considered most vulnerable to oil pollution (OVI 59-86; Camphuysen 1989). Species dependent differences in oil rates have been demonstrated in many reports of beached bird surveys. For the Netherlands, dealing with the years 1969-85, over 60% of divers, Fulmar, Gannet, Eider, scoters, Kittiwake, Guillemot, Razorbill *Alca torda* and the other auks were oiled, while rather low proportions (< 35%) were found in wildfowl, waders and terns (Camphuysen 1989). Similar differences have been found in other countries (table 4.3).

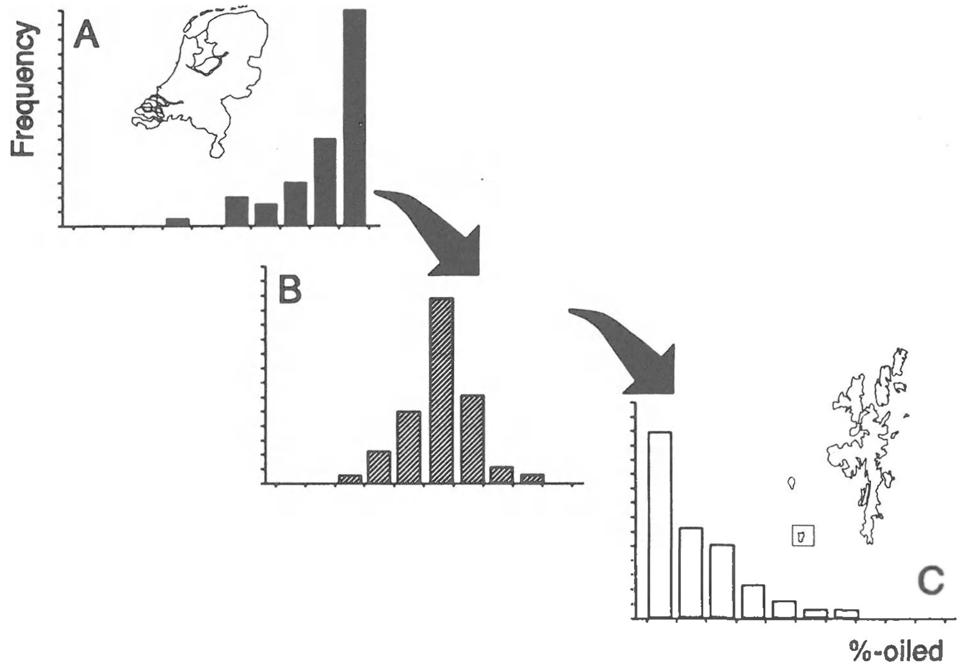


Figure 4.6 Hypothetical sequence in BBS results (frequency distributions of montly oil rates), when measures to reduce oil pollution in heavily polluted area (A) gradually take effect (B,C).

Table 4.3 Species dependent differences in oil rates in different areas around the North Sea.

Species/species group	Shetland[1] 1980-92	Norway[2] 1987-92	Denmark[3] 1987-89	Germany[4] 1984-90	Netherlands[5,6] 69-85	78-91
Divers	26	-	70	80	92	89
Grebes	-	-	78	79	60	64
Fulmar	7	12	65	25	68	68
Gannet	15	-	65	46	87	77
Corm./Shag	3	-	-	6	37	-
Eider	12	12	52	45	67	34
Scoters	-	-	72	51	95	70
Other seaduck	13	6	34	32	40	40
Wildfowl	0	3	19	18	32	27
Waders	0	-	-	6	12	9
Skuas	0	-	-	14	56	-
Larus-gulls	5	13	32	14	43	43
Kittiwake	12	37	52	15	84	77
Terns	-	-	-	12	31	-
Guillemot	11	34	82		89	88
Razorbill	12	-	93	} 70	89	90
Other auks	12	16	82		85	-
All birds	9	-	-	-	68	54

(1) M. Heubeck in litt., Oct-Mar data; (2) K. Skipnes in litt., unpublished data Rogaland; (3) From Danielsen et al. (1990), February data 1984-89; (4) From Averbeck et al. (1992), year round data; (5) From Camphuysen (1989), beached bird surveys 1969-85, year round data; (6) From Camphuysen (1992), Results of National beached bird surveys, February 1978-91.

Post-mortem oil contamination

There is often doubt about the proportion of corpses found on beaches that were in fact oiled after death (NRC 1985). Clearly, some birds found oiled on the beach have not been killed by oil. Of oiled land birds found dead on the beach, doubt as to whether the bird was actually killed by the oil is certainly justified, even although anectodical reports mention heavily oiled land birds still being alive (Vauk-Hentzelt & Schrey 1984, Ree 1986). Of some waders like for instance the Woodcock *Scolopax rusticola*, it is most unlikely that oil was the cause of death in any case. Still, of Woodcock found dead on the Netherlands' coast, 16.0% were oiled (NZG/NSO data 1969-85, n= 160)! From drift experiments we know that, not surprisingly, a certain number of corpses set out, gets oiled on their way to the beach (Stowe 1982b, Keijl & Camphuysen 1992). Raevel (1992) suggested to include data from rehabilitation centres, to compare oil rates between live and dead stranded seabirds. The difference between live and dead stranded auks has always been small in the Netherlands, but there is a difference, usually in favour of the live birds (smaller proportion oiled, NZG/NSO unpublished data). But, obviously, samples of live birds are biased towards clean specimens! Unexpectedly, the results from Northern France have indicated that oil rates in rehabilitation centres were in fact significantly above that found on the beach (1982-91, X^2=193.54, P< 0.001; table 4.4; Raevel 1992). The difference is odd and certainly requires further investigations. However, for studies of the regional differences in oil rates in our proposed monitoring programme, post-mortem oiling is in fact irrelevant. With beached bird surveys we intend to measure the chance for a bird, or a corpse, to get oiled at sea. Only for studies of species dependent differences and for studies of seabird mortality studies, further experiments to assess the scale of post-mortem oil contamination are to be recommended.

Table 4.4 Proportions oiled of birds found in Northern France during the IBBS 1982-91 and received in rehabilitation centres (UNCS), winter 1982/83-1990/91 (after Raevel 1992).

	UNCS data			IBBS data		
Winter	total	oiled	% oil	total	oiled	% oil
1982/83	168	133	79.2	1298	899	69.3
1983/84	188	94	50.0	1823	938	51.5
1984/85	89	50	56.2	1239	374	30.2
1985/86	98	32	32.7	985	306	31.1
1986/87	89	24	27.0	709	93	13.1
1987/88	136	93	68.4	590	174	29.5
1988/89	175	117	66.9	370	151	40.8
1989/90	388	274	70.6	533	239	44.8
1990/91	140	93	66.4	3876	565	14.6
1982/83-1990/91	1471	910	61.8	11423	3739	32.7

Recent trends: some examples

Looking at recent beached bird survey results, several interesting trends emerged. Five cases are discussed here in more detail, as examples of the use of BBS data and to answer the question as to how results of beached bird surveys can be treated, to find trends in the occurrence of oil pollution at sea. Perhaps the most spectacular results with respect to rise and decline in oil rates in response to oil industry developments and measures to reduce illegal discharges, have been described for Orkney and Shetland (Heubeck 1991). A strong decline in oil rates in auks on German beaches in recent years may be an effect of increased effort to get vessels to unload their ballast tanks in harbours in oil reception facilities that are free of charge (Averbeck in litt.).

In the Baltic, a special area under MARPOL 73/78 Annex 1, mortality of waterbirds in Polish waters due to oil pollution is currently considerably less than 20 years ago (Meissner in litt.). In the Netherlands, there are currently signs of a decline in oil rates, particularly amongst coastal species. An international project, in which oil samples were collected on stranded birds and beaches, revealed regional differences in oil types in the North Sea.

(1) Sullom Voe and Flotta terminals on Shetland and Orkney (from Heubeck 1991)
Monthly BBS began in Orkney and Shetland in response to the North Sea oil developments and the construction of major oil terminals at Flotta in Orkney and Sullom Voe in Shetland. Orkney surveys began in March 1976, and the first tanker loaded at the Flotta Terminal in January 1977. BBS were started in Shetland in August 1978 and the Sullom Voe Terminal exported its first oil in November that year. Both terminals experienced significant oil spills soon after opening. Crude oil leaked from the tanker *Nacella* at Flotta in March 1977, resulting in at least 110 seabird deaths. In December 1978 1,174 tonnes of heavy fuel oil spilled from the tanker *Esso Bernicia* at Sullom Voe, caused at least 3,700 seabird deaths. Samples of oil taken from seabird corpses between October and December 1977 were mainly of fuel oils. Both the proportion of corpses oiled and the rate of oiled corpses per km were rather high during January to April 1978. Samples of oil from corpses and beaches during March to November 1978 comprised approximately one-third fuel oils, one-third crudes (of which 27% were crude oil sludges, i.e. tank washings) and one-third a variety of other oils. The Sullom Voe Terminal loaded its first tanker on 28 November 1978, despite the fact that deballasting facilities were still under construction and would not be fully operational for another year. Within 10 days of the first shipment of oil leaving the Sullom Voe, unusual numbers of oiled birds were reported in Orkney and later along the coast of NE Scotland. In early 1979, oiled birds not connected with the *Esso Bernicia* oil spill began to be found all around the coast of Shetland, culminating in early March when 1,700 were collected in an 18-day period. Further incidents continued around Orkney and Caithness and by late April 1979, oil spills from unknown sources had killed at least 4,000 birds (mainly auks) in the area. Undoubtedly, large numbers of victims were never found. Analyses of samples of oil from beaches and birds in early 1979 showed a high proportion were crude oil sludges, confirming suspicions that tankers were deballasting or flushing tanks out at sea around Shetland and Orkney. The timing of the pollution suggested that ships bound for Sullom Voe were involved and public indignation included calls for the closure of the terminal. Instead, a number of measures to reduce chronic pollution from tankers, as well as to improve navigational safety, were introduced in March 1979. These included:

(1) Daily aerial surveillance of tankers around Shetland by the Shetland Islands Council;
(2) The threat to refuse loading facilities at the terminal for polluting tankers;
(3) All tankers entering Sullom Voe must carry at least 35% ballast water;
(4) Oil company shipping contracts to include clauses discouraging illegal dumping at sea of contaminated ballast.

Tankers were observed breaking these rules and navigational guidelines around Shetland on a number of occasions in 1979 and 1980. Legal action was taken, where possible, and several vessels and their masters were banned from entering Sullom Voe. In November 1979, full deballasting facilities became available at the terminal. In Orkney, the density of oiled auks fell considerably by the 1979/80 winter although the proportion of corpses oiled remained high. Both measures of chronic oil pollution remained low after the summer of 1980 and routine analyses of oil on dead birds showed that by 1982, crude oil sludges had fallen to 7% of samples taken. The Shetland survey recorded a high proportion of oiled auks throughout the 1979/80 winter although large numbers only occurred in December. Aerial surveillance continued to detect tankers discharging oil around Shetland and crude oil sludges remained prominent among samples taken from corpses. Few oiled auks were found in the 1980/81 winter and since then, although high proportions of oiled auks have been recorded, they were mostly on surveys when few birds were found. Of 52 oil samples taken from corpses during 1982, only 4% were of crude oil sludges.

The effect of the opening of the terminals in BBS data is clearly illustrated in figure 4.3 (Orkney), a sudden rise of the proportion of Guillemots found oiled, and so is the effect of the (successful) measures to reduce the number of spills in these waters: a sudden fall of the oil rates (figures 4.2 and 4.3). The example also illustrates that such an effect is likely to be recorded, irrespective of the number of birds washing ashore.

(2) Decline in oil rates in Germany The German Bight is often cited as one of the more severely polluted sea areas, with large harbours and industrial areas (Wilhelmshaven, Bremerhaven, Hamburg) and dense shipping traffic. It is an area were many shipping casualties have been reported and were marine pollution, both from river runoff and from discharges at sea, is immense (Couper 1983). Since the early 1960s, stranded oiled seabirds have been monitored in (West) German North Sea waters (Vauk & Pierstorff 1973, Vauk 1978, Vauk & Reineking 1980, Vauk 1984, Vauk *et al.* 1991). Not surprisingly, very high oil rates were found in these surveys (1983-86, e.g. Red-throated Diver *Gavia stellata* 85.8% (n= 141), Gannet 64.0% (n= 139), Common Scoter *Melanitta nigra* 76.0% (n= 1945), Razorbill 90.8% (n= 393), Guillemot 77.0% (n= 3150); Vauk *et al.* 1987). The results were perfectly consistent with those collected in the neighbouring countries, in Denmark, and in the Netherlands (Stowe 1982, Camphuysen 1989, Christensen 1989). By far the highest proportion of oiled birds was found in the entrance of river Elbe, the lead to Hamburg (94.5%, n= 2341; Vauk *et al.* 1989).

In June 1988, a new measure against oil pollution in Germany included better oil reception facilities which were also free of charge. Beached bird surveys were planned to assess the effectiviness of this measure (Averbeck 1991, Vauk *et al.* 1991). Soon after the installation of free reception facilities, little or no change could be noted (Vauk *et al.* 1991). However, in February 1990 the overall oil rate fell from an average of 50-70% during 1984-89 to only 25% (n= 792) Averbeck 1991). For the above mentioned species (excluding Red-throated Diver and Gannet because only 6 and 3 corpses (all oiled) were found), the proportions oiled were 18.2% for Common Scoter (n= 11), 33.3% in Razorbill (n= 54), and 34.7% in Guillemot (n= 308). One year later, oil rates for Razorbill and Guillemot were again lower (Christiane Averbeck in litt., see table 4.1). The decline in oil rates in Germany is remarkable, and definitely inconsistent with Danish and Dutch Data (NZG/NSO files, Henrik Skov pers. comm.). The next few years will be conclusive, to find out whether this trend holds in Germany. The current data strongly suggest that the German experiment of offering free oil reception facilities is highly succesful in reducing oil pollution at sea.

(3) The Baltic Sea as Special Area under MARPOL 73/78 Under MARPOL 73/78 Annex 1, the Baltic was designated as a Special Area (International Convention for the Prevention of Pollution from Ships, London 1973 and protocol, London 1978). This means that since MARPOL 73/78 came into force in 1983, all discharges of oil/water mixtures exceeding 15ppm of oil (over 100ppm for vessels less than 400 tonnes) were illegal. Baltic waters hold internationally important concentrations of wildfowl, such as scoters, Long-tailed Duck *Clangula hyemalis*, Steller's Eider *Polysticta stelleri* (Nilsson 1980, Bräger 1990, Kullapere 1990, Kuresoo 1990, Meissner 1990, Nehls 1990,

Raudonikis 1990, Shergalin 1990, Skov *et al.* 1990, Svasas 1990, Vaitkus in litt.), and breeding auks, including Black Guillemots *Cepphus grylle*, Razorbill and Guillemot (Evans 1984, Golovkin 1984). Fortunately, few major oil incidents have occurred in these waters. Examples of incidents are those with the tankers Tsesis, Palva and Antonio Gramsci (Haila 1970, Soikkeli & Virtanen 1972, Lindén *et al.* 1979, Vaslte 1983). However, chronic oil pollution was clearly widespread in the 1960s and 1970s (Kuhlemann 1953, Ecke 1957, Goethe 1961, Müller 1970, Szczepski 1975, Wolk 1975, Soikkeli & Virtanen 1978, Górski *et al.* 1975-80, Misiewicz 1980). In fact, chronic oil pollution was often listed as the major threat to the very large numbers of wintering Long-tailed Duck and scoters (Curry-Lindahl 1960, Bergman 1961, Lemmetyinen 1966). If the new regulations under MARPOL 73/78 have been properly met, we would expect a drastic decline in oil rates in BBS results in the Baltic states since 1983.

Unfortunately, very few data on oiled seabirds in Baltic waters have been published since 1980. Actually, it seemed as if all activities had stopped in these countries. During the project "Oiled Seabirds and Oil Pollution", national co-ordinators in the Baltic states, including Poland, Estonia, Lithuania, Latvia, and Sweden were contacted. In Estonia and Lithuania, BBS schemes are currently set up, but here are no (older) data available (Gediminas Vaitkus in litt., Vilju Lilleleht pers. comm.). It was found that in Poland, BBS have continued, virtually unbroken, through the years (Wlłodzimierz Meissner in litt.). A paper on Polish results will be published in the proceedings of the VIth Baltic Birds Conference. Currently, the results are not available, but Meissner was very certain that "the mortality of the waterbirds due to oil pollution on the Polish coast is now much lower than twenty years ago". During 1947-70, 56.0% of the auks in Gdansk Bay were oiled (n= 141; Szczepski 1976), whereas during 1980-87 of the same three species in the same area only 6.3% were oiled (n= 238; Meissner 1989). During 1987-89, a comparison between BBS results collected on the Danish North Sea coast, in the Kattegat and on (Danish) Baltic beaches showed that, both oil rates on birds and the frequency of oil on beaches, were decidedly lower in the Baltic than elsewhere (Christensen 1989). Several other reports indicate low numbers of birds, comparatively low oil rates and clean beaches in the Baltic (Averbeck 1991, Włodzimierz Meissner in litt., Jan Durinck, Vilju Lilleleht & Henrik Skov pers. comm.), although oil incidents still occur (Dahlmann & Hartwig 1984). It is very odd that there has not been an comprehensive evaluation of the 'impact' of the MARPOL 73/78 designation of the Baltic as a special area using BBS results. Fortunately, it seems that the data are there, at least in Poland, Denmark and Germany. After translation and proper publication, such an evaluation with hindsight is possible. For the time being, all signs are in the direction of a significant change from very much oil polluted waters towards a considerably cleaner sea area.

(4) Oil rates in the Netherlands, 1969-91 National BBS in February have been performed in the Netherlands since 1965 (Camphuysen 1991, 1992ab, in press). The results of the national surveys were split in two portions (1965-78, 1979-91), because the organization changed from NJN to NSO in 1978, with associated minor differences in methods (cf. Camphuysen in press). Proportions oiled were calculated for each survey for each group of species, if at least 10 corpses of that group could be examined. Overall oil rates were calculated for both periods, and trends within each period were calculated using the Rank Spearman correlation coefficient following Fowler & Cohen (1986; table 4.5). Few of the observed trends were statistically significant, and it should be realized that this may be partly true because of interference of other mortality factors. However, most trends are negative, which means that there is a general tendency of a decline in oil rates in the Netherlands.

Table 4.5 Proportion oiled in the most important groups/species during February 1965-78 (national surveys conducted by NJN) and February 1979-91 (national surveys conducted by NSO or NZG/NSO) and trends over the years in both periods. Spearman rang correlation coefficient one-tailed, n ≥ 8 significance: * = P< 0.05, ** = P< 0.01, n= number of years used for analysis (after Camphuysen in press).

	Percentage oiled (%)							
Group	1965-78	n	Rs	Sign	1979-91	n	Rs	Sign
Divers	94.7 %	10	0.148	n.s.	87.5 %	10	0.188	n.s.
Grebes	86.8 %	10	-0.233	n.s.	64.6 %	13	0.329	n.s.
Fulmar	84.4 %	5			67.2 %	11	-0.089	n.s.
Gannet	94.8 %	5			77.0 %	5		
Eider	77.8 %	10	-0.236	n.s.	34.3 %	13	-0.544	*
Scoters	83.5 %	12	-0.099	n.s.	70.8 %	13	-0.088	n.s.
Other seaduck	77.2 %	5			40.3 %	11	-0.282	n.s.
Other wildfowl	49.4 %	10	-0.818	**	27.0 %	13	-0.302	n.s.
Waders	30.3 %	11	-0.845	**	8.9 %	13	-0.444	n.s.
Larus-gulls	68.9 %	12	-0.021	n.s.	43.1 %	13	-0.214	n.s.
Kittiwake	77.7 %	11	-0.100	n.s.	77.7 %	13	-0.390	n.s.
All auks	95.5 %	12	0.406	n.s.	87.9 %	13	-0.478	*
Guillemot	93.4 %	11	0.232	n.s.	87.7 %	13	-0.430	n.s.
Razorbill	96.3 %	10	0.576	*	89.3 %	13	-0.225	n.s.
Coot	46.3 %	5			12.4 %	8	0.452	n.s.
All birds	73.2 %	13	-0.445	n.s.	53.6 %	13	-0.088	n.s.

However, the conclusion that there is a downward trend should not be drawn without examining the data in somewhat more detail. Illustrated are densities and oil rates as measured during national surveys for divers (figure 4.7), Eider (figure 4.8), Larus-gulls (figure 4.9), Kittiwake (figure 4.10), Guillemot (figure 4.11) and Razorbill (figure 4.12).

In divers, Kittiwake and both auks, the oil rate is invariably very high, largely irrespective of the number of birds found dead. In Guillemot and Razorbill, the proportion oiled may show the start of a slight decline in recent years. This recent decline, however, is definitely insufficient to conclude a downward trend in oil pollution at sea. For such a conclusion, the decline should be more pronounced and consistent over a longer period of time. Only in Kittiwake, a positive correlation was found between oil rate and densities (1979-91, Rs= 0.65, df= 11, P< 0.01; Camphuysen in press).

In Eider, the proportion oiled fluctuated strongly in response to oil incidents (1969, 1976, 1987) and strandings from other mortality factors (1985, 1990, 1991). Overall, the oil rate declined, but probably mainly in response to extra mortality from other causes. Lack of food is a likely cause. The shortage of shellfish in the Waddensea area has contributed to increased mortality of Eiders in 1990 and 1991 (Swennen 1991). Highly erratic changes as found in the Eider may require multivariate analysis to assess trends and to estimate effects of different mortality factors. In Larus-gulls, the decline in oil rate is more convincing, even though the statistical results were not clear (table 4.5). The decline in oil rate in gulls and Eider might indicate a decrease in oil incidents in the coastal zone. However, such a conclusion can not be unequivocal, as one would expect similar trends in other species using the same area, like divers. Figure 4.6 does not show a clear downward trend in oil rates of divers in Dutch coastal areas.

(5) Regional differences in oil types on birds and beaches From 1990-92, an EC funded Danish-German-Dutch project was carried out to assess the sources of oil pollution on beaches and (oiled) stranded seabirds in the Eastern North Sea (project "Oiled

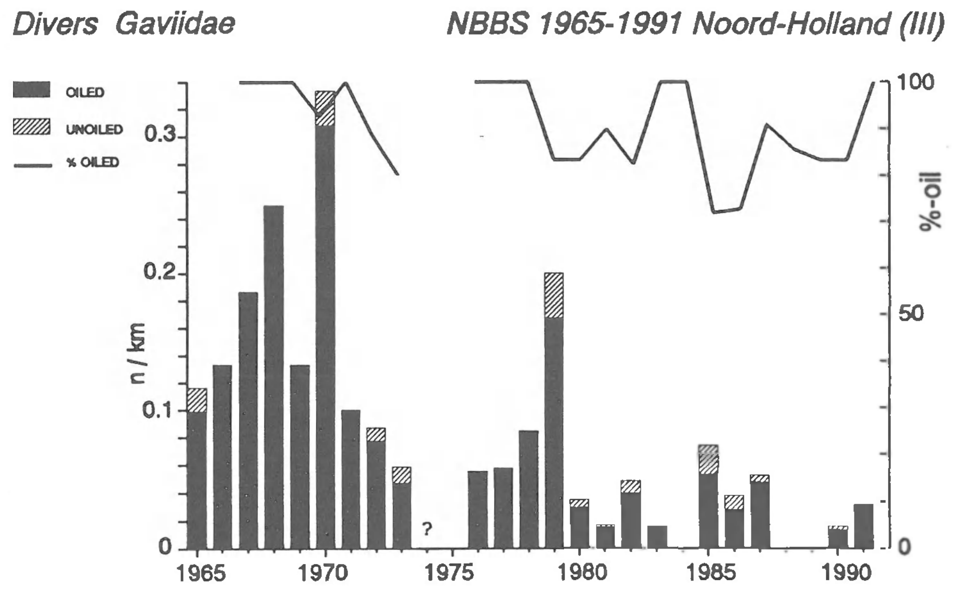


Figure 4.7 Number of divers *Gavia* species per kilometre in Noord-Holland, subregion III, NBBS 1965-1991, and the %-oiled (national index; see Camphuysen in press).

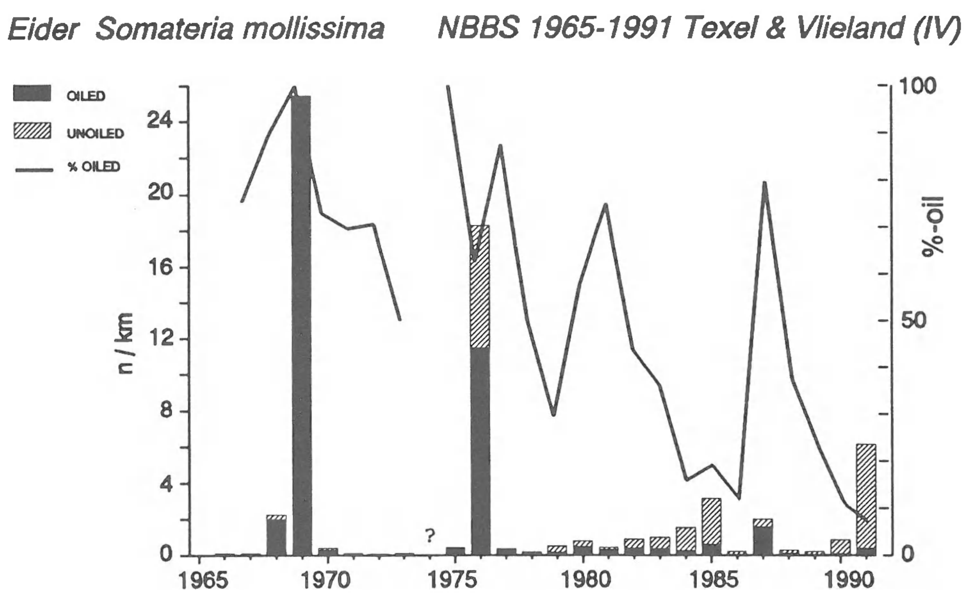


Figure 4.8 Number of Eider *Somateria mollissima* per kilometre, subregion IV, NBBS 1965-1991, and the %-oiled (national index; see Camphuysen in press).

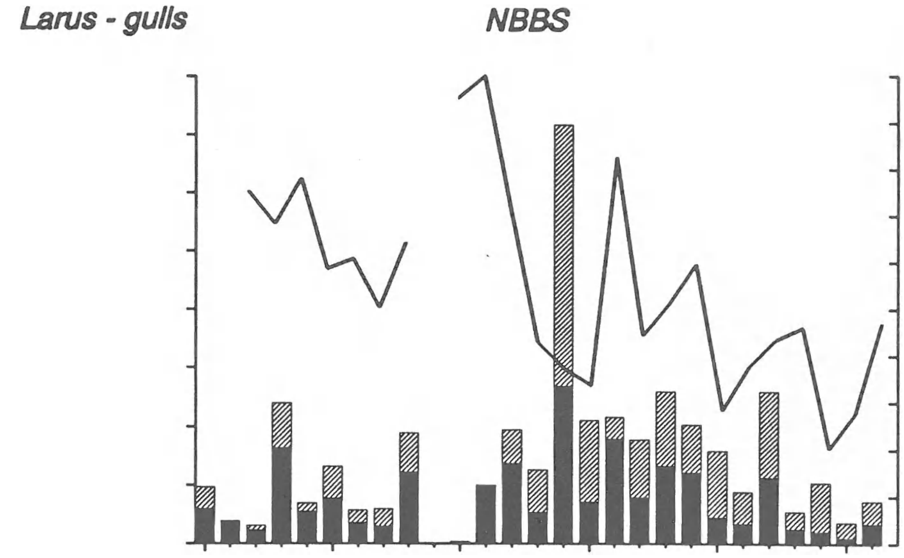


Figure 4.9 Number of gulls *Larus* species per kilometre in Zuid-Holland, subregion II, NBBS 1965-1991, and the %-oiled (national index; see Camphuysen in press).

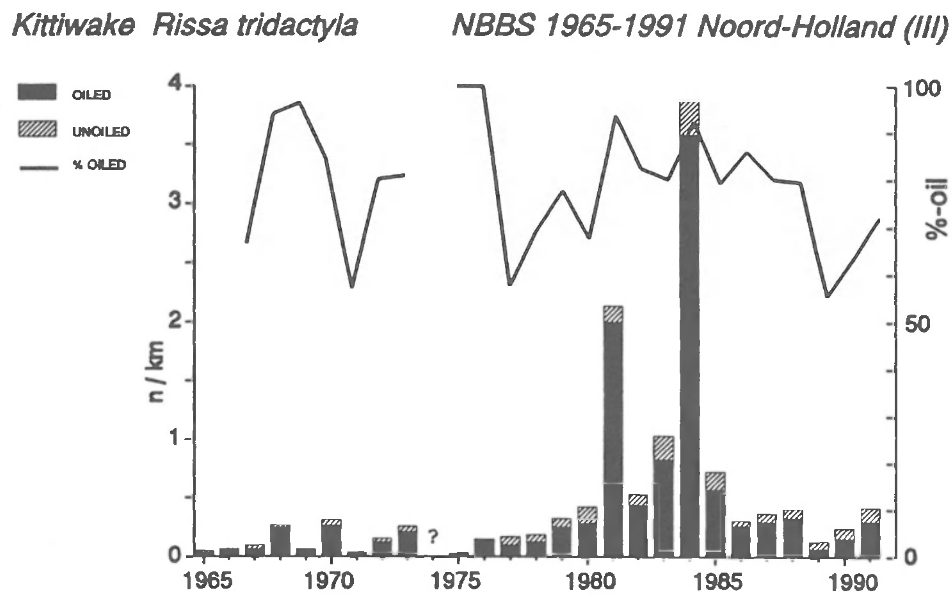


Figure 4.10 Number of Kittiwakes *Rissa tridactyla* per kilometre in Noord-Holland, subregion III, NBBS 1965-1991, and the %-oiled (national index; see Camphuysen in press).

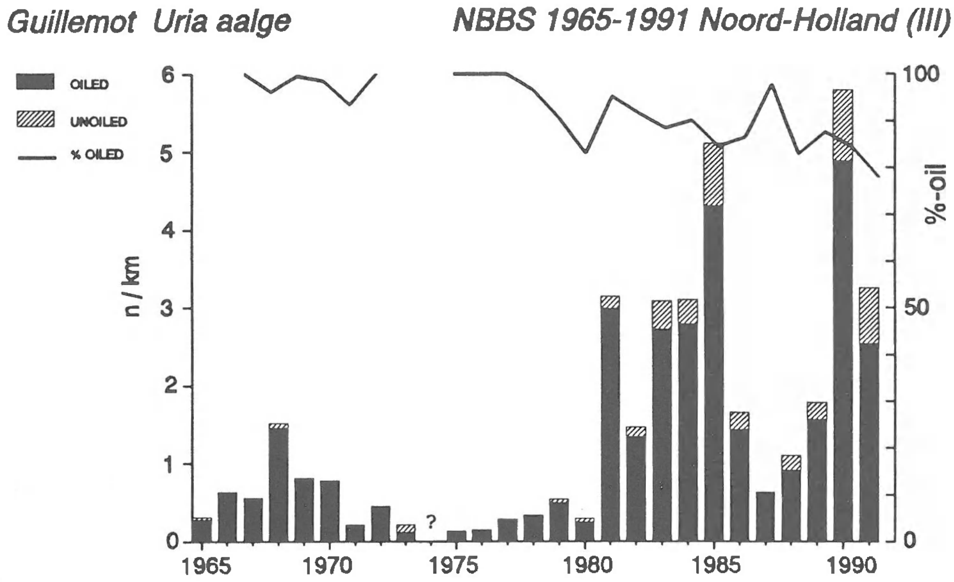


Figure 4.11 Number of Guillemots *Uria aalge* per kilometre in Noord-Holland, subregion III, NBBS 1965-1991, and the %-oiled (national index; see Camphuysen in press).

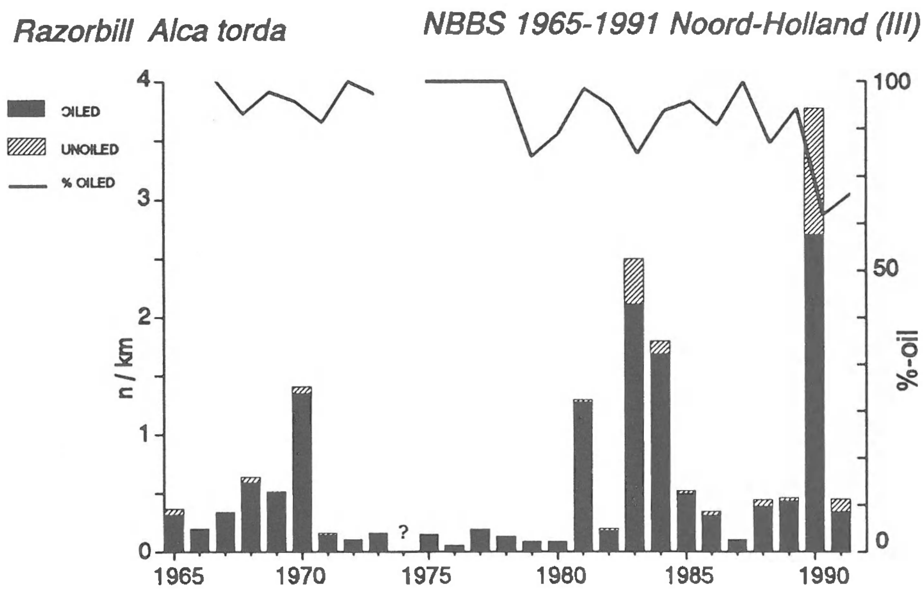


Figure 4.12 Number of Razorbills *Alca torda* per kilometre in Noord-Holland, subregion III, NBBS 1965-1991, and the %-oiled (national index; see Camphuysen in press).

Seabirds: Comparative investigations of oiled seabirds and beaches in the Netherlands, Denmark and Federal Republic of Germany"). Basic questions were (1) what is the main source of oil found on birds and beaches, (2) what other lipophilic substances are responsible for seabird mortality and beach pollution, and (3) are there any regional differences. The first conclusion was that, conform earlier findings, fuel oil discharges from ships were the main source of pollution on Danish, German and Dutch beaches. One major new finding of the project was that the Northern coast of Denmark is also regularly affected by crude oil pollution (largely from Dahlmann 1991b). In 1990, oil found on Danish beaches included North Sea, Venezuelean, Nigerian, Libyan and Middle East crudes and most were found on NW Jutland. Illegal discharges from crude oil tankers at the outlet of the Skagerrak are the source of this pollution and the great number of cases of severe crude oil pollution in this area must mean that illegal discharges from crude oil tankers leaving or entering the Baltic are common practice. It is perhaps significant that anti-pollution aircraft do not yet operate this area. In the other countries, crude oils were found only occasionally.

Conclusions

To return to the basic questions for this project (chapter 4), the above discussions and examples have clearly demonstrated that there is a link between oil pollution and beached oiled birds on beaches. The examples illustrate the fact that BBS results can describe the regional differences and trends in oil pollution of the sea area bordering particular parts of the coast. However, BBS results should be treated carefully and additional information is required for a proper interpretation of the results.

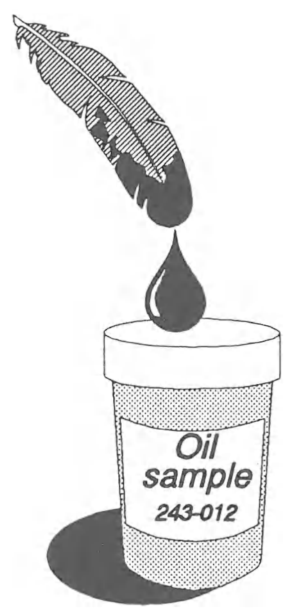
Although it will be difficult to predict what will actually happen with a very high oil rate as found in the Southern North Sea and Channel, when new measures are introduced to eliminate pollution, the data from Shetland and Orkney have shown how sensitive BBS results can be. A substantial reduction in the number of oil slicks will, no doubt, become visible as a decline in oil rates of birds found dead on our beaches.

Certain trends indicate that oil pollution is already, but very slowly, decreasing. In the Baltic, it seems evident that much less seabirds die in oil in recent years. A comprehensive analysis of base-line data is urgently required to describe and explain the recent changes in these waters. In the Southern North Sea, minor declines in oil rates have been found, but in the German area, recent data suggest locally a strong decline in oil pollution, following an experiment in which free port reception facilities were provided. The next few years will be conclusive, to find out whether these trends hold.

4.2 The need for chemical analysis of oil samples and other substances found on beaches and stranded birds

At the 30th session of the MEPC on 19 September 1990 in London, it was concluded that investigations into the sources of oil spillage are now urgently required (Anonymous 1990). Mineral oils consist of a very complex mixture of many thousands of organic compounds (NRC 1985). Many characteristic compounds of oil can be detected separately out of this mixture, by combined gas chromatography and mass spectrometry (GC/MS; Dahlmann 1985, 1991a). The analysis of components can be used to compare different oil samples (e.g. from the beach and from stranded oiled seabirds), in sufficient detail to identify a possible common source.

In Germany, several hundreds of oil comparisons were conducted since 1984 by the Bundesamt für Seeschiffart und Hydrographie (BSH, Hamburg; Dahlmann & Hartwig 1984, Dahlmann 1985, 1987, Vauk *et al.* 1987), and the analytical results were generally accepted as evidence in court (Dahlmann 1991a). Clearly, chemical analysis of oil samples is very valuable in criminal proceedings. Moreover, chemical analysis of (oil) samples from beaches and contaminated birds can be used to detect other floating lipophilic substances such as non-mineral oils and chemicals (Bommelé 1991, Timm & Dahlmann 1991). Investigations into the types of oil, non-mineral oils and other lipophilic substances responsible for seabird mortality and pollution on beaches are important to assess impact and scale of pollution of these substances (Bommelé 1991, Timm & Dahlmann 1991). In an EC funded project *Oiled Seabirds: Comparative investigations of oiled seabirds and beaches in The Netherlands, Denmark and the Federal Republic of Germany,* carried out during 1990-92, it was tried to assess the relative contribution of different oil types to seabird mortality and polluted beaches. Samples were taken from seabirds and beaches during BBS in the respective countries and these were then analyzed by BSH Hamburg. Preliminary results of the project were presented at the NZG/NSO workshop 'Oil Pollution, Beached Bird Surveys and Policy' (Rijswijk, April 1991; Camphuysen & van Franeker 1991), at the 'Wissenschaftliches Symposium Aktuelle Probleme der Meeresumwelt' (Hamburg, June 1991), and as a working paper on the 6th meeting of the North Sea Task Force (TF 6/Info, 19-E; Hirtshals, May 1991). Moreover, the results will be included in the second Quality Status Report of the North Sea. In this chapter, some of the more interesting results of this project, and the possibilities and merits of systematic oil sampling coupled with BBS are further discussed.



Oil sampling from beaches and from oiled beached birds

Beached bird surveys in combination with routine sampling of oil are very valuable, mainly for three reasons:

(1) identification of 'clusters' in a relatively constant stream of oiled birds or oil slicks washing ashore;
(2) identification of sources of oil pollution;
(3) identification of other substances responsible for seabird mortality or (significant) pollution of beaches.

Systematic sampling coupled with BBS will not only provide an idea of the scale of the different types of marine pollution, but also of the effect on seabirds. Separation by eye of different oil types on the beach and on corpses is impossible. Even in specific oil incidents, with substantial quantities of oil on the beach and many heavily oiled corpses of birds, it was shown by means of chemical analysis of oil samples, that an apparently single incident in fact consisted of a number of different discharges (Dahlmann & Timm pers. comm.).

Other substances responsible for seabird mortality and polluted beaches
Systematic sampling of substances in bird feathers and on the beach is the only way to properly assess the scale of mortality and pollution caused by discharges of other chemicals into the marine environment. Other lipophilic substances responsible for seabird mortality, as identified during 1990-92 in the Netherlands, Germany and Denmark, are palm oil and other non-mineral oils, high boiling alcohols, Dodecylphenol, Nonylphenol or derivates, thiophenes, other chemicals, and biogenic compounds (Dahlmann & Timm 1991, Timm & Dahlmann 1991, Dahlmann in litt., Zoun 1991, Zoun *et al.* 1991). The detection of such oils and chemicals, and indications for the frequency and scale of such incidents are important guidelines for adequate policy measures to counteract previously undetected sources of marine pollution.

The link between strandings and certain slicks at sea
Accidental spillages of oil at sea have to be reported to coastal state authorities. As a result, the type of oil spilled should be known. Analysis of oil samples from beaches have been used to link strandings with incidents at sea (e.g. Kerkhof *et al.* 1981, Anonymous 1982). Such cases of known origin and stranding of oil slicks will be extremely valuable in predicting the 'behaviour' of oil slicks in future incidents. In some German cases, analysis of oil found on beaches could be linked with previously undetected sources in the German North Sea (Dahlmann 1985). Most interesting are successful cases of linkage of oil on birds and beaches with ships suspected to be the source of particular pollution incidents (e.g. Dahlmann & Hartwig 1984).

Back calculations using drift simulations
In several cases, the pollution of beaches could not easily be linked with slicks at sea. The reasons were that there were no reports of incidents from ships or offshore installations, nor slicks sightings from aerial surveillance. The drift of floating oil lumps or dead oiled seabirds onto beaches can be calculated using a computer aided drift model (Dahlmann 1991b). For successful back-calculations, the 'behaviour' of different oil types has to be known, as well as the factors responsible for any displacement (wind, current, wave actions). Drift simulations can be used to find out where the mortality of birds has taken place (Leopold & Camphuysen 1992), or to link beached oil with a certain source (Dahlmann 1991a). An examples of a back calculation is given in figure 4.13. For oil slicks and for corpses of birds, drift speed and factors responsible for direction of displacement have been studied in drift experiments and during major oil incidents (e.g. Bibby 1981, NRC 1985, Galt *et al.* 1991, Keijl & Camphuysen 1992).

Sources of (oil) pollution in the North Sea
Within the project *Oiled Seabirds: Comparative investigations of oiled seabirds and beaches in the Netherlands, Denmark and the Federal Republic of Germany,* as it was carried out during 1990-92, it was tried to assess the relative contribution of different oil types to seabird mortality and polluted beaches. Earlier suggestions, that the main source of oil pollution found on birds and beaches were discharges of oily residues from ships' engine rooms, were confirmed (e.g. Dahlmann 1991b). One major new finding of the project is that the Northern coast of Denmark is also affected by crude

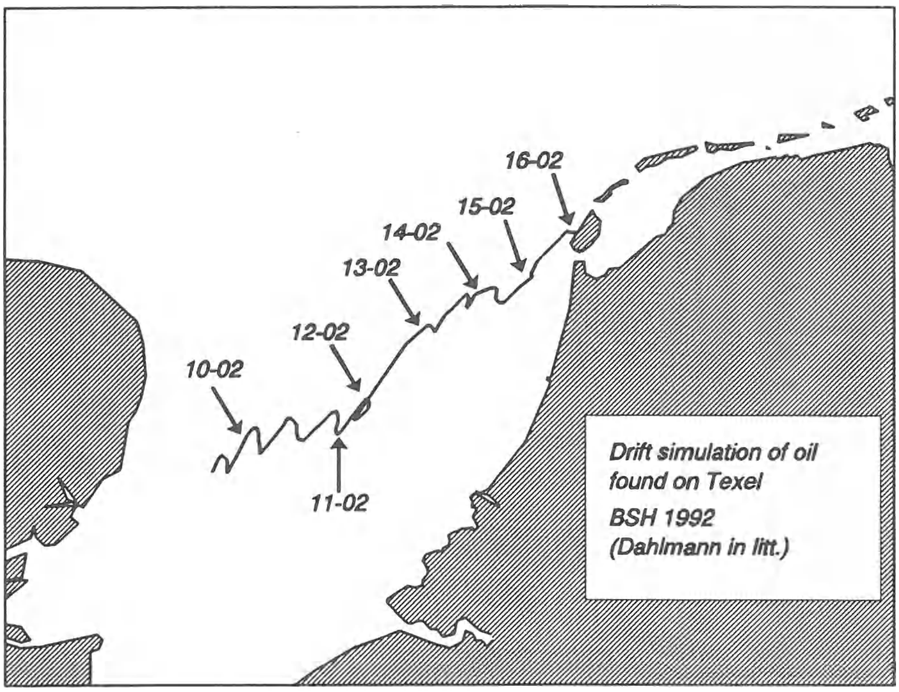


Figure 4.13 Example of back-calculation of oil washed ashore on 16 February 1992 at Texel, using a drift simulation model (BSH 1992 in Leopold & Camphuysen 1992).

oil pollution. Illegal discharges from crude oil tankers at the outlet of the Skagerrak are the source of this pollution and the great number of cases of severe crude oil pollution in this area must mean that illegal discharges from crude oil tankers leaving or entering the Baltic are common practice. North Sea crudes were found during the project. The complex mixture of components, different in all North Sea crudes, permits the identification of the oil-well from stranded oil. There is firm evidence that most North Sea crudes found on Danish beaches were discharged from ships during transportation (Dahlmann pers. comm.). The presence of products other than oil, such as dodecylphenol, vegetable oil, paraffin wax or coal tar in the feathers of birds or on beaches is a second striking factor (e.g. Timm & Dahlmann 1991).

Conclusions

The findings highlight the necessity of an international sampling programme on our coasts if we are to gain better understanding of sources, frequencies and effects of illegal discharges of oily and chemical residues. Such knowledge is essential to develop further policy measures to reduce pollution from specific sources.

4.3 The additional value of beached bird surveys as compared to aerial surveillance to assess the occurrence of oil slicks at sea

In several European countries, the presence of oil slicks at sea has traditionally been studied by means of aerial surveillance (e.g. Kramer 1991). On the Dutch sector of the continental shelf, between 1983 and 1990, some 3223 oil slicks were recorded (an average of 1.2 per hour of flight; figure 4.14). From the aerial surveillance data it was estimated that in the Dutch sector some 5000-7000 oil slicks per annum occur (Stoop 1989). Shortly after 1983, it was suggested from the results of aerial surveillance that the number of oil slicks had declined. In later years, the conclusion was drawn that in fact there is no consistent decline to be observed (Kramer 1991). From beached bird surveys in the Southern North Sea it has always been concluded that there is no decline in the risk to become oil contaminated, particularly not for pelagic seabirds (figure 4.14, bottom). In this chapter, the aims, results, and costs of aerial surveillance are described and finally discussed in comparison to beached bird surveys.

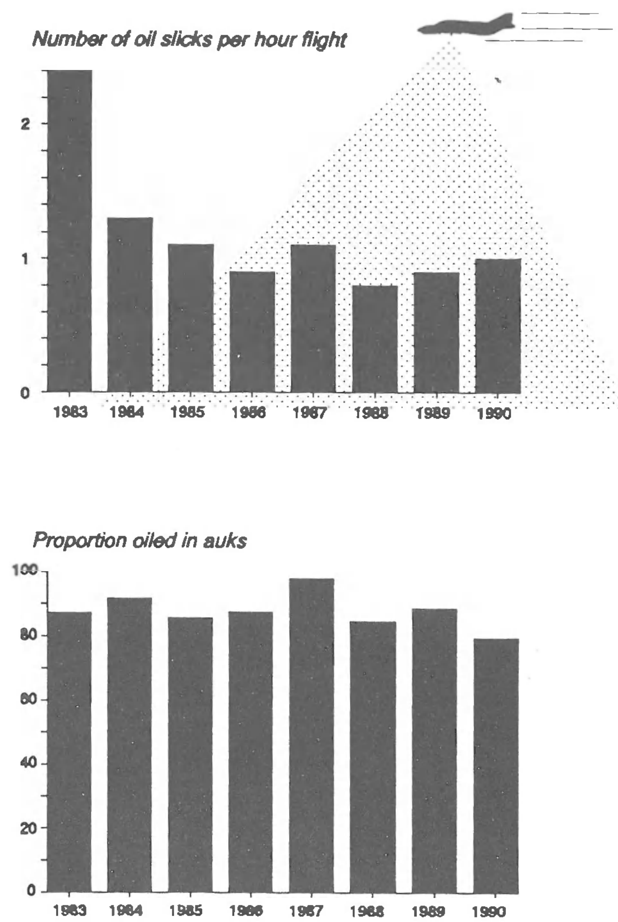


Figure 4.14 Number of oil slicks observed during aerial surveys (top; Anon. 1990b) and oil rate in auks in the Netherlands (bottom; NZG/NSO).

Aerial surveillance: methods and goals

The description of methods of aerial surveys for oil slicks is based on the monitoring programme of the Dutch North Sea Directorate of the Ministry of Trasnport, Public Works and Water Management in Rijswijk (Koops 1980ab, Anonymous 1991b, Kramer 1991). Methods and goals in other countries may be slightly different. The description only deals with the official monitoring programme of the North Sea Directorate, with dedicated flights of the aircraft which is equipped with remote sensing since 1983, not with reports of oil slicks of third parties (e.g. offshore industry, Water Police, merchant fleet, KLM helicopters, and others).

Aerial surveys for oil slicks are in the first place meant to detect infringements of (international) regulations on the prevention of oil pollution by ships or offshore platforms (Kramer 1991) and, secondly, to detect slicks at sea and to assess the need for immediate clean-up operations. Hence, the spatial distribution of slicks at sea has been studied in great detail. Monthly or annual distribution maps of oil slicks often show concentrations of slicks around the major shipping lanes and near offshore installations (e.g. Dahlmann 1985, Anonymous 1991). Since most effort is directed towards dense shipping traffic and offshore operation areas (Kramer 1991), the data may be biased. Within the systematic monitoring programme, the colour, surface area, volume and, if possible, the source of the observed slick are assessed. The volume of the oil slicks observed is assessed using the colour and the estimated surface area. From experiments, field observations, and literature sources, the initial volume of the slick is estimated at (after Anonymous 1991b):

Colour	Colour code	Estimated volume
Silver, transparent	(1)	initial volume = 0.0 m^3/ km^2
Grey	(2)	initial volume = 0.1 m^3/ km^2
Rainbow	(3)	initial volume = 0.3 m^3/ km^2
Blue	(4)	initial volume = 1.0 m^3/ km^2
Brown/blue	(5)	initial volume = 5.0 m^3/ km^2
Brown	(6)	initial volume = 15.0 m^3/ km^2
Black	(7)	initial volume = 20.0 m^3/ km^2

Slick length, width and cover, together with the colour, lead to an estimate of the total quantity. In 1990, of 190 visually observed slicks, 46% were brown/blue or blue, 19% were grey, and 16% were rainbow (Anonymous 1991b). The aerial surveillance programme is not coupled with systematic sampling of oil at sea. The number of slicks seen during the dedicated flights is expressed as number per hour of flight, while the mid-position is plotted on a map. In 1990, the statistical research programme involved 372.3 hours of flight and 362 detected oil slicks (1.0/hr; figure 4.14).

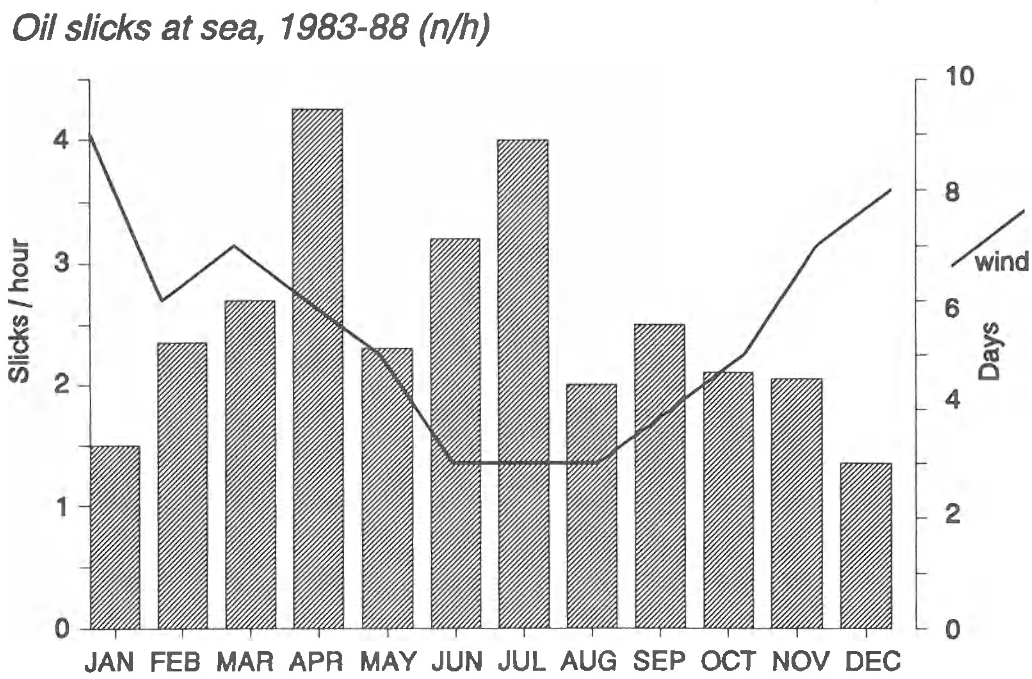


Figure 4.15 Monthly frequency of oil slicks sigthings on the Dutch sector of the Continental Shelf (1983-88; Anonymous 1991), and (normal) occurrence of strong wind (>6B, KNMI 1982).

Limitations
Since 1983, oil slicks are detected by means of remote sensing equipment. Before that year, visual observations were the main source of information. Remote sensing equipment can also be used in conditions with poor visibility. However, in strong winds, oil slicks are usually broken up quickly and dispersed in the water, thus escaping detection by aerial surveillance. There are no dedicated flights in situations with windforce 8B or more, while the statistical analysis has shown that the number of slicks found drops dramatically in windforce 5 or more. In 1990, of 190 observed slicks, well over 160 slicks were observed in wind conditions ≤ 4B, while not a single slick was observed during 6B or more (Anonymous 1991b). The seasonal pattern is probably influenced by this factor (figure 4.15). As a result of this limitation, oil can still be discharged unnoticed in windforce 8B or more, while the chance of detection of oil slicks in windforce 5B or more is very small.

Source, distribution and scale of oil pollution
The sources of the observed oil pollution can be divided in two: offshore and shipping. Of all observed oil slicks (n= 721) in the Dutch sector in 1990, 85 were known to be related to the offshore industry, while 79 slicks were caused by a ship. Of the slicks caused by the offshore industry, 78 cases were reported by the offshore industry itself, 3 were observed by the coastguard aircraft, and 3 by others. Of the slicks caused by ships, 34 were recorded by the coastguard aircraft and 45 by others. With 1990 as an example, 37 sources were identified within the aerial monitoring programme (22.6% of all known cases). The distribution maps of oil slicks, as briefly mentioned earlier, are one of the more 'attractive' results (figure 4.16). Besides the valuable information which can be deduced from such maps, the information can be used to show the public the occurrence of illegal discharges at sea. Even although a substantial number of slicks is overlooked, especially during stronger winds, the distribution maps, together with the information on number of slicks detected per month and estimated volume of oil, are an excellent illustration of the scale of marine oil pollution.

Prevention
One reason to operate an aircraft to detect oil slicks is prevention. The sighting of an inspection aircraft may encourage the crew to obey the regulations. However, this effect should not be overestimated. The drop in number of slicks sighted since 1983 may well be caused by a slight change in the habits: discharge of oil only in stronger winds, during the night, during weekends, on public holidays and so on. In Germany, neither the surveillance programme carried out by a special naval aircraft and by patrol vessels of the water police, the customs and the border police, nor the so rarely successful prosecutions and penalties for misdemeanours resulting from the surveillance programme, led to an appreciable reduction of illicit oil pollution at sea (Vauk *et al.* 1991). In the Netherlands, a ship which was actually circumnavigated by the coastguard aircraft during its illegal discharge did not react on radio calls but continued course and activity undisturbed, obviously unimpressed (Theo Kramer pers. comm.). On the other hand, most crude oil discharges in the Eastern North Sea in 1990-92 were recorded in an area where 'anti-pollution-aircraft' does not operate: off Northern Denmark (see 4.1; Dahlmann 1991b).

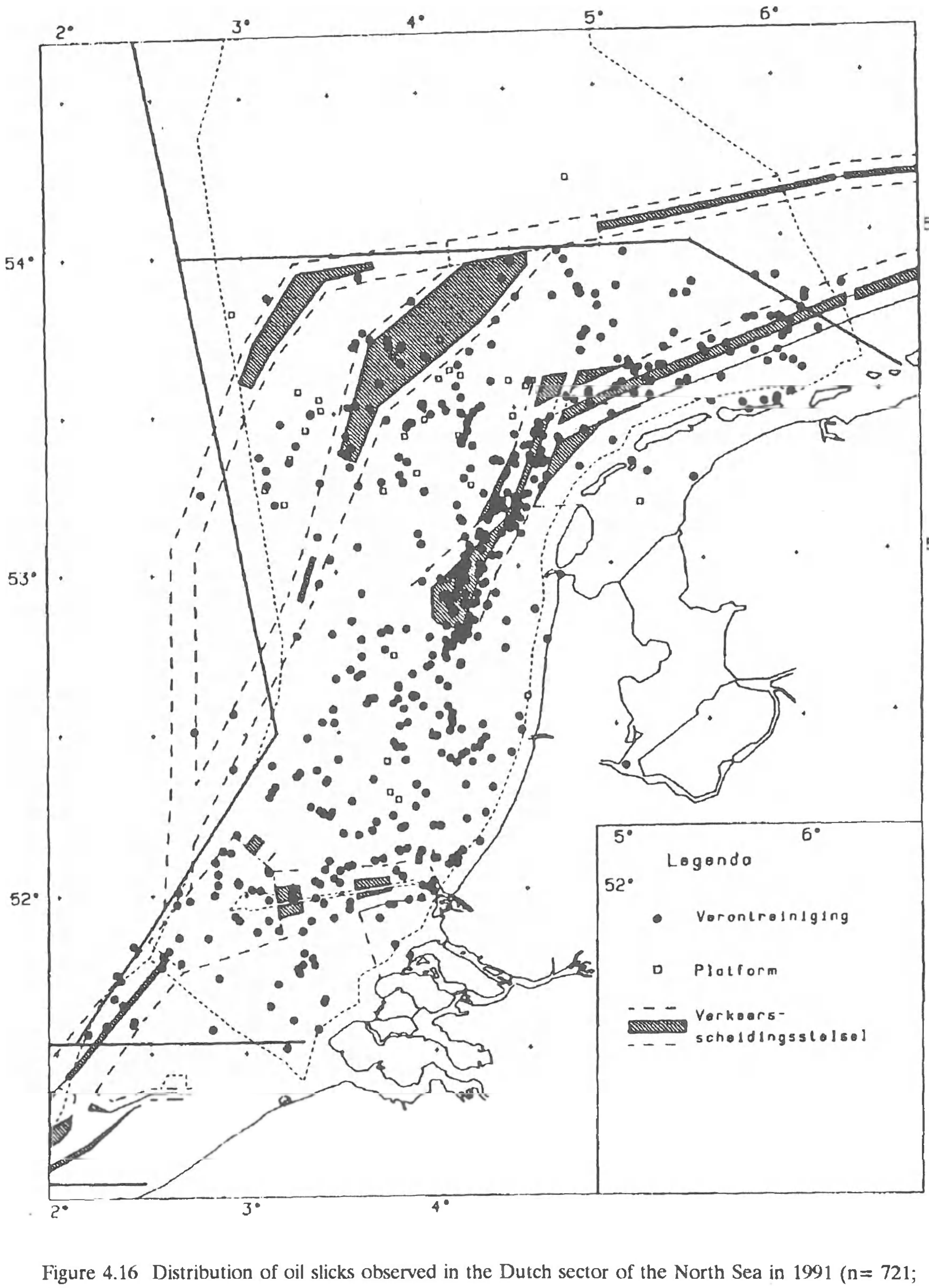


Figure 4.16 Distribution of oil slicks observed in the Dutch sector of the North Sea in 1991 (n= 721; Anonymous 1992).

Cost
The annual costs for the exploitation of an aircraft as used for the aerial surveillance in the Netherlands is some *f* 1,100,000 per annum (ECU 480,000). This is sufficient for 900 hours flight, including surveys for oil slicks, but also for other tasks. Costs for personnel that co-ordinate the programme, analyse data and disseminate results are not included in this budget.

Discussion
Aerial surveillance for oil slicks is important to study the distribution of oil slicks at sea and to detect vessels which are actually discharging oil at sea. The results would be considerably more valuable (but more expensive) if the surveys were coupled with routine sampling of oil. The source of oil slicks sighted at sea is now very often unknown. To study source and scale of oil pollution at sea, aerial surveys and beached bird surveys are complementary. BBS as a monitoring programme is continuously recording, while the aerial surveys 'sample' the situation on a given moment. The inability to observe oil slicks in strong winds from the air, despite remote sensing equipment, does bring quite a number of 'surprises' on the beach. A recent stranding of palm oil on the Dutch Waddensea islands illustrates this perfectly. With the source (a collission near Dover, 15 April 1992) perfectly known, the palm oil slick was lost during aerial surveys for several weeks, only to show up again on the beaches late April 1992. Several more severe cases of oil pollution on beaches were unexpected, even although aerial surveys had been performed (cf. Camphuysen 199b, Leopold & Camphuysen 1992). Systematic oil sampling coupled with BBS may even help to find sources (for instance trace the ship) of oil slicks that had been missed in the aerial surveillance. Moreover, with BBS not only source and scale are studied, but also the effect of oil and other substances on birds and beaches. When results of aerial surveys and BBS programmes are compared routinely, a much more complete picture will emerge of source, scale and effect of marine oil pollution.

Aerial surveys (AS) are restricted to relatively small areas, while BBS cover a much wider scale. While BBS results have a serious bias towards the winter, aerial surveys are biased towards summer (or less windy periods, which are more frequent in summer). Both BBS and AS are biased towards heavier oil types, but BBS coupled with systematic oil sampling will reduce this bias. From BBS, there is a much longer set of baseline data available (coastguard surveillance in The Netherlands using remote sensing equipment only since 1983) and considering the scale of the investigations, AS is relatively expensive, BBS relatively cheap. Very important, perhaps, is the risk that vessels may change their 'behaviour' and discharge oil when the change for detection is very small (holidays, weekend, windy periods). As long as the oil or oiled birds reach the shore, a BBS scheme will always detect these spillages. The conclusion should be, however, that AS and BBS are complementary rather than exclusive.

5. MONITORING SEABIRD MORTALITY BY SPECIAL INVESTIGATIONS

In mass strandings of seabirds, the usual reaction is a survey of the affected beaches and a count of corpses of the different species, while the birds are subsequently destroyed, buried, thrown away above the high water mark, or just left on the beach to disintegrate. In fact, this is a wasted opportunity, because so much more could be discovered from a rapid, but well-organized examination of each corpse (cf. Jones 1985). It is a misconception to believe that BBS alone can be used as a measure of (oil induced) seabird mortality. When monitoring seabird mortality, BBS results are only part of a larger jigsaw. Obviously, seabirds die for many reasons. Important factors are age, disease, adverse environmental conditions (low ambient temperatures, severe gales), food shortage, and pollutants. Information on numbers, sex, age, physical condition, and the cause of death of birds found beached are essential in relation to information on distribution and numbers at sea, trends in the breeding populations and recruitment into the breeding stock.

As was concluded earlier, the density of corpses on beaches is a very unstable figure in most species and most areas, which should be used with great care (chapter 6). Detailed investigations are required to identify causes of trends and fluctuations.

No doubt, investigations into these matters are extremely complicated. The BBS monitoring programme should provide evidence whether the beached birds were killed by oil or by (a combination of) other factors. Post-mortem oiling is one of the aspects which needs particular attention. The monitoring programme should provide as detailed as possible information on origin of the birds (in terms of subspecies, population or colony), sexratio, and age composition. These data, combined with information from breeding populations, should be used to provide information on the expected effect in (breeding) populations (cf. Mead & Baillie 1981). In this chapter a discussion of the goals, possibilities, and limitations of this sort of studies is given.

Sex and age

In any mortality incident, it is valuable to know the age distribution in the birds involved. A high proportion of juveniles or immatures is likely to be less damaging to the breeding stock than a high proportion of adults, for many of the immatures would have died anyway before recruitment into the breeding population (Jones 1985). In some years, almost all fledglings die soon after leaving the colonies due to adverse weather conditions (Halley 1992). Within species, the sexes and different age cohorts may have different wintering distributions. In some species, like in most wildfowl, sex and age are obvious and easily studied using plumage characteristics during waterfowl counts or migration studies. In other species, this is more difficult, since important plumage characteristics are only visible at very short range (divers, auks). Sexratio and age composition of stranded birds are usually relatively easy to assess. Again, in some species sex and age can be stated from the plumage (e.g. most wildfowl and waders, some auks; e.g. Prater *et al.* 1977, Sandee

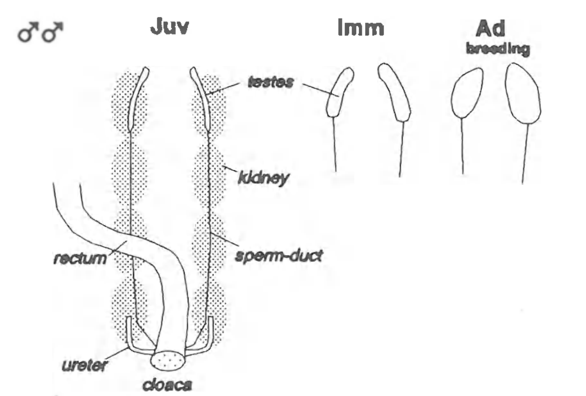


Figure 5.1 Ventral view of testes of immature and adult Guillemots (after Van Franeker 1983).

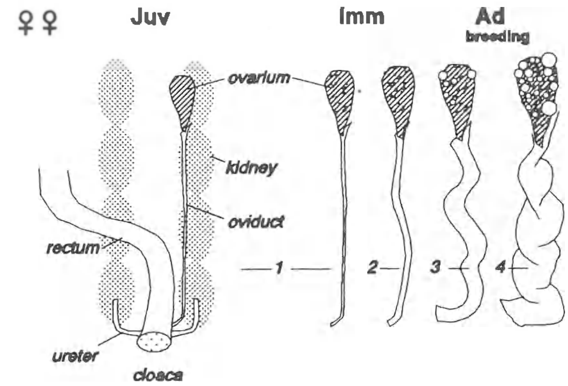


Figure 5.2 Development of oviduct and ovarium in female Guillemots, ventral view (after Van Franeker 1983).

1983, de Wijs 1985a). However, unexperienced observers make many mistakes, particularly during more complex exercises, like the ageing of auks using minor contrasts in upper wing coverts (Sandee 1983). Moreover, several species need to be dissected for ageing and sexing, to describe gonads and the presence of *bursa Fabricii* (divers, grebes, auks; e.g. Klima 1956, Chiba 1978, Anker-Nilssen & Røstad 1981, Jones *et al.* 1982ab, Jones 1985, Jones *et al.* 1985, van Franeker 1983, de Wijs 1983, Heubeck 1986, Harris *et al.* 1991). Thus, to obtain this sort of information, it is important that trained ornithologists examine substantial numbers of corpses in sufficient detail, by collecting specimens for dissections and using methods of ageing, sexing and dissecting which have been standardized all over Europe.

Examples of the results of sexing and ageing Guillemots *Uria aalge* during the 1980s in various parts of the North Sea are given in table 5.1. The results show that there is some segregation of the sexes, with females predominating in the Skagerrak area, and males in the Southern North Sea and off Brittany. At least in the Netherlands, these results are consistent from year to year, and the predominance of males was even found in the early 1920s (Verwey 1922). In Shetland, females were only predominating in samples of adults, while in immatures males were usually more numerous. The next finding is the enormous difference in age classes from case to case. In Shetland and Orkney, immatures predominated in 1985 and 1987 with 93.5% and 99.2% respectively (Heubeck *et al.* 1992). No doubt, there must have been a rather different situation as compared with the mass strandings in the islands in 1986 and 1990, when between 70 and 80% were adult birds. In the Southern North Sea, as expected from our knowledge of Guillemot migration, adults were comparatively numerous in autumn and early winter (e.g. 77.5% adults in Nov 1990; Camphuysen & Keijl 1990), while immatures more and more predominate later in the season (88.9% immatures in Apr 1985; Camphuysen 1990b, 71.1% immatures in Feb 1992; Leopold & Camphuysen 1992). In the oil incidents in the Skagerrak and Frierfjorden, virtually all Guillemots were immatures (Anker Nilssen & Røstad 1981, 1983).

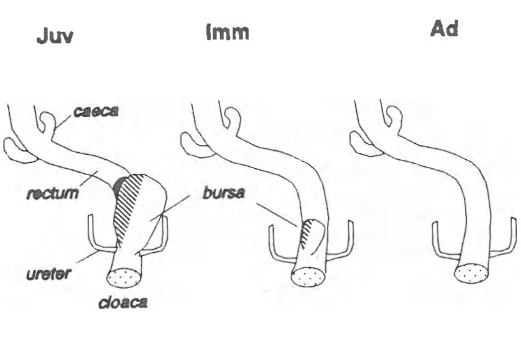


Figure 5.3 Bursa Fabricii as characteristic of age in auks (dorsal view; after Van Franeker 1983).

Table 5.1 Sex ratio (upper) and age (presence/absence *bursa Fabricii*) composition (lower table) of Guillemots *Uria aalge* from published reports around the North Sea.

Place	Season		% ♂♂	% ♀♀	n	Source
Skagerrak	Dec-Jan 1980/81		49.3	50.7	951	Anker-Nilssen & Røstad 1981
Frierfjorden	Dec-Jan 1982/83		29.0	71.0	31	Anker-Nilssen & Røstad 1983
Rogaland	winter 1989/90		43.5	56.5	69	Jacobsen *et al.* 1991a
Rogaland	winter 1990/91		34.7	65.3	98	Jacobsen *et al.* 1991b
Orkn. & Shetl.	Jan-Feb 1985		52.6	47.3	150	Heubeck *et al.* 1992
Shetland	Feb 1986		39.8	60.2	118	Heubeck *et al.* 1992
Orkn. & Shetl.	Oct 1987		56.1	43.9	114	Heubeck *et al.* 1992
Shetland	Dec 1990		44.0	56.0	141	Heubeck *et al.* 1992
East Britain	Feb 1983	ad	42.7	57.3	215	Jones *et al.* 1985
		imm	64.6	35.4	246	
Netherlands	Nov-Apr 1982/83		56.8	43.2	213	Camphuysen 1983
Netherlands	winter 1982-85		55.7	44.3	345	Camphuysen 1990b
Netherlands	Apr 1985		69.6	30.4	46	Camphuysen 1990b
Netherlands	Nov 1990		48.7	51.3	39	Camphuysen & Keijl 1990
Netherlands	Feb 1992		53.9	46.1	76	Leopold & Camphuysen 1992
Brittany	Mar 1978		51.6	48.4	124	Jones *et al.* 1982

Place	Season	%	+bursa	-bursa	n	Source
Skagerrak	Dec-Jan 1980/81		82.6	17.4	814	Anker-Nilssen & Røstad 1981
Frierfjorden	Dec-Jan 1982/83		93.8	6.2	32	Anker-Nilssen & Røstad 1983
Orkn. & Shetl.	Jan-Feb 1985		93.5	6.5	124	Heubeck *et al.* 1992
Shetland	Feb 1986		22.0	78.0	118	Heubeck *et al.* 1992
Orkn. & Shetl.	Oct 1987		99.2	0.8	126	Heubeck *et al.* 1992
Shetland	Dec 1990		28.7	71.3	136	Heubeck *et al.* 1992
East Britain	Feb 1983	♂♂	36.6	63.4	251	Jones *et al.* 1985
		♀♀	58.6	41.4	210	
Netherlands	Nov-Apr 1982/83		59.1	40.9	213	Camphuysen 1983
Netherlands	winter 1982-85		55.7	44.3	342	Camphuysen 1990b
Netherlands	Apr 1985		88.9	11.1	45	Camphuysen 1990b
Netherlands	Nov 1990		22.5	77.5	40	Camphuysen & Keijl 1990
Netherlands	Feb 1992		71.1	28.9	76	Leopold & Camphuysen 1992

Generally speaking, dissections are time consuming and thus relatively expensive. The sexing and ageing of birds, however, is a routine which need not take too much time. For field studies of sex and age, using external characteristics, as well as for dissections, specialists are needed. Manuals should be provided to standardize methods all over Europe. For the time being, the manuals written by Jones *et al.* (1982) and van Franeker (1983) should be used for sexing and ageing.

Physical condition and cause of death

Several studies have shown that there is a relation between the amount of oil on individual corpses and the condition of the bird when it died (van Franeker 1983, Camphuysen 1990b). Heavily oiled corpses were often birds in perfect condition (very fat), while most corpses with few oil specks were usually of severely emaciated birds. Apparently, first category birds were killed instantly and subsequently washed ashore, often together with the oil (e.g. Camphuysen 1990b, Leopold & Camphuysen 1992), while second category birds had struggled to death and oiling was perhaps the trigger factor or only an additional cause of death (Camphuysen 1989). Most notably in the early 1980s, very large numbers of slightly oiled, severely emaciated seabirds washed ashore (Camphuysen 1981a, van Franeker 1983, Underwood & Stowe 1984, Jones *et al.* 1984, Camphuysen 1989a, Heubeck 1991b, Heubeck *et al.* 1992). The poor condition of the birds caused suspicion that these 'wrecks' were caused by food shortages rather than by oil pollution alone. BBS showed increased densities of birds in most European countries, sometimes associated with a decline in oil rates (chapter 6). In other countries, more and more clean, very fat auks were found stranded. It appeared that drowning incidents in fish nets were responsible for the strandings. Again, densities on the beach rose, while oil rates fell markedly.

Information on the condition at the time of dying (as an indicator of the fact whether or not other causes of death may be involved) is clearly extremely valuable during the interpretation of BBS data. A mass stranding of severely emaciated, slightly oiled or unoiled juveniles following some storms is quite different from a stranding of heavily oiled, fat, ('healthy' but dead) birds following some discharge of oil offshore. Physical condition at the time of dying can easily be described after dissection (van Franeker 1983, Jones *et al.* 1984). The presence or absence of subcutaneous and abdominal fat, the state of the breast muscle are important parameters. To avoid time consuming and thus relatively expensive dissections, fat presence and muscle conditions are simply scored conform van Franeker (1983).

The assessment of the cause of death is more difficult. However, problems are most prominent when judging an individual corpse, while the cause of death in mass strandings is often rather obvious. In many occasions, only the proximate cause of death will be assessed but this may be sufficient to meet our goals. Important factors for (sudden) mass mortality are oil contamination, entanglements in fishing gear, starvation, and cold stress. It may often be difficult to prove that a certain cause of death was responsible for a mass stranding. However, circumstantial evidence will often be sufficient. For instance, when a large number of birds suffers from extreme temperatures ('cold stress'), the precize cause of death is practically irrelevant for the monitoring project studying oil pollution and oiled seabirds. The mere fact that densities rose in response to these weather conditions is enough for further interpretation of the data. If for instance a large number of clean birds is found, while dissections show that these birds were in perfect condition, apparently healthy, there is circumstantial evidence that these birds may either have been shot or have drowned in fishing gear.

Origin of the birds

Another problem is the link between beached birds and their native colonies: from where do the beached birds originate? The judgement on the origin of an individual (if not ringed) is difficult. In larger samples, biometric analysis of corpses may give rather good clues to their origin through various known morphological variations in the breeding populations (e.g. Jones 1985, Jones 1988). Also, in larger samples the number of ringed birds may be sufficient to draw conclusions (e.g. Mead 1978, Baillie & Mead 1982, Hudson & Mead 1984, de Wijs 1985b). Unfortunately, the sample size (the number of ringed birds from which the origin is known) is usually extremely small. To lump data from different years may be very misleading, since winter distribution may well change from year to year.

The geographical variation of (sea-) birds is a subject which has been studied in great detail (e.g. Salomonsen 1944, 1965, Bourne & Warham 1966, Kurotschkin 1970, de Wijs 1978, van Franeker 1978, Asbirk 1979, Ainley 1980, van Franeker & Wattel 1982, Sluys 1982, Jouventin & Viot 1985, Power & Ainley 1986, Carrera *et al.* 1987, Moen 1991). In most studies, races or subspecies are described using external features (e.g. biometrics, striping or colour). Within sub-populations, the frequency of occurrence of a certain colour phase (Fulmar *Fulmarus glacialis*, skuas; Southern 1943, van Franeker 1978, van Franeker & Wattel 1982, Furness 1987), or a bridled morph (Guillemot; Brun 1970, Birkhead 1984) were assessed. The geographical variation has also been studied in considerably greater detail, by means of DNA studies or electrophorese (e.g. Barrowclough & Zink 1981, Jacob & Hoerschelmann 1982, Jouventin & Viot 1985, van Ginkel 1990).

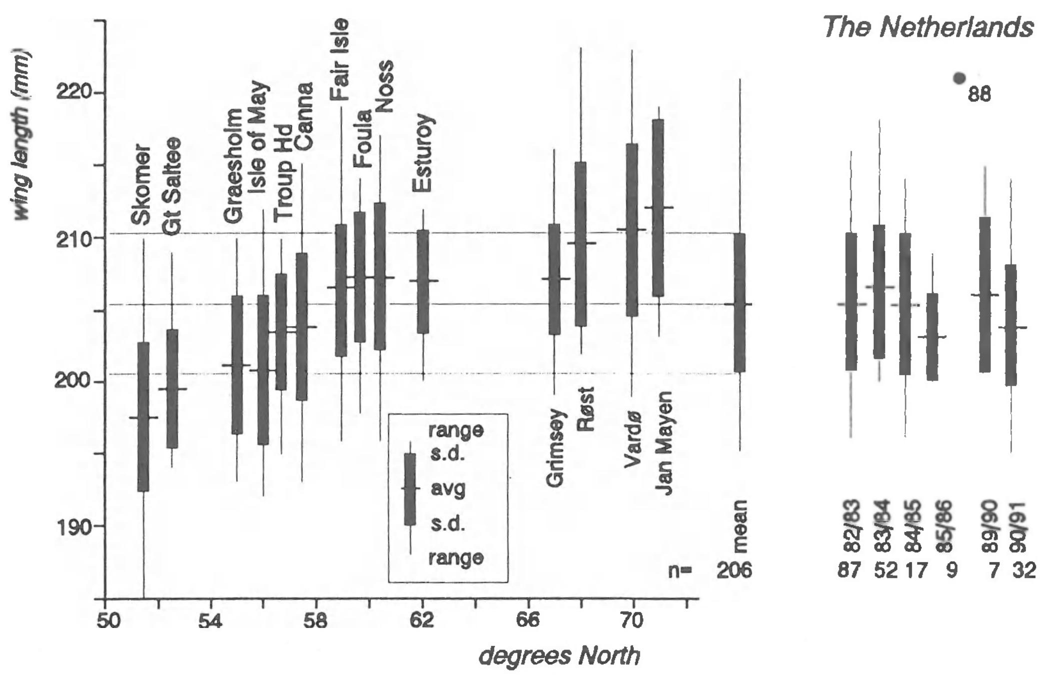


Figure 5.4 Mean wing-lengths of 14 samples of adult Guillemots at different latitudes in NW Europe (cf. Jones 1988), and wing-lengths of adult Guillemots beached in the Netherlands.

Biometrics have often been used to assess from which population or race a particularSmit & Wymenga 1989, Vandenbulcke 1989, Jones 1990, Wymenga *et al.* 1990, Harris *et al.* 1991, Heubeck & Suddaby 1991). Biometrics have also been used to age and sex birds (Dunnet & Anderson 1961, Croxall 1982, Coulson *et al.* 1983, Smith 1988, Koopman 1990). Inaccuracies have been experienced when comparing results of different persons (Barrett *et al.* 1989) or even of the same person in different excersises (Jones 1985) and not all species have a clear division in subspecies or a cline in measurements over its range (e.g. Gannet *Sula bassana*).

In several species there are genuine clines in body size, wing-length, bill-length or -height, or relative frequency of colour phase or bridled morph (Sluys 1982, van Franeker & Wattel 1982, Birkhead 1984, Moen 1991), irrespective of subspecies. Jones (1988) produced a cline of wing-lenghts of Guillemots in NW Europe. He showed, from adult Guillemots measured in Ireland, Britain, the Faroe islands, Graesholm (Denmark), Grimsey (Iceland), Røst and Vardø (Norway), that wing-length increases northwards with increasing latitude (figure 5.4). Later published data from Jan Mayen fitted perfectly well in the cline (Camphuysen 1990d). This sort of information can be used to compare with biometrics from beached auks, to try and find from what geographical area the birds may originate. In figure 5.4, adult Guillemots found dead in the Netherlands are added. The conclusion could be drawn that from wing-length data, Guillemots beached in the Netherlands most probably originate from Scottish colonies. However, from wing-lengths alone, the presence of Guillemots from Færøerne and from Iceland is possible.

Table 5.2 Wing length (average, standard deviations) of beached adult Guillemots *Uria aalge* around the North Sea.

Place	Season		avg	s.d.	n	Source
Skagerrak	Dec-Jan 1980/81	♂♂	206.4	4.0	68	Anker-Nilssen *et al.* 1988
		♀♀	208.4	5.3	73	
Shetland	Feb 1986	♂♂	207.1	4.4	35	Heubeck 1986
		♀♀	209.5	3.8	56	
Buchan, Scotland	Mar 1983		205.1	4.3	193	Jones 1985
Moray Firth	Feb 1983		205.9	5.2	43	Jones 1985
NE England	Feb 1983		205.4	4.8	71	Jones 1985
East Anglia	Feb 1983		204.4	4.6	101	Jones 1985
Netherlands	winter 1982/83		205.5	4.4	87	NZG/NSO unpublished data
Netherlands	winter 1983/84		206.6	4.2	52	NZG/NSO unpublished data
Netherlands	winter 1984/85		205.5	4.4	17	NZG/NSO unpublished data
Netherlands	winter 1985/86		203.3	2.5	9	NZG/NSO unpublished data
Netherlands	winter 1989/90		206.1	4.9	7	NZG/NSO unpublished data
Netherlands	winter 1990/91		203.9	3.9	32	NZG/NSO unpublished data

Interestingly, when listing a number of published measurements of adult Guillemots collected on beaches around the North Sea, the overall means and standard deviations are very similar indeed (table 5.2) and there is little or no fluctuation between years. Obviously, from these measurements, North Sea Guillemots (in the 1980s) originate from the same 'pool', apparently mainly from Scottish colonies, which is supported by recoveries of ringed birds recovered in the Netherlands in the 1980s (figure 5.5). Indeed, arctic Guillemots are usually labelled as rarities (e.g. Voous 1948, Camphuysen 1989d). From ringing recoveries it is known that Faeroese birds mainly

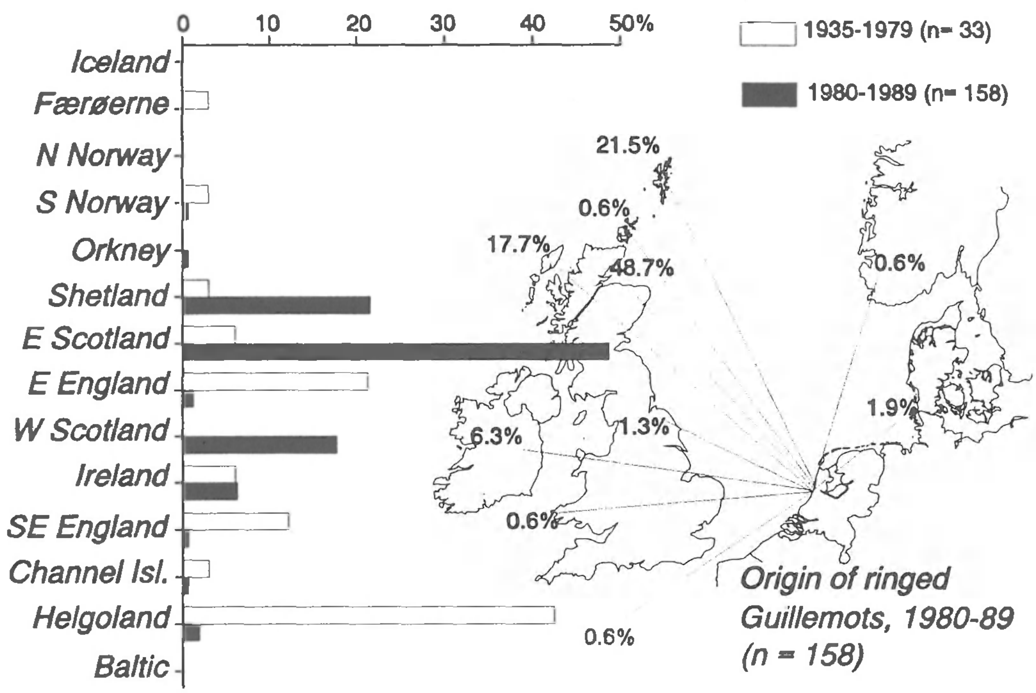


Figure 5.5 Origin of ringed Guillemots *Uria aalge*, reported to the Dutch Ringing Centre, during 1935-79 and 1980-89 (data Vogeltrekstation, Heteren).

winter off West Norway (Olsen 1982). Most Guillemots breeding in the Irish Sea area are known to disperse towards the Channel, west coast France and Bay of Biscay (Baillie 1982).

Ringed birds are a very important source of information. If the birds were ringed as chick in the colony, not only the origin of the bird is known, but also its age. The number of recoveries of ringed birds is, despite all efforts to ring as many birds as possible, very small. Moreover, only accessible colonies are regularly visited for ringing, while others have never been included in the ringing scheme. As a result, only a small minority of the beached birds is ringed and only during mass strandings a sufficiently large sample can be studied.

Recoveries of ringed Guillemots and Razorbills *Alca torda* were used to investigate the effects of the severe oil pollution over much of NW Europe in winter 1980-81 on British and Irish auks populations (Baillie & Mead 1982). Major concentrations of oiled recoveries occurred in the Skagerrak, Netherlands and SW Britain, between December 1980 and March 1981. The recoveries in the Skagerrak all occurred in a short period in late December and early January. Mortality in the SE North Sea and the South coast of England was, in contrast, spread over the whole winter, suggesting that the recoveries resulted from chronic pollution from a variety of sources in each area, rather than from one large spillage. These findings were totally in line with descriptions of the mortality in the Skagerrak (caused by a spillage of the Greek tanker Stylis; Anker-Nilssen & Røstad 1981) and the Netherlands (Camphuysen 1981a). Detailed analysis of the recoveries allowed the calculation of the size of population change for Guillemots and Razorbills, assuming constant monthly survival and no compensation for the observed mortality. The expected change in British colonies was -3.97% for first year Guillemots, -0.35% for immatures, and -0.58% for adults. The loss of adult Razorbills was expected to lead to a population change of something inbetween 3.43% and 5.59%. However, the analysis of the recoveries also led to the conclusion that other, unidentified, European breeding populations of auks must have suffered increased mortality during the winter 1980-81, as recoveries indicated that birds of British origin were insufficient to account for the numbers found dead on European beaches. The example shows the valuable possibilities of analysis of ringing recoveries, but at the same time that such an exercise is not necessarily conclusive. A combination of efforts, to assess the origin of the beached birds by using ringing recoveries ánd biometrics, is therefore recommended.

Detailed examination of corpses

In order to collect the maximum information in the shortest time and at lowest cost, a technique had to be evolved for the rapid examination of corpses. Jones *et al.* (1982) and Jones (1985) have constructed a manual for the dissection of auks, mainly based on their work at the Amoco Cadiz in 1978 (Jones *et al.* 1982b) and the Stylis incident in the Skagerrak area in 1981 (Anker-Nilssen & Røstad 1981). The system has been adopted and applied for other seabird species in the Netherlands (van Franeker 1983), and subsequently in other North Sea countries. Jones (1985) has listed the published, worldwide, examinations of auks. In the North Sea, auks are the most numerous species washing ashore. Since his publication, many more papers were published in which details of examinations of auks were given (table 5.3). The new list indicates the strong interest in the topic, and the numerous locations involved. The range of examinations included in table 5.3 is sex and age (mainly through dissection), weight and/or fat contents, origin of the birds (biometrics, rings, identification of races), toxic chemicals involved in the observed mortality (chemical analysis of tissues), other obvious causes of death (drowning in nets, entanglements, others), and diet. The last issue is relatively new and cannot be applied in all cases. However, stomach content analysis of birds collected in the oil incident in the Skagerrak in 1981 (Blake 1983), of birds drowned in nets in the Skagerrak in the 1980s (Durinck *et al.* 1991), and of birds washing ashore following some very severe cases of pollution (Camphuysen 1990b, Camphuysen *et al.* 1990, Leopold & Camphuysen 1992), proved to be very informative. Jones (1985) concluded that so far, people involved in BBS have been very slow in capitalising on knowledge from an obvious source of study material. We can now conclude that there has been a change in attitude in this respect and will discuss in this chapter what sort of information is collected, and for what reasons this information is crucial in a monitoring project for oiled seabirds.

Table 5.3 Summary of published examinations (age, sex, weight/fat, origin, toxic chemicals, cause of death diet) of Guillemot (*Uria*) and Razorbill (*Alca*) in mortality incidents in Europe (after Jones 1985, modified and completed).

Species		Examination for							Location	Source
Uria	*Alca*	age	sex	wgt	org	tox	cse	diet		
x	x	x	x	-	-	-	-	-	Netherlands	Verwey 1922
x	-	-	-	-	x	-	-	-	Netherlands	Voous 1948
x	-	-	-	-	x	-	-	-	Yorkshire, UK	Mather 1966
x	x	x	-	-	x	-	-	-	SW Britain	Bourne 1967
x	x	x	-	-	x	-	-	-	NE England	Parrack 1967
x	x	-	x	x	-	-	x	-	Cornwall, UK	Beer 1968
x	x	-	-	-	x	-	-	-	Scotland	Bourne 1968
x	-	-	-	-	x	-	-	-	UK	Bourne 1969
x	-	x	-	x	x	x	x	-	Irish Sea	Holdgate 1970
x	-	x	-	-	x	-	-	-	N Wales	Jones 1970
x	-	-	-	-	x	-	-	-	Merioneth, UK	Jones 1971
-	x	-	-	x	-	x	x	-	Irish Sea	Lloyd 1974
x	x	x	-	-	x	-	-	-	German Baltic	Lambert 1977
x	x	-	-	-	-	x	x	-	Helgoland	Vauk 1978
x	x	x	-	x	-	-	x	-	Ireland	Whilde 1979
x	x	x	x	-	x	-	-	-	Skagerrak	Anker-Nillsen *et. al.* 1981
x	-	x	-	-	x	-	-	-	Netherlands	Camphuysen 1981b
x	x	x	-	-	-	-	-	-	Germany	Kuschert *et. al.* 1981
x	-	-	-	-	x	-	-	-	Yorkshire, UK	Stowe 1982a
x	x	x	x	-	x	-	-	-	Brittany	Jones *et. al.* 1982
x	x	-	-	-	-	-	-	x	Skagerrak	Blake 1983
x	-	x	x	x	x	-	-	-	Frierfjorden	Anker-Nilssen *et. al.* 1983
x	-	x	x	x	x	-	-	-	Devon, UK	Jones *et. al.* 1983
x	x	x	x	x	x	-	x	-	Netherlands	van Franeker 1983
x	x	-	-	x	-	-	-	x	E Britain	Jones *et. al.* 1984
x	x	-	-	-	-	-	-	x	E Britain	Blake 1984
x	x	-	-	-	x	-	-	-	E Britain	Hudson & Mead 1984
x	x	x	x	-	x	-	-	-	E Britain	Jones *et. al.* 1985
x	-	x	x	x	x	-	-	-	Shetland	Heubeck 1986
x	-	-	-	x	x	-	-	-	Netherlands	Camphuysen 1989b
x	-	x	x	-	-	-	-	x	Netherlands	Camphuysen 1990b
x	-	x	x	-	-	-	-	x	Netherlands	Camphuysen *et. al.* 1990
-	x	x	-	x	-	-	-	-	Netherlands	Camphuysen 1990c
-	x	-	-	-	x	-	-	-	UK	Jones 1990
x	x	x	-	-	x	-	-	-	NE Scotland	Bourne 1990ab
x	-	x	x	x	-	-	-	x	Skagerrak	Durinck *et. al.* 1991
x	x	x	x	x	-	-	-	x	Rogaland	Jacobsen *et. al.* 1991a
x	-	x	x	-	-	-	-	-	Rogaland	Jacobsen *et. al.* 1991b
x	x	x	x	-	-	-	-	-	Orkn. & Shetland	Heubeck *et. al.* 1992
x	x	x	x	x	-	-	-	x	Netherlands	Leopold *et. al.* 1992

Seabirds at sea, outside the breeding season

Fluctuations in densities on the beach largely follow fluctuations in abundance at sea. Most obvious is this effect in severe winter conditions, when large numbers of waterfowl leave fresh water reservoirs, lakes and rivers and enter the coastal zone (e.g. Verwey 1956, van Dijk 1980, Chandler 1981, Elkins 1983, Keijl & Mostert 1988). Massive mortality has often been observed in these cases (Dacker 1948, Bub & Henneberg 1954, Slominski 1959, Piechocki 1964, Schoennagel 1980, Raevel 1985, Leopold *et al.* 1986, Camphuysen & Derks 1989, Meininger *et al.* 1991). Less obvious, but nonetheless very important, are changes or temporary shifts in the wintering distribution of seaduck and pelagic seabirds from year to year. Seabird distribution in the North Sea has only been studied systematically since the late 1970s (Blake *et al.* 1984, Tasker *et al.* 1987). These studies have led to 'vulnerability atlasses', in which certain areas are identified to hold more vulnerable concentrations of seabirds than others or in publications in which areas were identified which deserved special protection (Danielsen *et al.* 1986, Tasker & Pienkowski 1987, Tasker *et al.* 1990, Webb *et al.* 1990, Bergman *et al.* 1991). At least since the early 1970s, waterfowl distribution in European coastal waters became better known (Joensen 1974, Atkinson-Willes 1978, Baptist & Meininger 1984, Laursen 1989, Nilsson 1990, Platteeuw 1990, Offringa 1991). Recent studies of seabirds at sea were often in great detail (e.g. Joiris 1983, Tasker *et al.* 1985, 1986, Webb *et al.* 1985, Leopold 1987, 1988, Webb & Tasker 1988, Skov *et al.* 1989, Follestad 1990, Leopold 1991), but failed to produce a clear picture of changing distribution between years. These changes from year to year are very important during the interpretation of mass strandings of seabirds. The mass strandings of pelagic seabirds in the Southern North Sea and the increase in drowning incidents of auks in Swedish fish nets, were both explained by shifts in the wintering distribution of these species towards the Southern North Sea and the Skagerrak respectively. Much larger numbers became at risk to become oil contaminated in the first, or to drown in the latter area. For a proper understanding of the backgrounds and effects of seabird mortality, BBS needs complementary data on seabird distribution from offshore or coastal observations. BBS organisers should therefore promote such programmes and co-ordinated activities.

Seabird populations

In strictly biological terms, oil-induced seabird mortality is significant only when it has some impact on the population (cf. Clark 1984, Dunnet 1987). Since many factors contribute to the level of seabird populations, this is notoriously difficult to monitor. In the early 1980s, there was a wide believe that the mortality caused by oil had no effect whatsoever on the North Sea seabird populations, which were indead thriving. In fact, the success of the North Sea seabirds had been caused by an overwhelming food supply in the 1970s. Unfortunately, information on seabird distribution at sea in the 1970s in the North Sea is very incomplete. Apparently, wintering seabirds were concentrated in the Northwestern North Sea. When the availability of food changed in the early 1980s, wintering distributions changed, and many more seabirds entered the Southern and Eastern North Sea. Scarcity of food, or reduced availability of food fish, led to massive seabird wrecks, which, in the Southern North Sea, were exacerbated by the very high levels of chronic oil pollution in these waters. Densities on beaches increased dramatically, and reductions in the recruitment into the breeding stock of several seabird colonies led to the believe that the oil-assisted seabird wrecks affected population levels. British seabird populations levelled off in the early 1980s (Lloyd *et al.* 1991), or even declined, often despite a consistently good breeding success. Several more serious oil-incidents have led to crashes in local (wintering or breeding) seabird populations. Chronic oil pollution induced mortality was considered at relatively low level (Dunnet 1987). However, the hundreds of thousands of seabirds which were killed in the 1980s and early 1990s in the English Channel, in the Southern and Eastern North Sea, were not killed in oil incidents, but because of a very high level of chronic oil pollution in these waters. The extra mortality in these years has most certainly contributed to the stand-still of growth in North Sea seabird populations. Whether the current population level of North Sea seabirds is natural or an artefact caused by human influences on fish stocks, remains an open, and here irrelevant question. Oil-induced seabird mortality must be considered seriously when seabird populations decline as a result of unfavourable conditions in the breeding season or in winter. The success of a seabird, for whatever reason, should not be a reason to play down any obvious threats. Hence, information on numbers of birds killed by oil should be used in combination with information on seabird populations: numbers of breeding birds, wintering concentrations, and distribution and abundance of seabirds at sea. In most discussions on the significance of oil-induced seabird mortality in the early 1980s, BBS information of the early 1980s (massive wrecks) were compared with population data of the late 1970s (rapid increase). It is important to realize that numbers and distribution are factors which constantly change. Thus, BBS information in a particular year should not be compared with population data of older origin.

Survival of seabirds and recruitment into the breeding population

Age at first breeding and the mean annual survival rates of juveniles, immature and adults are different per species (Dunnet *et al.* 1990). On average, Fulmars breed for the first time at an age of 9.2 years, Gannets at an age of 4 to 5 years, Guillemots between 3 and 7 years, and Common Scoters *Melanitta nigra* between 2 and 3 years. Adults of these four species have a mean annual survival rate of 97%, 94%, 94%, and 77% respectively. Seabirds with a mean annual survival rate of over 90% would have an overall mean lifespan of up to 35 years (Dunnet *et al.* 1990). With delayed maturity, large numbers of seabirds are in the non-, or rather pre-breeding component of the population. Obviously, extra mortality within the pre-breeding component of a population will not be measureable within the (expected) population in the summer following the incident, but in later years. Moreover, the large numbers of birds found oiled may constitute only a small porportion of the expected natural mortality, and the recruitment of new breeders into the breeding stock from the large reservoir of pre-breeding birds make it difficult to assess the (local or regional) consequences of even large winter mortality incidents caused by oil pollution. However, during the 1980s, several Scottish Guillemot colonies in which a very good breeding success was found, suffered from reduced recruitment into the breeding stock (Swann *et al.* 1989, Harris & Bailey 1992). These changes appeared to be linked with fish abundance, or the availability of fish in the North Sea which, as discussed earlier, led to shifts in the wintering distribution and eventually to increased mortality in winter (Camphuysen 1990a, Harris & Bailey 1992). When the origin of beached birds is known, regular contacts with biologists studying the colonies or areas from which the casualties are thought to originate, might result into information on recruitment into the breeding stock, breeding success and population trends, to monitor the effect of winter mortality more directly.

Diet studies

Information on seabird diets outside the breeding season is still very scant. For multi-species models of the North Sea ecosystem the information on top-predator consumption is urgently required. Therefore, all possible means to increase current knowledge should be considered seriously. Obviously, the best information is obtained when seabirds are collected at sea during foraging. However, practical and ethical reasons prohibit such sampling programmes. In BBS, most beached birds have been ill for quite a while, are emaciated or may have had atypical feeding habits for other reasons. However, serious oil incidents were found to 'surprise' healthy seabirds, killing them almost instantly, and to provide most valuable samples of birds (Blake 1983, Camphuysen 1990b, Camphuysen & Keijl 1990, Leopold & Camphuysen 1992). Similarly, samples of birds drowned in fish nets provide a lot of information on diets (Durinck *et al.* 1991). Therefore, when mass strandings of heavily oiled seabirds occur, corpses should be checked rapidly to assess the condition of the birds when hit by the oil. If birds prove to be fat, a substantial sample should be taken to examine stomach contents. It is important to note that analysis and identification of stomach contents is specialist's work which will require special training.

Conclusions

A rapid, but detailed and well organized examination of corpses is strongly recommended, for a better understanding and interpretation of seabird strandings. Important parameters are: sex, age, condition, and biometrics, while notes have to be made on any obvious causes of death. When possible (that is when the birds were clearly in good condition when killed), stomach contents should be collected for identification. The current standard for sexing is inspection and description of the gonads, while birds may be aged by inspection of cloacal bursa and/or by external characteristics. Condition can easily be scored by ranking subcutaneous and abdominal fat on a four-point scale (Jones *et al.* 1982a, van Franeker 1983). Biometric data that have to be collected are different for each species. Lists of preferred measurements have to be made up. For the identification of stomach contents, a lot of experience and a reference collection of otoliths and other slow digestible parts are required. To standardize and stimulate this sort of research, training courses may have to be organized.

The data collected during these 'special investigations', should be exchanged with biologists studying seabird colonies and/or seabird distribution at sea. When information on breeding and wintering 'performance' are routinely coupled with strandings data, a much better picture of factors leading to seabird mortality will emerge.

Recommendations for further research

BBS should be coupled with systematic sampling of corpses of target species, to assess age and sexcomposition of the beached birds. The origin of the birds should be studied using all possible means and stomach contents will have to be analysed if appropriate. Next to the BBS monitoring programme, it is important to collect data on seabird distribution at sea, preferably focussing on time trends and shifts in distribution. Besides counts in colonies and the assessment of breeding success, it would be valuable if more information on recruitment into the breeding stock could be obtained. Ringing programmes, which are now limited to a certain number of areas, should be stimulated.

6. BEACHED BIRD SURVEYS: OBJECTIVES AND METHODS

Beached Bird Surveys (BBS) are organized in many North Sea countries (see chapter 9). To avoid confusion, it is important to explain and describe abbreviations and terms used for different national and international beached bird surveys in some detail. The following terms will be used:

Beached Bird Surveys (BBS)

Counts of birds on beaches are called *beached bird surveys* (BBS). In some countries, methods of these surveys are well described (e.g. Stowe 1982, Camphuysen 1989), in others methods are sometimes less well defined. However, BBS methods ar roughly the same in most countries (counts of corpses on stretches of beach, notes on oil in feathers), but the planning of these surveys is quite different. Some countries have surveys strictly each month, each two months, or once a year, other have surveys not planned at all.

National Beached Bird Survey (NBBS)

In the Netherlands and in Belgium, late-winter surveys were organized in February or March in some form of co-operation as early as 1965 (Anonymous 1965, Tjallingii 1966, Kuyken & Zegers 1968). It was attempted to cover as many kilometres as possible on one weekend. These *National Beached Bird Surveys* (NBBS) have been organized in many more countries since 1972, when the Royal Society for the Protection of Birds (RSPB) set up an international programme, named:

International Beached Bird Survey (IBBS)

In the *International Beached Bird Survey* (IBBS), many countries participate (Stowe 1982, Skov et al. 1989). The IBBS is organized annually on the last weekend of February or the first weekend of March. All participating countries do a NBBS of which the data are sent to the co-ordinating body of the IBBS (formerly the RSPB,

England; nowadays Ornis Consult, Denmark). The IBBS produces no more (or less) than numbers found per species, numbers oiled (%-oiled), and observer effort (to calculate densities). The IBBS may be considered sufficient if only a general impression of regional differences in numbers of stranded (oiled) seabirds is required. However, IBBS is subject to severe interpretation problems mainly because it is only a single measurement within a year and therefore subject to strong variability resulting from short term effects of wind, temperature, local oil incidents and other facors.

European Beached Bird Survey (EBBS)
A *European Beached Bird Survey* (EBBS) scheme, in which the (February) IBBS is included and continued, should extend the exchange of data to at least the complete winter season. Participants are asked to produce monthly, or bi-monthly indices of seabird strandings, either from their entire coastline, or from study plots. Moreover, EBBS is designed in a way so that marine oil pollution can be monitored more properly (including oil sampling and chemical analysis) and it is aimed to monitor seabird mortality rather than just seabird strandings (including additional, detailed investigations). It is important to realize that EBBS does not yet exist, but is proposed in this report, while BBS, NBBS, and IBBS are currently running schemes.

6.1 Objectives of Beached Bird Surveys

Traditionally, BBS aimed at attracting attention for the occurrence of oil pollution at sea and its effect on birdlife. There was no need for a more detailed identification of goals. Gradually, however, BBS have gained wider application, became more professional, and finally attracted political attention with associated funding. This required a clear identification of goals and methods to achieve these goals. Objectives and methods of BBS have been discussed at international workshops in Rijswijk (Apr 1991), Copenhagen (Nov/Dec 1991) and Glasgow (Mar 1992; Appendices A-C). Descriptions of methods of field work in this report are based on what is known from publications and these international meetings. Obviously, before considering a new international monitoring programme, clear objectives and standard methods needed to be developed focussing on the specific questions arising from earlier work.

The occurrence of stranded, oiled seabirds on beaches and specific and regional differences herein are studied in beached bird surveys. BBS are not needed to prove that seabirds and oil don't mix. However, BBS are mainly used as a demonstration of ongoing oil-induced mortality, and as an illustration of the human abuse of the marine environment. Traditionally, objectives of BBS were formulated as (e.g. Stowe 1982):

- Monitoring seabird mortality as reflected by the occurrence of dead birds on beaches;
- Monitoring the frequency of oiled birds on beaches;
- Assessing the role of oil pollution in seabird mortality/strandings;
- Assessing the biological impact of oil spills/incidents;

The ability to quote at least the minimum number killed by oil in certain oil incidents or by chronic oil pollution, and especially the identification of time trends, is very useful when exerting political pressure. The first two objectives, i.e. counts of corpses and the assessment of oil rates, are thus clearly important. The last two objectives have attracted most criticism (e.g. Rijswijk workshop April 1991; Camphuysen & van Franeker 1991). To assess the role of oil pollution in seabird mortality or the impact on seabird populations, more detailed investigations are required. Beached bird surveys alone are an insufficient tool to meet these requirements.
A future BBS monitoring programme, depending on its goals, may require the collection of additional data, to assess relative contributions of different mortality factors. The identification of the cause of death, or more generally of a common

factor behind mass strandings, is therefore important. The objective can be formulated as:

- Assessing the relative contribution of oil induced mortality among seabirds and its impact on seabird populations

BBS results have shown that measures under OILPOL or MARPOL were inappropriate, or at least ineffective with respect to oil induced seabird mortality (e.g. Brouwer 1953, Tanis & Mörzer Bruijns 1962, Joensen 1972ab, Vauk & Pierstorff 1973, Joensen & Hansen 1977, Andrews & Standring 1979, Vauk & Reineking 1980, Camphuysen 1989, Skov et al. 1989 and others). Oil rates remained very high in most countries. On the other hand, BBS results have shown what positive effects certain measures can have in reducing the amount of oil discharged at sea (chapter 6.1). Oil rates rose following the opening of oil terminals in Orkney and Shetland, but dropped again when visiting tankers were effectively discouraged to discharge bilge oil before entering the terminals. More explicitly than in the past, one of the main objectives of a future monitoring programme should be:

- Measuring the effect of government policies aimed at a reduction of marine oil pollution

The sources of marine oil pollution are, globally, rather well known (NRC 1985, Anonymous 1990). The major environmental impact of maritime transport of oil arises from operational and accidental pollution from ships (in all 568,800 tonnes per annum; Anonymous 1990). However, accidents at sea account for a relatively small part of marine oil pollution (121,000 tonnes per annum), even although quantities of oil spilled in certain incidents are massive. Tanker operations (158,600 tonnes per annum) and operational discharges of bilges and fuel oils (252,600 tonnes per annum) are considerably more important sources. Within the North Sea, operational discharges of oil by ships and offshore installations, illegal under MARPOL 73/78, result in many thousands of oil slicks each year (Koops 1980), often called 'chronic' oil pollution. In recent years, despite the enforcement of MARPOL 73/78 since 1983, the number of slicks found during aerial surveys has not declined (Kramer 1991). Non-mineral oils and chemicals, operational discharges of which are often legal under MARPOL 73/78, have also led to substantial pollution on beaches and significant seabird mortality (Newman & Pollock 1973, Anonymous 1975, Swennen 1977, McKelvey et al. 1980, Smith & Herunter 1989, Bommelé 1991, Timm & Dahlmann 1991, Zoun 1991, Zoun & Boshuizen 1991, Zoun et al. 1991). The scale of this type of marine pollution is currently virtually unknown.

Combined German, Danish and Dutch studies have demonstrated that within an area like the North Sea, rather large regional differences in oil types occur (Dahlmann & Timm 1991, Dahlmann in litt.). Crude oils occurred relatively often on Northern Danish beaches and were virtually absent in Germany and the Netherlands. Obviously, the standard list of sources of oil pollution is not strictly valid for all sea areas. Hence, standard measures to reduce oil pollution may not be effective in certain areas, even if they work in others! It appeared that systematic oil sampling, coupled with BBS, to identify types of oil or other (lipohifilic) substances on corpses and on the beach, revealed new information which is otherwise unavailable (Dahlmann & Hartwig 1984, Dahlmann 1985, 1987, Dahlmann & Timm 1991). This sort of research is crucial to reveal the impact of non-mineral oils and other lipohilic substances. More generally, it is important to assess the scale, sources and impact of this sort of marine pollution and to study trends in relative importance if new measures are introduced. Therefore, within a BBS monitoring programme, an important goal should also be:

- Identification of types of oil and/or other (lipophilic) substances leading to seabird mortality or pollution of beaches

To summarize, objectives for a future beached bird monitoring programme may be:

(1) Monitoring the occurrence of dead seabirds on beaches
(2) Monitoring the frequency of oiled birds on beaches
(3) Measuring the effect of government policies aimed at a reduction of marine oil pollution
(4) Assessing the scale of oil induced seabird mortality and the impact on seabird populations
(5) Identification of types of oil and/or other (lipophilic) substances leading to seabird mortality or pollution of beaches

The remainder of this chapter discusses methods of beached bird surveys, in the light of these objectives. Agreements on BBS methods, meant to be used within the IBBS, were made on the Copenhagen workshop in Nov/Dec 1991. During this workshop, and again in Glasgow in March 1992, standards were set for data collection and data exchange for the IBBS in 1992 and 1993. Most of these standards can readily be adopted in a European Beached Bird Survey (EBBS) monitoring programme. Some activities, e.g. dissections and systematic sampling, have not yet been fully standardized. In these cases, proposals are put forward here, to be discussed and agreed upon on the next international meeting.

6.2 BBS methods

The descriptions of BBS methods now following are mainly based on long running BBS schemes. National schemes will always be slightly different from each other. However, as long as national co-ordinators are able to stick to their own methods or to adopt the methods of their predecessor over years, results can be easily compared. Since we are working with volunteers, even within nations it may be difficult to get all surveys done in precisely the way we want. If such data are used, for whatever reason, this should be clearly indicated and explained in the publication or in the notes accompanying the dataset sent to the central database. If possible, however, methods should be changed to meet the proposals below. If methods are changed and when a re-assessment of old data is impossible, one should be very careful with comparisons and at least one paper in an well known (accessible) periodical should explain what has happened. It should be realized that the methods described below focus on the data which have to be collected in an international database. National schemes may be considerably more comprehensive.

Subregions

Within the IBBS, numbers, oil rates and densities were usually presented per country, regardless where and how many kilometres were surveyed. Also if sub-units were chosen (Normandy, East Britain, Shetland), the borders were rather arbitrarily assessed. A suggestion for 'fixed routes' was considered valuable, but impractical. Working with volunteers requires some flexibility with respect to where these people want to go. During the Copenhagen workshop on standardizing methods for IBBS purposes, a proposal to designate subregions, was adopted. In this proposal, the total coastline of a country should be divided in a number of subregions. Of these subregions, a substantial proportion should be surveyed to produce a figure which is considered reliable (representative). The subregions should be some sort of unit, designated on the basis of exposition (allowing correction for wind factors) and accessibility, its total length (km) should be known (figure 6.1). The subregions should be designated once and for all, taking into consideration a possible re-analysis of older data. It was suggested and agreed upon that each country should designate, dependent on its size, 5-10 subregions. Coast length should be assessed for each subregion, while wind parameters of at least 1 month before the survey should be added when sending the data of the national survey. A (brief) description of the type of coast should be made and stored for reference in the IBBS/EBBS database (cliff, boulders, pebbles, dike, sandy beach, estuaries, ...). IBBS/EBBS data should be presented for these subregions rather than for countries. It should be tried to 'sample' these subregions properly. The reliability of the survey will partly depend on the proportion of that sector that has been surveyed. The subdivision into subregions rather than in countries, will considerably increase the possibilities for data analysis in the IBBS or in an EBBS scheme as compared to older survey types.

Study areas

For the EBBS monitoring programme, certain study areas will be selected out of the subregions. Within study areas, surveys are conducted by experienced ornithologists. Surveys in study areas may include 'special investigations' (detailed notes on plumages and moult of the birds, on state of the corpse, samples of oil from beaches and corpses, samples of birds for dissections; see chapter 7). Statistical anlysis of BBS results will be mainly based on surveys in study areas. The study areas are the hard core of the future monitoring programme. To check whether or not densities and oil rates in study areas are representative for the surrounding coastal areas, surveys by volunteers may be organized in the other subregions. In these areas, following the present situation, only numbers of stranded birds and oil rates are assessed.

In chapter 11, a European study area network is proposed. For the North Sea area, being the first priority area in the proposed EBBS programme, this network could include 10 study areas (figure 6.2). The study areas are rather different. To compare densities in an archipelago like Shetland or Orkney, where corpses concentrate on small strips of sandy beach, with densities on the mainland coast, where corpses spread out over vast lengths of sandy beach, may seem difficult. However, if study areas are maintained over years, seasonal patterns and time trends can be compared easily. For each study area, routes should preferably be fixed. This is especially true for surveys in archipelagos or in heavily indented coastlines like in Norway. On lengthy (sandy) beaches, study areas may be 'sampled' (surveys on a

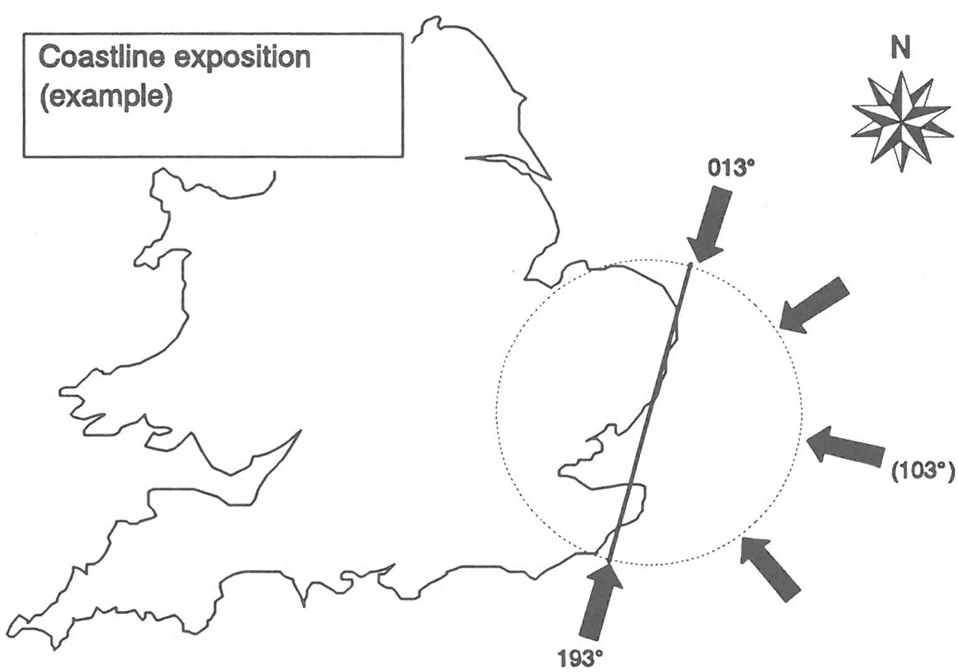


Figure 6.1 Example of assessing coastline exposition of subregions.

representative part of the coast), if local anomalies are well understood and considered. Generally, following the calculations of Raevel (1992b), at least 50 or 60% of the areas should be studied in a given month.

Timing of surveys

Corpses wash ashore and disappear again. Reasons for disappearance are not only disintegration of the corpse but include scavenging by birds or mammals, burying under sand and debris, washing away at high tide, and actions of humans (skull collectors, hunters, tourists, sanitary and technical department of coastal towns (Alexandersen & Lamberg 1971, Jones 1980, Sheridan & Pamart 1988, Camphuysen 1989, Raevel 1992c). On average corpses disappear from the beach in 3-4 weeks time (Camphuysen 1989). The EBBS scheme should at least produce monthly indices for numbers of birds stranded in study areas. Experiments are recommended, to assess the number of birds which is missed in monthly visits.

In most countries, surveys in summer are meaningless. Beaches are visited by large number of tourists in summer and are frequently cleaned of debris and dead birds. Moreover, seabirds are concentrated near the breeding colonies. Higher ambient temperatures make seabirds less vulnerable to oil pollution, and corpses that do wash ashore disintegrate rapidly. Therefore, surveys are recommended between November and April, with a general look-out for oil incidents and mass strandings in summer (May-October).

Recording beached birds

All corpses found on the beach, including non-seabirds and (marine) mammals are recorded and identified as to species or down to the smallest possible taxon (e.g. diver species, Razorbill/Guillemot). Data transfer to international database (IBBS/EBBS alike) will contain:

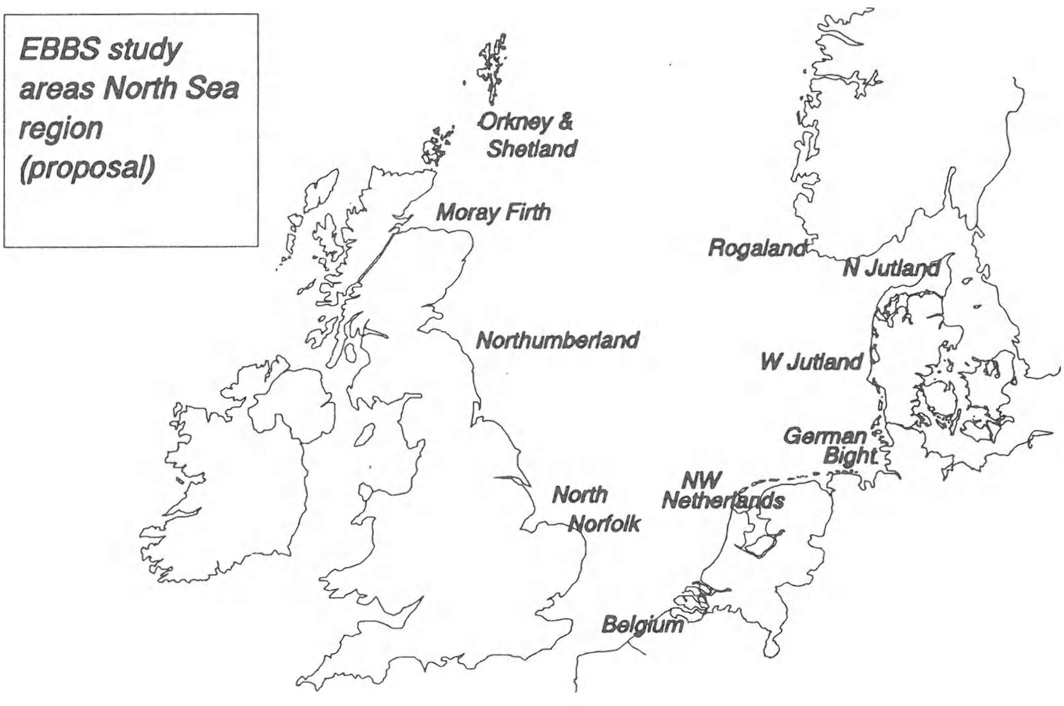


Figure 6.2 Proposed study area network in the North Sea.

per survey: date, place
kilometres surveyd (effort),
reliability of survey,
species found, and
per species: number found,
number oiled,
number unoiled

Oiled or unoiled seabirds
Birds are considered 'oiled' when any fatty substance on the feathers has clearly damaged or disrupted the plumage. Within IBBS, we will not go any further than this, within EBBS, systematic sampling is required. When calculating the proportion of oiled birds (%-oiled) from BBS results, it is important to agree on what an 'oiled bird' actually is. Every single corpse should be checked for the presence of oil in its feathers. The possible outcome is (a) yes, oil, (b) no oil seen, (c) unknown. Possibilities (a) and (b) apply only to a complete corpse, possibility (c) applies to remains of corpses with crucial bits missing. As a result, for all species the proportion oiled can be calculated:

$$\frac{\sum(a)}{\sum(a)+\sum(b)} * 100 = \textit{proportion oiled}\ (\%)$$

The sample is virtually always considerably smaller than the total number found stranded, but it is accepted as a measure for all birds found.

Reliability
New will be the assessment of the reliability of the sample taken in each subregion. The national co-ordinator will be asked to (arbitrarily) assess the reliability on the basis of several, obvious factors: unusual weather conditions prior to the surveys, insufficient coverage, small sample size, inexperienced observer, etcetera. At the same time it should be indicated if all or part of the survey is considered unreliable. Results of surveys which have been considered unreliable, or in which part of the survey failed to produce satisfactory results will be left out during standard analysis of the data, but may function as background information.

Avoiding double counts
Double counts may be avoided by removing the corpses (e.g. Stowe 1982), or by marking (e.g. Camphuysen 1989). In Belgium, people have been marking corpses with paint (Verboven 1978), but for practical reasons other marks are preferred. In the Netherlands, the tips of the primaries are clipped and this mark is considered very useful. When it has to be decided whether to remove or rather mark corpses, it should be considered how counts are organized. When study areas are 'sampled' (proportion of total coastline surveyed), the visited stretches may not always be quite the same. In order to be able to compare recently visited stretches from stretches which have not been surveyed for several months, the turnover of corpses can be assessed by marking (and re-recording) the corpses (Camphuysen 1989).

Target species
Within a EBBS monitoring programme, qualified, experienced people will do surveys in study areas. They will gather information on plumage (age, sex, colour phase) and moult as a routine, on other (obvious) causes of death and they will sample corpses for dissection (age, sex, diet, biometrics where appropriate, condition, other causes of death). Within EBBS, it may therefore be necessary to select certain groups or species

for special investigations. These 'target species' should not only include species which are particularly vulnerable for oil pollution, but also other. This selection, listed below, is certainly not 'strict', and may be changed when circumstances require a different approach. From currently available base-line data, it appears that the species listed here are most numerous as beached birds and most valuable as indicators of marine oil pollution in different areas. The following groups/species are selected:

Species of the coastal zone

divers
- Red-throated Diver *Gavia stellata*

grebes
- Great Crested Grebe *Podiceps cristatus*

seaduck
- Long-tailed Duck *Clangula hyemalis*
- Eider *Somateria mollissima*
- scoters *Melanitta nigra/fusca*
- Larus-gulls
- Black-headed Gull *Larus ridibundus*
- Common Gull *Larus canus*
- Herring Gull *Larus argentatus*
- Lesser Black-backed Gull *Larus fuscus*
- Great Black-backed Gull *Larus marinus*

Pelagic seabirds

petrels
- Fulmar *Fulmarus glacialis*

Kittiwake *Rissa tridactyla*

auks
- Guillemot *Uria aalge*
- Razorbill *Alca torda*
- Puffin *Fratercula arctica*
- Little Auk *Alle alle*

Species which are usually rather rare during beached bird surveys in most countries, but which play a more prominent role in certain oil incidents and which require particular attention in such cases are: Great Northern Diver *Gavia immer*, Black-throated Diver *Gavia arctica*, Red-necked Grebe *Podiceps grisegena*, Shag *Phalacrocorax aristotelis*, and Black Guillemot *Cepphus grylle* (all coastal zone).

Oil on the beach

Recorded will be the presence of clearly visible oil on beaches. Within IBBS, the presence will be indicated roughly as yes, no or unknown, while if a beach is oiled, the proportion oiled is assessed, as % of surveyed length. Within EBBS, beach oiling in study areas should be carefully described (notes have to be made as to whether the oil seems to be fresh or not (just washed up or present as old residues high on the beach), and sampled.

Oil sampling

Of oiled corpses (or rather from corpses with 'any' substance in the feathers which is clearly disturbing the structure of the feathers), some contaminated feathers are collected using a clean pair of scissors. The feathers are kept in a clean glass jar, labelled, and sent to the laboratory by the national co-ordinators. Samples have to be taken (in principle) of every corpse with a disrupted plumage. If numbers of corpses are too large to allow such an approach, every second or third (or whatever is appropriate) corpse should be sampled as a routine. Also, contaminated stretches of beach will be sampled for chemical analysis. The details for methods of sampling are currently being discussed by a group of national co-ordinators and experts in this type of work.

Chemical analysis of oil samples

Preferably, the analysis of samples in any international Beached Bird Survey should be carried out in one specialized institution. Intercallibration between institutions is strongly recommended to provide consistent results between countries or laboratories. Methods and equipment for analysis as described here are according to the standard at the Bundesamt für Seeschiffart und Hydrographie (BSH) in Hamburg (Dahlmann 1991b). Samples may be analyzed by UV-Fluorescence spectroscopy and capillary gas chromatography. In addition, gas chromatography/mass spectrometry coupling may be used in difficult cases or to actually prove similarity between samples (table 6.6).

Other data

The standard set of BBS data for a given month (i.e. number of birds, proportion oiled, proportion surveyed, reliability) should preferably be accompanied by a standard set of meteorological data such as frequency of onshore winds and days with (mean) temperatures below zero. Onshore winds are winds within a 180° section around the exposition of the subregion (i.e. 180-360° if the exposition is west (270°), 013-193° if it is 103°, as in figure 6.1). Wind should be measured at a station near the coast. The frequency should be given as the number of days in percents for the 30 day period prior to the survey, but split into:

number of days with: onshore breeze (0-3B)
onshore wind (4-7B)
onshore storms (≥ 8B)
offshore breeze (0-3B)
offshore wind (4-7B)
offshore storms (≥ 8B)

If the survey was spread over an interval of days, wind data should deal with the 30 day period before the first survey date, while any peculiarity during the survey interval should be clearly indicated in the notes. All these data are presented in the heading of a standard data (transfer) form, including:

Name / number of subregion
Country
Date / Month / Year
Name and address of national co-ordinator
Kilometer surveyed and proportion surveyed of total coast lenght
Reliability of survey result
Reference (file) number(s) in national database (if any)
Note on methods (corpses removed or marked, counts on foot or by car)
Frequency of onshore/offshore wind (0-3B) (%), (4-7B) (%), (≥8B) (%)
Number of cold days prior to surveys (n / 30 days period)
Approximate temperature during surveys (°C)
Oil on the beach (% of total coast lenght surveyed)
Number of beach oil samples taken (n)
Number of feather oil samples taken (n)
Total number of birds found (n; only including seabirds, waterfowl and waders)
Total number of birds oiled (%)
Number of birds oiled, unoiled or unknown (species level)
Notes

Table 6.6 Instrumental conditions for analysis of oil samples from beaches and beached birds. BSH analysis in the Danish-German-Dutch project, 1990-92 (after Dahlmann 1991b).

Sample preparation	Dissolution of the oil samples in n-hexane, slight addition of dichloromethane (to dissolve the more polar components)
Oil concentrations	3-4 µg/µl
UV-Fluorescence	synchronous spectra 25 nm wavelength difference
Gas chromatographic conditions	
Instrument	Hewlett-Packard 5890
Column	capillary, fused silica, 5% phenyl-silicone
Internal diameter	0.25 mm
Column length	8 m
Initial temperature	50 °C (1 min)
First rate	20 °C/min up to 90 °C
Second rate	15 °C
Final temperature	300 °C
Carrier gas	He 5 ml/min
GC/MS conditions	
Instrument	(1) Hewlett-Packard 5985, (2) VG-Tribrid
Column	capillary, fused silica, 5% phenyl-silicone
Column length	25 m
Initial temperature	50 °C (1 min)
First rate	10 °C/min up to 150 °C
Second rate	5 °C/min
Final temperature	300 °C
Carrier gas	He 2 ml/min

Discussion of methods

Following these methods, considering the objectives summarized earlier, a BBS monitoring programme would provide the following information:

Per subregion:	Number of stranded birds Species composition Proportion oiled Occurrence of oil on beaches Effect of wind and temperature on densities or oil rates
Per study area:	Number of stranded birds Species composition Sex and age composition Proportion oiled Occurrence of oil on beaches Occurrence of other (lipophilic) substances on beaches Frequency of oil types on corpses or on the beach Frequency of other substances on corpses or on the beach Other causes of death Effect of wind and temperature on densities or oil rates

To return to the objectives of BBS as defined in chapter 6.1, objectives 1, 2, and 5 are fulfilled by a simple presentation of data. To assess the scale of oil induced seabird mortality and the impact on seabird populations (objective 4), these data need further evaluation and other information is required (recruitment in colonies, survival, distribution at sea, breeding success, etcetera). Obviously, it will often be impossible to find all relevant data and to produce a conclusive summary. It is therefore recommended to perform detailed analyses only in certain special cases (mass strandings or studies of a particular (target) species), not as a routine.

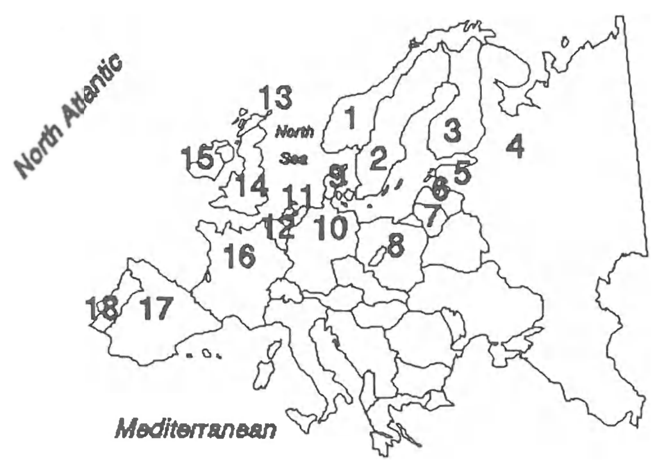
One of the more important, and new objectives is to measure the effect of government policies aimed at a reduction of marine oil pollution (objective 3). To meet this goal, baseline data are compared with recent trends. Regional differences and time trends are evaluated in an annual report. It is expected that effective measures to reduce oil pollution lead to a reduction in oil rates on beaches and stranded seabirds. There are, however, other reasons why oil rates can change (chapter 6.1). The consistency of trends have to be tested over different countries (or study areas), and in time. The set of data which is collected following the proposal above can be considered adequate to look systematically for explanations of trends, whether caused by changes in marine oil pollution or otherwise.

7. BEACHED BIRD SURVEYS IN EUROPE: CURRENT STATUS AND BIBLIOGRAPHIES

Beached bird surveys have been carried out for several decades in many West European countries, but particularly since the late 1960s. In response to large wreckages of oil tankers, like the *Torrey Canyon* (1967) and the *Amoco Cadiz* (1978), people were motivated to search for oiled seabirds and report their results. Comprehensive reviews and many papers have been published on a national basis, but a more or less complete list of publications is not available. In fact, for some countries it is very unclear what has happened during the last decades. For each country, brief descriptions of current activities and contact addresses were mainly based on two questionnaires, distributed during workshops in Rijswijk in April 1991 and in Glasgow in March 1992. The list of references on beached bird surveys in Europe was compiled using the NZG/NSO database and lists, kindly submitted by Francisco Arcos (Spain), Christiane Averbeck (Germany), Dr Bill Bourne (Scotland, UK), Jan Durinck (Denmark), José Pedro Granadeiro (Portugal), Martin Heubeck (Shetland, UK), Alexey Kurochkin (Latvia), Włodzimierz Meissner (Poland), Eduard R. Osieck (Netherlands), Pascal Raevel (France), Dr Jane Sears (UK), Kolbjørn Skipnes (Norway), and Henrik Skov (Denmark). For the Baltic states, since so little information is available anyway, some recent papers on waterfowl surveys are included in the list.

Obviously, this list is subject to changes every year. In order to keep informed, updates will be prepared every now and then. Updates can only be made if all national co-ordinators are prepared to check the relevant parts of the current status reports and bibliographies for errors or ommissions and to contact the Netherlands' national co-ordinator on changes and/or additions.

7.1 Norway
7.2 Sweden
7.3 Finland
7.4 Russia
7.5 Estonia
7.6 Latvia
7.7 Lithuania
7.8 Poland
7.9 Denmark and Færøerne
7.10 Germany
7.11 Netherlands
7.12 Belgium
7.13 Orkney & Shetland
7.14 British mainland and Northern Ireland
7.15 Ireland
7.16 France
7.17 Spain
7.18 Portugal
7.19 Reports of the International Beached Bird Survey
7.20 General papers: oil pollution and marine birds



7.1 Norway

Norways enormous coastline is washed by the Barents Sea in the far north, the North Atlantic or rather the Norwegian Sea in the West, the North Sea in the Southwest and the Skagerrak in the Southeast. The coastline is heavily indented, often with complicated archipelagos and many areas are unsuitable for beached bird surveys. Activities related to stranded seabirds and oil pollution in Norway were mainly opportunistic, in response to certain incidents. Examples are reports on a mass stranding in Northern Norway (Barrett 1979), on the Stylis incident in 1981 in the Skagerrak (e.g. Anker-Nilssen & Røstad 1981a, Anker-Nilssen *et al.* 1988), or, more recently, the wreckage of the tanker Arisan near the Runde bird cliffs (Skjelstad 1992). Interesting was a special issue of Vår Fuglefauna, published in 1982 (vol 5, nr. 2), on oil pollution and oiled seabirds (e.g. Barrett 1982abc, Byrkjedal, Eldøy & Jacobsen 1982, Røv 1982). Considerable commotion and concern was associated with the Ekofisk Bravo blow-out in the Norwegian North Sea in 1977 (references listed separately). Routine surveys of beached birds are seriously hampered by either a lack of beaches, or a lack of stranded birds. Norway only participated in the International Beached Bird Survey of 1980 (Stowe 1982). A more extensive beached bird survey scheme was established in Rogaland, SW Norway (figure 7.1), in 1982, with weekly surveys of 27 km of beaches, scattered over 195 km of coastline, between November and March (will be Nov-Apr in future; Skipnes in litt.). Rogaland participated in the IBBS since 1987 (including a beach near Lista in Vest-Agder; figure 7.1). Several papers were published on activities here (e.g. Jacobsen 1987a, Jacobsen, Låtun & Skipnes 1991ab). Oil is considered an important factor in seabird mortality in these waters, with oil rates varying between 23 and 40% during 1983-90 (Skipness in litt.). Drowning in nets is an important factor in some areas. There is keen interest in Norway for the EBBS monitoring programme, as it was proposed in workshops in Rijswijk, Copenhagen, and Glasgow. The Rogaland scheme will probably join in unchanged (including

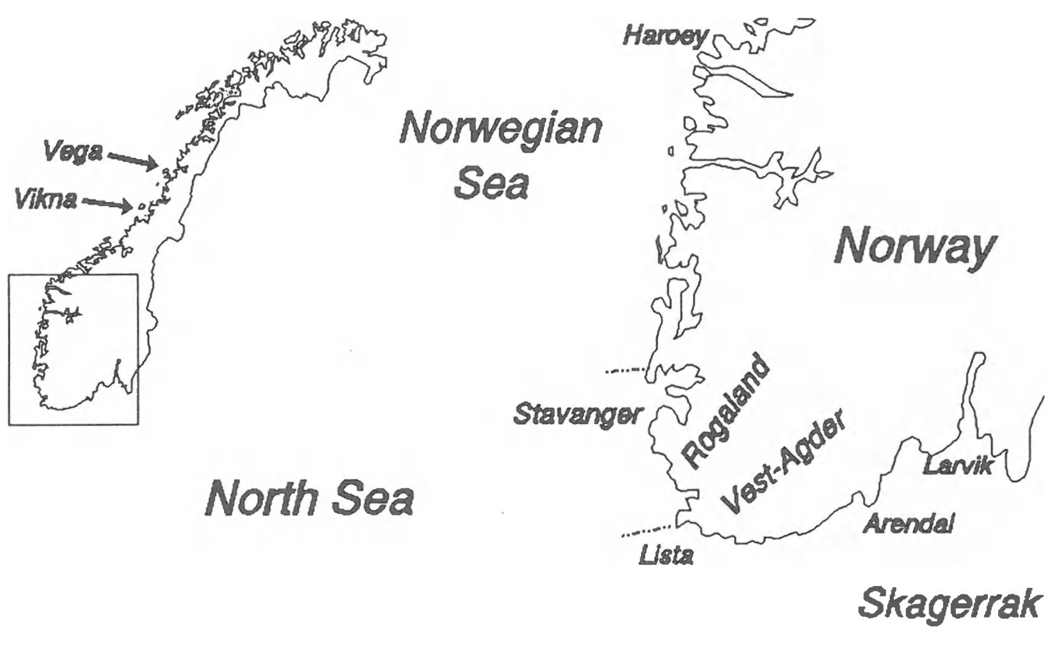


Figure 7.1 South west coast of Norway, showing Rogaland, Lista (Vest-Agder) and other place names mentioned in the text.

surveys at Lista). But when the EBBS will be started, Norwegian surveys may be extended to the Skagerrak area (Arendal to Larvik, 17 km of beach out of 100 km coastline), Haroey (10/10 km), Vikna (10/50) and Vega (10/25 km; figure 7.1).

Addresses Rogaland surveys: Kolbjørn Skipnes, Stavanger Museum, N-4005 Stavanger, Norway.
West coast Norway: Arne Follestad, Directorate for Nature Management, Tungasletta 2, N-7004 Trondheim, Norway.

Anker-Nilssen T., Jones P.H. & Røstad O.W. 1988. Age, sex and origins of auks (Alcidae) killed in the Skagerrak oiling incident of January 1981. Seabird 11: 28-46.
Anker-Nilssen T. & Røstad O.W. 1981a. Undersøkelser av oljeskadede sjøfugler i forbindelse med oljekatastrofen i Skagerak desember 1980/januar 1981. Viltrapport 16: 1-41. *[In Norwegian - English summary; Report of detailed investigations following the mass mortality amongst auks as a result from the spill caused by the Greek tanker MV Stylis in the Skagerrak in December 1980. Most numerous were Guillemot (60%), Little Auk (12.5%), Eider (11%), and Razorbill (9.5%). Some 1500 corpses were collected and brought to the Zoology Museum in Oslo, of which 756 auks were dissected in co-operation with the Scottish seabirds at sea team. Methods of dissections are carefully described. Data on age, sex, plumage, and origin (rings) of the auks are presented in this report. - CJC]*
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——— 1982b. Sjøfuglkatastrofen i Varanger-fjorden - en forklaring og vurdering. Vår Fuglefauna 5(2): 100-102.
——— 1982c. "Tusenvis av sjøfugl går mot en sikker død" - overskrift i bladet "Nordlys" 6. april 1982. Vår Fuglefauna 5(2): 103-104.

Some Norwegian key words

Død	Dead (død(e) fugl(er) = dead bird(s))
Dødelighet	Mortality
Foreløpig	Preliminary
Forekomst	Occurence
Fugl(er)	Bird(s) (sjøfugl = seabird)
Høsten	Autumn
Ilanddrevne sjøfugler	Beached seabirds
Katastrofe(r)	Disaster(s)
Kyst	Coast (Norskekysten = Norwegian coast)
Olje	Oil (oljeskadet = oiled; oljeskadede sjøfugler = oiled seabirds; oljeutslepp = oilspill)
Område	Area
Registrere	Record
Telling	Count, survey
Ulykke	Accident
Undersøkelse	Research, study, investigation
Utblåsing	Blow out
Vinteren	Winter

Barrett R.T. & Vader W. 1984. The Status and Conservation of Breeding Seabirds in Norway. *In* J.P. Croxall., P.G.H. Evans & R.W. Schreiber, Status and Conservation of the World's Seabirds. ICBP Techn. Publ. 2: 323-333. International Council for Bird Preservation, Cambridge. *[In English; Brief description of Norwegian oil drilling activities and the potential threat to breeding seabirds in Norway - CJC]*
Blake B.F. 1983. A comparative study of the diet of auks killed during an oil incident in the Skagerrak in January 1981. J. Zool., London 201: 1-12. *[In English; Comprehensive report of stomach contents of Guillemots, Razorbills, and Little Auks killed in the Stylis-incident in winter 1980/81. Diets consisted mainly of fish, including Two-spotted Goby* Gobiusculus flavescens, *Crystal goby* Crystallogobius linearis, *Sprat* Sprattus sprattus, *Poor Cod* Trisopterus minutus, *and sandeels* Ammodytes *spp. as most common species. Invertebrates were rather rare - CJC]*
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——— 1982. Oljeskader på sjøfugl. Korleis kan problemet handterast?. *In* S. Myrberget, Negative Faktorer for Sjøfugl, NKV's Møte Høvikodden 1981. Viltrapport 21: 57-64.
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——— 1981. Ilanddrivne sjøfuglar 1981. Rallus 11(2): 40-41.
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——— 1982. Death of the Mute Swan in Norway. Fauna 35(1): 36-39.
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Hanssen O.J. 1982. Impact on the local breeding population of Common Eider, Red-breasted Merganser and Black Guillemot in the Østfold Archipelago after an Oil spill 1978 (I). *In* S. Myrberget, Negative Faktorer for Sjøfugl, NKV's Møte Høvikodden 1981. Viltrapport 21: 51-55.
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——— 1985. Mengden av oljeskadd fugl på Jæren vinteren 84/85. Falco 14: 61-65.
——— 1986. Undersøkelsen av oljeskadd sjøfugl vinteren 85/86. Falco 15: 156-158.
——— 1987a. Forekomst av oljeskadde fugler langs Jaerkysten 1982-1986. Vår Fuglefauna 10(1): 19-24. *[In Norwegian - English summary; Report on the BBS on the coast of Rogaland. Between week 44 and week 10, beaches are visited weekly. Guillemot and Little Auk were most numerous, while high numbers of Eider in 1982 were probably caused by mass infection by Acanthocephala that year. Of auks, many birds were starved to death rather than oiled. Passing ships rather than offshore oil industry have been responsible for oil pollution off SW Norway - CJC]*
——— 1987b. Undersøkelser av oljeskadd sjøfugl på Jæren vinteren 1986-87. Falco 16: 63-65.
——— 1988. Forekomst av ilanddrevne, døde sjøfugl langs Jærstrendene vinteren 1987/88. Vår Fuglefauna 11(3): 151-152.
——— 1989. Undersøkelser av oljeskadde sjøfugler på Jæren vinteren 1988-89. Falco 18: 74-75.
Jacobsen E., Låtun O. & Skipnes K. 1991a. Undersøkelser av ilanddrevne sjøfugler i Rogaland vinteren 1989/90. Vår Fuglefauna 14(2): 69-75. *[In Norwegian - English summary; Results of BBS in Rogaland in winter 1989/90, compared with results during 1983/84-1988/89. Results are presented in 7 tables and 3 diagrams, including results of dissections (fat contents, stomach contents, sex, and age). The most numerous species were Guillemot, Little Auk, Razorbill, Puffin, Fulmar, Eider, and Kittiwake. Female Guillemots predominated in samples of adult birds, while most auks were severely emaciated - CJC]*
——— 1991b. Undersøkelse av døde sjøfugler vinteren 1990/91. Falco 20: 80-83. *[In Norwegian - No English summary; Report of surveys in Rogaland (Stavanger - Lista) in winter 1990/91. In all, 1360 birds found dead of which 13.1% oiled. Oil rate varied during 1983/84-1989/90 between 23 and 40% (avg. 29.5% oiled). Exceptional number of Little Auks (641, 47% of all birds found). Substantial numbers of Puffins, Guillemots and Little Auks were sexed and aged during dissections, details are presented in tables - CJC]*
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——— 1981b. Sjøfuglulykken i ytre Oslofjord desember 1980-januar 1981. Naturvernsinspektøren for Sør-Norge. Situasjonsrapport 12.1.1981, Oslo. Mimeogr. 8 p.
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——— 1988. Ilanddrevne sjøfugler på Tromøy vinteren 1987/88. Fylkesmannen i Aust-Agder, miljøvernavdelingen. Rapport 12, 6 p.
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Ree V. 1975. Søppel og olje langs strendene på Utsira i Rogaland, høsten 1974. Fauna 28(4): 185-195.
Røv N. 1982. Olje og sjøfugl på Helgelandskysten 1981. Vår Fuglefauna 5(2): 91-95.
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——— 1982. Dødsårsaker hos noen sjøfuglarter som vist ved ringmerkingsgjenfunn. *In* S. Myrberget, Negative Faktorer for Sjøfugl, NKV's Møte Høvikodden 1981. Viltrapport 21: 31-35. *[In Norwegian - English summary; Most ringing recoveries of Cormorant, Shag, and auks in Norway show that the majority was either shot or drowned in fishing gear. Very few were 'found dead', and even fewer were oiled. Mortality caused by fishing nets showed a rising trend - CJC]*
Skjelstad H.B. 1992. Marerittet ved Geitmaren. Vår Fuglefaune 15(1): 5-7. *[In Norwegian - No English summary; Early report of the wreckage of the tanker 'Arisan', just 1 km off the seabird cliffs or Runde, Norway. Some 2000-2500 birds were reported dead at the time of publication - CJC]*
Spikkeland O.K. 1983. Undersøkelse av ilanddrevne sjøfugler. Larus marinus 12(2): 96-98.
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——— 1986. Ilanddrevne sjøfugler på Tromøy, Aust-Agder vinteren 1985/86. Fylkesmannen i Aust-Agder, miljøvernavdelingen. Rapport 16, 8 p.
——— 1990. Olje-sjøfugl 1989/90!. Larus marinus 19(1): 92-94.
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Vader W. 1990. Why has the Common Guillemot *Uria aalge* decreased in Norway? Pelagicus 5: 17-22.

Ekofisk Bravo blow-out (Norwegian North Sea, 1977)

On 22 April 1977, an uncontrolled blow-out occurred at the *Bravo* production platform in the *Ekofisk*-field in the Norwegian sector of the North Sea (56°33'N, 03°12'E). Oil mixed with about 30% of gas, of a temperature of 75 °C, was discharged from a well head 20m above sea level and was, because of the high pressure, forced another 30m up in the air before spraying over the platform and the sea surface. Some 3-4000 tonnes of oil and gas were released per day. Because of the high temperature and because the oil was sprayed into the air, about 40% of the oil evaporated before reaching the sea surface. When capping operations succeeded 7.5 days after the start of the blow-out, it was estimated that a total quantity of 9000 tonnes of curde oil covered an area of over 3000 km²: 6000 tonnes covering surface waters, while the rest was distributed in the water column (after Mehlum 1980).

Anonymous 1977. Foreløpig rapport om aksjonen i forbindelse med ukontrollert utblåsning på produktionsplatform Ekofisk Bravo. Unpublished Internal Report, Norway.
Audunson T. 1977. Bravoutblåsingen: Feltobservasjoner, analyseresultater og beregninger tilknyttet oljen på sjöen. Cont. Shelf Institute, Trondheim, Publ. 90.
Langhelle G. 1977. Sjöfuglregistreringer i forbindelse med Bravoulykken, Ekofisk april 1977, Del II. Min. Environm., Norway. Mimeogr. 16 p.

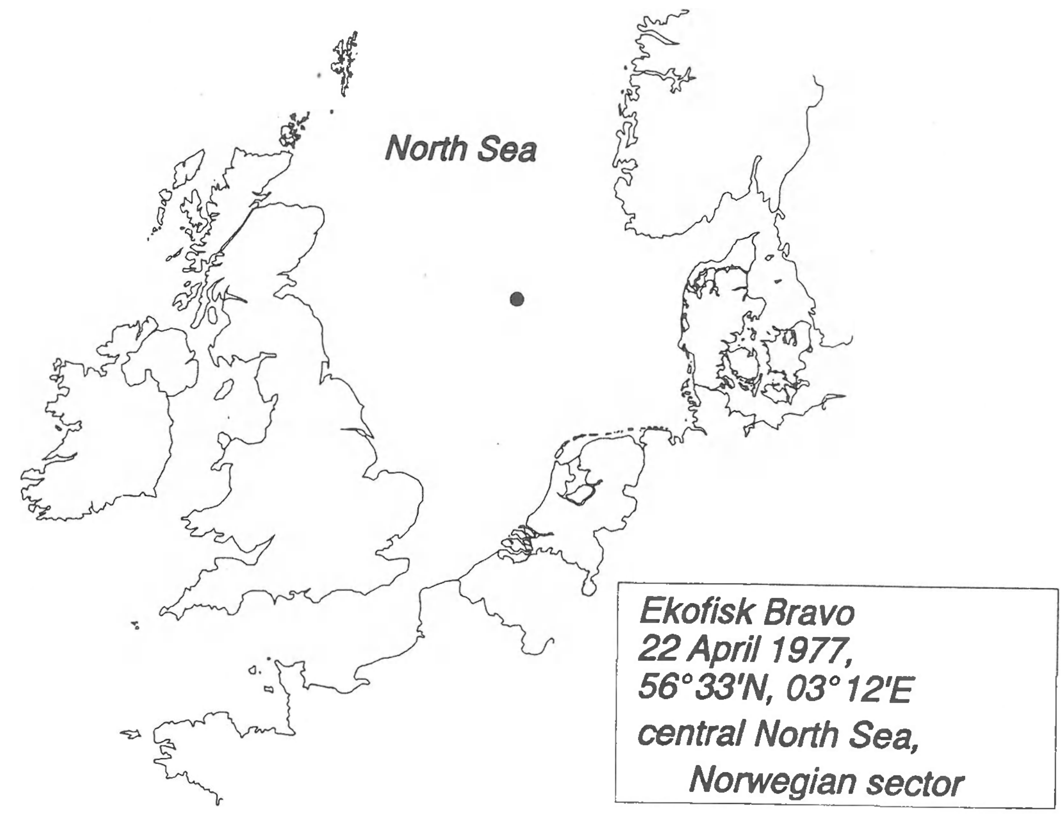

Figure 7.2 Location of Ekofisk Bravo blow-out in the central North Sea.

Mehlum F. 1977. Sjöfuglregistreringer i forbindelse med Bravoulykken, Ekofisk april 1977, Del I. Min. Environm., Norway. Mimeogr. 28 p.

——— 1980. Seabirds and the Bravo blow-out at Ekofisk North Sea. Acta Orn. 17(10): 119-126. *[In English - Russian summary; This paper reports on seabird abundance in the central North Sea, around the Ekofisk-field, and on the development, spreading, drift of the oil slick, and the efforts to prevent the spreading of the oil following the uncontrolled blow-out at the Bravo platform (56°33'N, 3°12'E). Very few heavily oiled seabirds were seen in the polluted area (15 individuals, including Fulmars and large gulls). Many birds were seen on the water in areas with 'blue shine' and belts with oil lumps, but it was impossible to see any damage on them. Birds behaved just normal, apparently unaffected by the presence of the oil film - CJC]*

7.2 Sweden

Swedish waters include the Skagerrak and Kattegat in the West, the Baltic in the Southeast, and the Gulf of Bothnia in the Northeast (figure 7.3). Beached bird surveys have occasionally been organized, particularly on the West coast (e.g. Hult & Uddén 1979, Pehrsson 1980, 1981ab), but also in the Baltic (Broman & Hjernquist 1982, Hanssen 1982, Lindén, Elmgren & Boehm 1979). In most cases, counts of birds involved with oil incidents took place but, apparently, routine monitoring programmes for beached birds do not exist here. A large oil slick and associated seabird mortality in 1978 and the Stylis incident in 1981 in the Skagerrak have engendered considerable activity in Bohuslän, Westcoast Sweden (e.g. Pehrsson 1980, Uddén & Åhlund 1984). However, the extensive drowning of auks in nets near the Swedish coast was an aspect which received much more attention in recent years (e.g. Oldén, Kollberg & Peterz 1986). Routine sampling of stranded birds is carried out in study plots on the island of Gotland by Sven Blomqvist and Mats Peterz, but no details on this work were received through the questionnaires. Interest is expressed towards participation in a European monitoring programme.

Address Sven Blomqvist, Department of Systems Ecology (Marine Ecology), Stockholm University, S-196 91 Stockholm, Sweden.

Broman D. & Hjernquist B. 1982. Sörsta oljespillet för svenska Östersjön. Fauna Flora 77(3): 169-176.
Broman D. & Lindblad C. 1981. Oljesanering? Biologiska effekter av hetvattensanering. Sveriges Natur 72: 289-293.
Hanssen O.J. 1982. Impact on the local breeding population of Common Eider, Red-breasted Merganser and Black Guillemot in the Østfold Archipelago after an Oil spill 1978 (I). *In* S. Myrberget, Negative Faktorer for Sjøfugl, NKV's Møte Høvikodden 1981. Viltrapport 21: 51-55.
Hjernquist B. 1981. Hur bör bekämpning och sanering av olja utföras inom fågelskyddsområden?. Länsstyrelsen i Stockholms län, Naturvårdsenheten Mimeogr. 11 p.
Hjernquist B. 1982. Olja i fågelskyddsområden-bekämpning och sanering [Oil and bird sanctuaries - control and cleaning up]. Fauna Flora 77(3): 195-202.

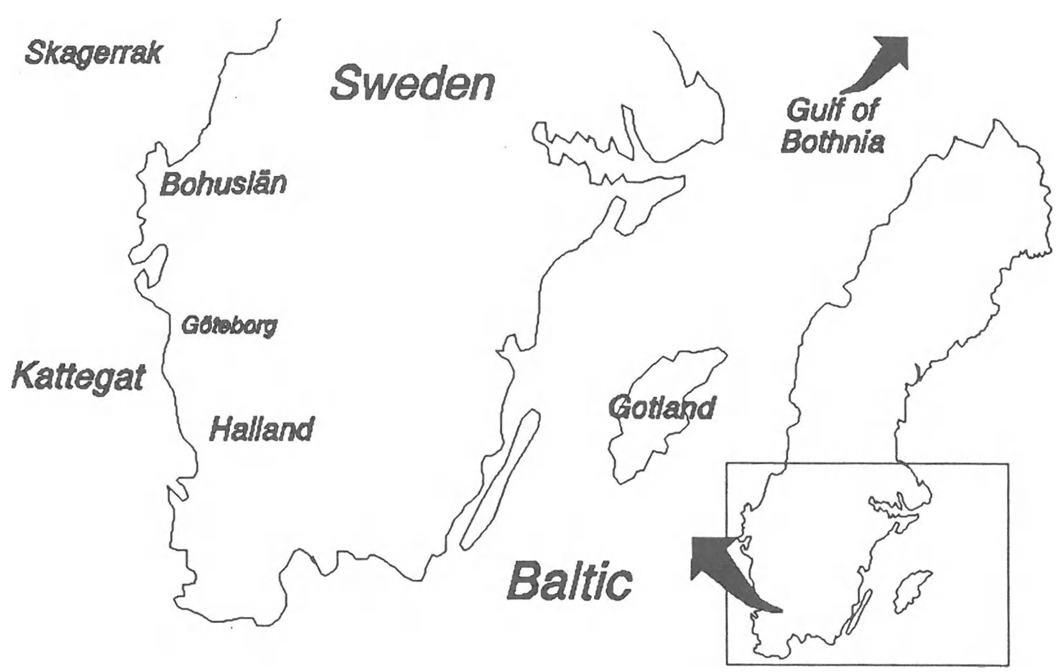

Figure 7.3 Swedish south coast, including Bohuslän (west coast) and Gotland.

Some Swedish key words

Alkfåglarnas	Auks
Bekämpningen	Oil clean up operations
Kemiska analyser	Chemical analysis
Kustnära	Near the coast
Kustströmmarna	Coastal waters
Fåglar	Birds
Fågellivet	Bird life
Fågelskyddsområden	Bird reserves
Masseförekomsten	Mass occurrence; often used for mass strandings
Olja	Oil
Oljedöden	Oil victims
Oljeföroreningar	Oil pollution
Oljeprøver	Oil samples
Oljeskadad	Oiled (hence, oljeskadad fågal = oiled birds)
Oljeutsläpp	Oilspill
Orsaken	Cause
Östersjön	Baltic sea
Sjöfågeldöden	Dead seabirds
Skärgården	Group of small skerries
Västkusten	West coast
Vatten	Water

Hult S. & Uddén J. 1979. Effekter på fågellivet i Bohuslän av oljeutsläppet i november 1978.Fåglar på Västkusten. Meddel. Göt. Orn. Fören. 13(1): 4-6.

Lehtinen C. 1981. Miljöaspekter på bekämpning och sanering av oljeföroreningar. Oljeföroreningar i kustnära områden. Symp. Göteborg 30 Nov-1 Dec 1981. IVL, NIVA & VKI. Mimeogr. 3 p.

Lindén O. 1981. Vad händer med skärgården efter alla oljeutsläpp. Sveriges Natur 72: 8-13.

Lindén O., Elmgren R. & Boehm P. 1979. The Tsesis oil spill: Its impact on coastal ecosystems of the Baltic Sea. Ambio 8(6): 244-253.

Måre M. 1979. Oljan på Bohuskusten. Bekämpningen och saneringen 1978-79. Rapp. åt 1977 års oljeskyddskommitté.

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Nortini M. & Wennergren G. 1981. Kemiska analyser av oljeprover från Sverige och Norge. Kort lägesrapport 1981.09.19. Inst. vatten och luftv. foskn. (IVL). Mimeogr. 15 p.

——— 1981. Kjemiska analyser av oljeprøver från Sverige och Norge. Kort lägesrapport och preliminära slutsatser angående orsaken till masseförekomsten av oljeskadad fågal årsskiftet 1980/81. Inst. vatten och luftv. foskn. (IVL). Mimeogr. 8 p.

Olden B., Kollberg B. & Peterz M. 1986. [Seabird mortality in the gill-net fishing, Southeast Kattegat, South Sweden the winter 1985/86]. Anser 25: 245-252. (Swedish with English summary).

Pehrsson O. 1980. Oil and seabirds on the Swedish West coast. Rep. Zool. Inst. Göteborg Sec. Intern. Meet. Wildl. Oil Poll. North Sea, Oslo 20-26 March 1980 7 p. *[In English; Review of oil induced seabird mortality along the Swedish West coast, using ten years of wildfowl counts, three times each non-breeding season, from coast guard vessels. It is concluded that the Swedish side of the Kattegat is much less affected by oil pollution than the Danish side. Details are provided of a major oil incident, which occurred 11 November 1978. An 12 * 6 km oil slick was observed between Skagen (Denmark) and the Swedish West coast. Large numbers of seabirds were affected. Of 2,399 seabirds recorded on the Swedish coast, 2,043 were shot by coastguard, police* *and private persons, and another 356 were found dead. Auks predominated (85.6%, n= 2,399), with Guillemots as most numerous species (1,390 specimens) - CJC]*

Pehrsson O. 1981a. Oljedöden slår till igen på våstkusten. Vår Fågelvärld 40(1): 69-71.

——— 1981b. Oljedöden i kustströmmarna - alkfåglarnas öde?. Sveriges Natur 72: 197-201.

Tåning A.V. 1952. Oljedoden. Sveriges Nat. 5.

Uddén J. & Åhlund M. 1984. Sjöfågeldöden och oljan på bohuskusten nyåret 1981. Länsstyrelsen Naturvårdsenheten 1984: 1 Göteborg. *[In Swedish - English summary; Report on the activities associated with the Stylis incident in winter 1980/81 (see also Norwegian papers). Along the coast of Bohuslän, 31,860 oiled birds were shot and collected, while another 10,000-15,000 oiled birds were estimated to have been left on the shore and a few thousands of oiled Eiders and Kittiwakes were seen still alive, weeks after the incident. Most abundant species were Guillemot (59%), Little Auk (13%), Eider (11%), Razorbill (9%), Kittiwakes (4%), and Black Guillemots (1%). From dissections, assuming birds with a distinct bursa Fabricii to be immatures, it was concluded that 85% of the Guillemots and 20% of Razorbills and Little Auks were immatures. Methods and results are clearly described and illustrated with numerous tables, sketches, and diagrams - CJC]*

Uhler S. 1978. Swedish Coast Guard Service, organisation, mission and responsibility for oil pollution control. *In* Å. Andersson & S. Fredga, Proceedings Symposium Sea Ducks, p. 7-11. National Swedish Environmental Protection Board, Solna & International Waterfowl Research Bureau, Slimbridge.

7.3 Finland

Finnish waters include the Gulf of Bothnia in the Northwest, the Baltic in the Southwest, the Gulf of Finland in the South. Activities related to stranded seabirds and oil pollution in Finland are mainly opportunistic, in response to certain incidents. Examples are reports on the Palva incident in 1969 (Soikkeli & Virtanen 1972) and the Antonio Gramsci oil spill in 1979 (Vaslte 1983). In the 1950s and 1960s, there was considerable concern about the wintering populations of Long-tailed Duck *Clangula hyemalis* in the Baltic. By 1960, the number of Long-tailed Duck migrating through Finland had been reduced to one tenth of figures recorded in the 1930s (Bergman 1961). Several of the papers of Bergman are of interest in this respect, and although most do not refer to beached bird surveys, a number of his publications is included in the Finnish list. There was no recent information on seabird mortality and oil rates available for this report. Titles in Finnish are followed by an English translation ([]). The Canadian Wildlife Service has translated several of these publications (e.g. Bergman 1961, Grenquist 1956, Haila 1970, Soikkeli & Virtanen 1972; see for abstracts Hooper, Vermeer & Szabo (1987; listed in chapter 11). Available from Canadian Wildlife Service, Pacific & Yukon Region, P.O.Box 340, Delta, British Columbia, Canada V4K 3Y3.

Address At present, there are no contacts with Finnish beached bird survey organizers.

Bergman G. 1941. Der Frühlingszug von *Clangula hyemalis* und *Oidemia nigra* bei Helsingfors. Orn. Fenn. 18: 1-26.

—— 1961. Allin ja mustalinnun muuttokannat Keväällä 1960 [The migrating populations of the Long-tailed Duck and the Common Scoter in the spring, 1960]. Suomen Riista 14: 69-74.

—— 1974. The spring migration of the Long-tailed Duck and the Common Scoter in Western Finland. Orn. Fenn. 51: 129-145.

Bergman G. & Donner K.O. 1960. Die jetzige Grösse des Frühjahrsbestandes von *Clangula hyemalis* und *Melanitta nigra* am Finnische Meerbusen. Orn. Fenn. 37: 117-122.

—— 1964. An analysis of the spring migration of the Common Scoter and the Long-tailed Duck in Southern Finland. Acta Zool. Fenn. 105: 1-59.

Grenquist P. 1956. Öljytuhoista Suomen Aluevesillä [Oil damage in Finnish teritorial waters in 1948-1955]. Suomen Riista 10: 105-116.

Haila Y. 1970. Öljyonnettomuus [The tanker Palva disaster involving oil pollution]. Suomen Riista 22: 7-13.

Lemmetyinen R. 1966. Jäteöljyn vesilinnuille aiheuttamista tuhoista Itämeren alueella [Damage to waterfowl caused by waste oil in the Baltic area]. Suomen Riista 19: 63-71.

Soikkeli M. & Virtanen J. 1972. The Palva oil tanker disaster in the Finnish Southwestern Archipelago, II. Effects of oil pollution on the Eider (*Somateria mollissima*) population in the Archipelago of Kökar and Föglö, South-western Finland. Aqua Fenn. Special Issue: The Palva oil tanker disaster in the Finnish Southwestern Archipelago, pp 122-128.

—— 1978. Oil discharges in Finnish coastal waters from 1970 to 1974. *In* Andersson Å. & S. Fredga, Proceedings Symposium Sea Ducks, p. 12-14. National Swedish Environmental Protection Board, Solna & International Waterfowl Research Bureau Slimbridge. *[In English; A report of annual, seasonal, and spatial occurrence of oil discharge in Finnish coastal waters. Some 529 slicks were reported during 1970-74, of which 17% required clean-up operations. A severe case was recorded in March 1974, when over 1,000 seaducks (mainly Eider) died off Åland - CJC]*

Vaslte J. 1983. Effect of the Antonio Gramsci oil spill on the avifauna of the Finnish Southwestern archipelago. Orn. Fenn. Suppl. 3: 112-113.

7.4 Russia

Russian waters include the Gulf of Finland in the Baltic region (figure 7.4), and the White and Barents Seas in the Northwest. Information on oil pollution in these waters is extremely scant and there are no known reports from beached bird surveys here. Two titles, followed by an English translation ([]), are from translations of the Canadian Wildlife Service (for abstracts Hooper, Vermeer & Szabo 1987 (see 7.3 Finland)). One of those papers is in fact from Azerbaidzhan.

Address for beached bird surveys in the Murmansk Region in Russia is: Yuri Krasnov & Alexander Koryakin, Kandalaksha Nature Reserve, Lineinaya 35, 184040 Kandalaksha Murmansk Region, Russia. Currently, there is no contact with ornithologists working along the Russian Baltic coast.

Dubrovsky A. 1959. Ptitsy gibnut v nefti. [Birds perish in oil] Okhota i Okhotnich'e Khozyaistvo 13(4): 58. *[In Russian - English translation available as Canadian Wildlife Service TR-RUS-281; In Ukhta, Komi, countless numbers of migrating ducks and geese perished in an open oil reservoir with a surface area of over 500m² during its 5 years of existence - from Hooper, Vermeer & Szabo 1987]*

Vereshchagin N.K. 1946. Gibel'ptits ot nefti v Azerbaidzhan. [Death of birds from oil in Azerbaidjan]. Zool. Zhurnal 25(1): 69-80. *[In Azerbaidzhanian - English translation available as Canadian Wildlife Service TR-RUS-277; Review of the oil pollution problem in the Caspian Sea. Important sources of pollution are drainage of oily refinery effluent into the Caspian Sea, offshore drilling, dumping of oily ballast waters, spills during transfer and loading operations and accidental breakage of pipe lines. Most numerous oil victims at sea are Coot and Tufted Duck, while Mallard, Pintail, Teal, and Coot were hit on inland locations - shortened abstract from Hooper, Vermeer & Szabo 1987]*

Figure 7.4 Eastern Baltic, showing the coastline of Russia, Estonia, Latvia, Lithuania, Kaliningrad, and Poland.

7.5 Estonia

Estonian waters include the Gulf of Finland in the North, the Baltic off Hiiumaa and Saaremaa, several sea straits between these islands and the Gulf of Riga in the West (figure 7.5). Winter surveys in Estonia are usually quite impossible until April, when the ice breaks up. However, in some years there is no stable ice-cover at all. The EBBS proposals were well received in the Estonian Ornithological Society (EOS). In 1992, plans for BBS in Estonia were materialized. In February 1992, 68 instructions and proposals were distributed amongst members of the EOS in different regions (Vilju Lilleleht in litt.). About 80 km of shoreline were surveyed, in 6 separate locations (figure 7.5), between 22 February and 17 April 1992. No oil pollution was discovered, and beached birds included 12 Long-tailed Duck *Clangula hyemalis*, 2 unidentified swans *Cygnus* spp., and 3 -gulls *Larus*. Some papers published in the 1960s indicate that oil pollution occurred in these waters and was considered a serious problem (Veroman 1962, Aumees 1966). The list below includes some papers on recent waterfowl surveys in Estonian waters (Kuresoo 1990, Shergalin 1990). The rapid worsening of the economical situation in Estonia will perhaps hamper a full participation in an EBBS scheme, but interest to join is certainly there.

Address Vilju Lilleleht, Institute of Zoology and Botany, Estonian Academy of Sciences, Vanemuise 21, EE-2400 Tartu, Estonia.

Anonymous 1910. Eisentenhavarie bei Dago. Neue Baltische Waidmannsblätter 6(6): 489.

Aumees L. 1966. Olikatk Vilsandil [Oil pollution on Vilsandi Island]. Eesti Loodus 1966 (4): 222-223. *[In Estonian - English summary]*

Kuresoo A. 1990. Results of mid-winter counts of waterfowl in Estonia in 1990. Summ. lect. Joint Meeting International Waterfowl Research Bureau's Western Palearctic Seaduck Database. IWRB Newsletter December 1990: 18. *[From abstract in English; Questionnaires were used for the mid-winter census. In the mild winter 1989/90, important numbers of Steller's Eider (2042),*

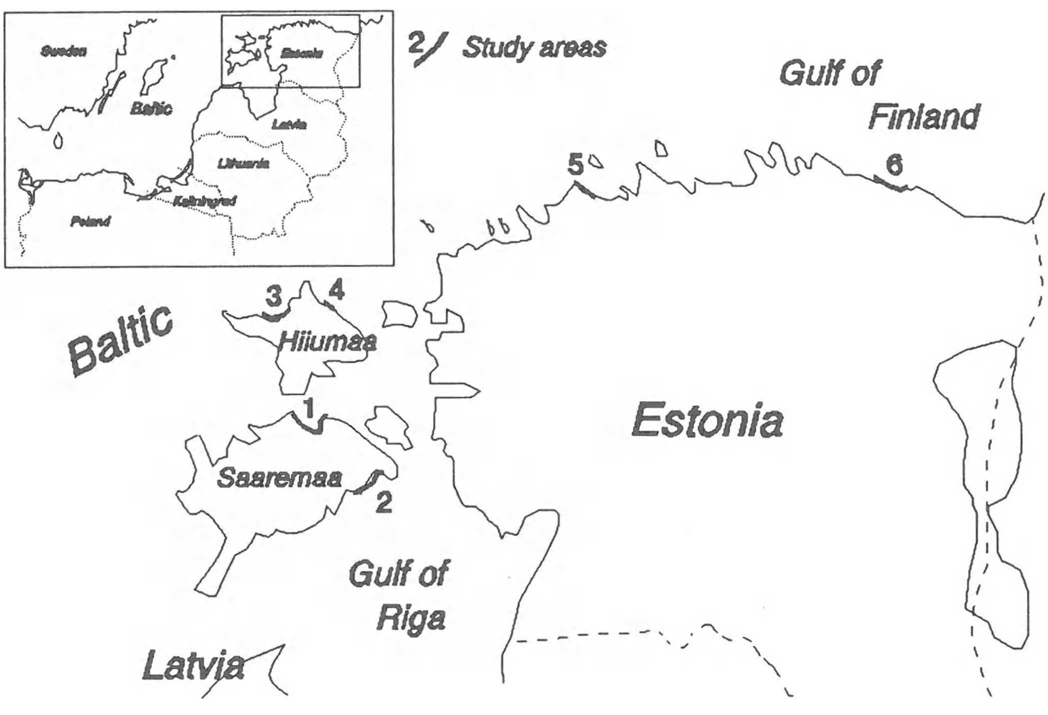

Figure 7.5 Estonian coastline and beaches surveyed in 1992.

Goldeneye (5287 counted/ 8000 estimated), Goosander (2336/3500) and Long-tailed Duck (6127/10-15,000) were found - CJC]

Shergalin J. 1990. Results of waterfowl aerial survey during flights for ice reconnaissance and sea pollution control in Estonia in 1986-90. Summ. lect. Joint Meeting IWRB's West. Pal. Seaduck Database. IWRB Newsletter December 1990: 19. *[From abstract in English; Identification of duck proved difficult. A maximum of 12,600 'seaducks' were found along the Estonian coast - CJC]*

Veroman K. 1962. Olikatku probleem on aktuaalne [The urgent problem of oil pollution of the seas] Eesti Loodus 1962 (4): 209-214

7.6 Latvia

Latvian waters include the Gulf of Riga and the Baltic. Beached bird surveys were started in Latvia in 1988 by a small working group, and regular surveys were carried out since the summer of 1990. In 1992, Latvia could join the IBBS, as a result of the exceptionally mild winter. Usually in February, the Gulf of Riga is frozen over or there is much ice on the beach. Monthly coverage nowadays is some 10-30% of the Latvian coastline. Currently, there are no publications on beached birds in Latvia, but one paper is in press (listed below), showing results of surveys during 1988-91. Most numerous species were Long-tailed Duck *Clangula hyemalis* (35%, n= 354), Great Crested Grebe *Podiceps cristatus* (8.4%), Mallard *Anas plathyrhynchos* (8.1%), Mute Swan *Cygnus olor* (5.9%), Red-throated Diver *Gavia stellata* (4.8), Goldeneye *Bucephala clangula* (4.5%), and Razorbill *Alca torda* (3.1%). Roughly 15% of the birds found along the Latvian coast was oiled. In the paper of Viksne & Stipniece (1990), but also in the manuscript of Kurochkin & Smislov, recent information on waterfowl numbers in Latvian waters is available. The Latvian group is most interested to join the EBBS, but considers the time span covered in the current EBBS proposal as rather inconvenient, because of ice conditions (Alexey Kurochkin in litt.).

Contact address: Alexey Kurochkin, Latvian Ornithological Society, c/o Dzirnavu 119-32, 226011 Riga, Latvia.

Kurochkin A. & Smislov V. in press. [Seabird mortality on the Latvian coast] Putni daba 4. *[From English summary; Paper reviews BBS results obtained during 1988-91, covering some 2,000 km. Highest densities are reported in spring, lowest densities in summer. Over the year, some 0.2 corpses per km are found, with Long-tailed Duck predominating and 15% being oiled. A comparison of BBS results and mid-winter waterfowl counts is given. Coastal and inshore species were found most frequently, while the number of divers, grebes and auks found dead were more than unexpected. It is considered that BBS results contribute to the knowledge of the coastal avifauna - CJC]*

Viksne J. & Stipniece A. 1990. Results of mid-winter counts in Latvia in 1990. Summ. lect. Joint Meeting IWRB's Western Palearctic Seaduck Database. IWRB Newsletter December 1990: 20.

7.7 Lithuania

Lithuanian waters include the Baltic only and the coastline of Lithuania is some 100 kilometres long. Systematic BBS are now planned, working three study areas (figure 7.6), each of 10-15 km length, preferably as a combined project with mid-winter waterfowl surveys (Gediminas Vaitkus in litt.). It is considered that at least 25-35% of the Lithuanian has to be surveyed in order to provide a reliable 'sample'. The first subregion (1), runs between Sventoji and Palanga. This beach is bordering an important wintering area of Long-tailed Duck *Clangula hyemalis*, Steller's Eider *Polysticta stelleri* and Common Eider *Somateria mollissima*. There are no large industrial areas in this region and the waters near Palanga are rather shallow. The next subregion (2) runs between Karkle and Melnrage, just to the north of Klaipeda. This beach borders rather deep waters with stone/gravel bottoms. There are usually no important wintering sites for seaduck here, except occasional concentrations of Long-tailed Duck, but industrial activities are concentrated in this region. Around the harbour of Klaipeda, marine pollution of the Lithuanian coast is most pronounced, partly because of the fresh water runoff from Kursiu Marios (through Klaipeda harbour). A new oil terminal is planned to be built in the Klaipeda region, and BBS are considered essential to evaluate its impact on this part of the Baltic. The last subregion (3) runs between Juodkrante and Pervalka on the long peninsula just north of the border with Kaliningrad. Near this beach are important wintering sites for Velvet Scoter *Melanitta fusca* and Common Scoter *M. nigra*, and Long-tailed Duck. There are no important industrial areas here. In the near future, offshore oil drilling may take place in this region. So far there are only plans for offshore oil exploration, but off the neighbouring Kaliningrad, drilling has commenced already. Results of Lithuanian BBS have not been published yet, but some information is given in papers on recent waterfowl surveys in Lithuanian waters (listed below). The Lithuanian group is most interested in future co-operation.

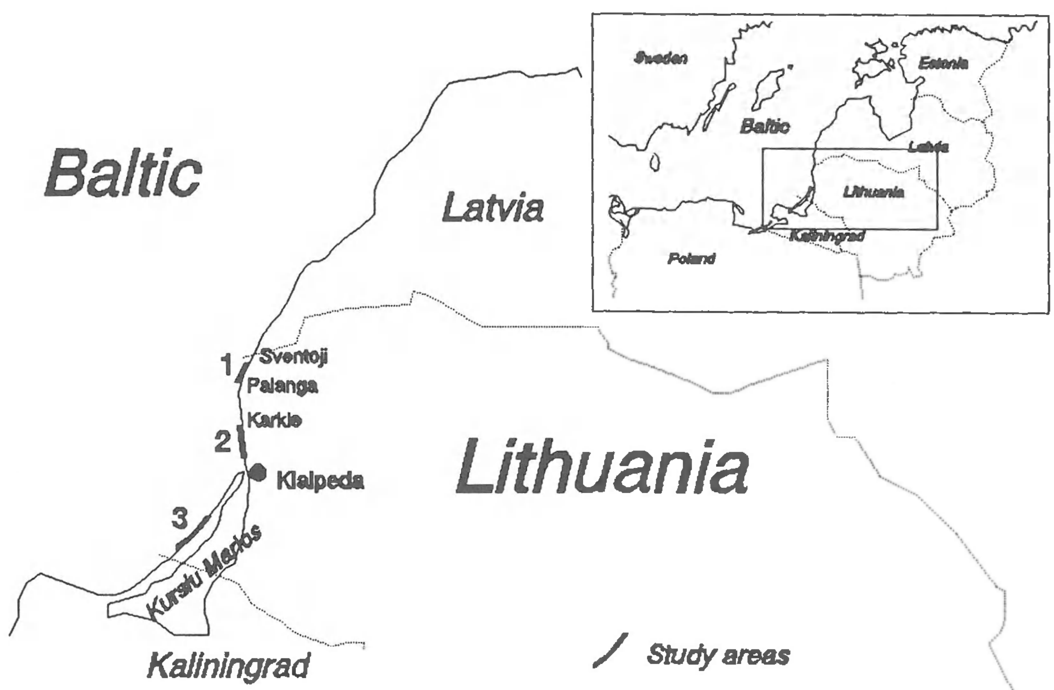

Figure 7.6 Lithuanian coast and study regions in the eastern Baltic.

Address Gediminas Vaitkus, Institute of Ecology, Akademijos 2, Vilnius MTP 232600, Lithuania.

Petraitis A. 1991. Steller's Eider (*Polysticta stelleri*) at Lithuanian Baltic coast from 1969 till 1991. Acta Orn. Lituanica 4: 96-106.

Petraitis A. 1992. Wintering Steller's Eider (*Polysticta stelleri*) at the Lithuanian Baltic Coast. International Waterfowl Research Bureau Seaduck Bulletin 1: 41.

Raudonikis L. 1990. Wintering waterfowl in Lithuania and the coastal area of Kaliningrad in 1990. Summ. lect. Joint Meeting IWRB's West. Pal. Seaduck Database. IWRB Newsl. Dec. 1990: 20-21. *[From abstract in English; Report of (3rd) 1990 survey of waterfowl in Lithuanian waters. In all, 23 wintering waterfowl species were found, with an estimated total number of 66,500 individuals. Important numbers were found of Velvet Scoter (15,000), Smew (900), Goosander (7000), and Steller's Eider (670). The paper provides some information on wintering Velvet Scoters (2500) and Long-tailed Duck (7500) off Kaliningrad - CJC]*

Svasas S. 1990. Wintering sites of International Importance for seaducks in the coastal areas of Lithuania. Summ. lect. Joint Meeting IWRB's Western Palearctic Seaduck Database. IWRB Newsl. Dec. 1990: 21-22. *[From abstract in English; Surveys of waterfowl are important in connection with possible oil and gas exploitation in Lithuanian waters, and a possible oil refinery near Nida. Lithuanian waters hold internationally important numbers of Velvet Scoter, Long-tailed Duck, Smew, Goosander, and Steller's Eider. The paper provides some information on wintering Velvet Scoters and Long-tailed Duck off Kaliningrad - CJC]*

Svazas S. & Pareigis V. 1992. The significance of Lithuanian Baltic coastal waters for the wintering population of the Velvet Scoter. IWRB Seaduck Bulletin 1: 41-42.

Svazas S. 1992. The threat of an ever increasing oil and industrial activity in Lithuanian coastal waters for the waterfowl areas of international importance. IWRB Seaduck Bulletin 1: 43-44.

Vaitkus G., Svazas S., Raudonikis L. & Pareigis V. 1992. The report on mid-winter counts in Lithuania 1991. IWRB Seaduck Bulletin 1: 31-32.

7.8 Poland

Polish waters include the Baltic and Gdansk Bay. Important numbers of Goldeneye *Bucephala clangula* (15-30,000) and Goosander *Mergus merganser* (≤ 20,000) are found along the Polish coast. Large flocks of Smew *Mergus albellus* are found in mild winters in Vistula Lagoon (4-5000). Some 100,000 Long-tailed Duck *Clangula hyemalis*, up to 60,000 scoters, and 5-7000 Red-breasted Merganser *Mergus serrator* winter off the Polish Baltic coast (Meissner 1990). Razorbill, Black Guillemot *Cepphus grylle* and Guillemot *Uria aalge* are the most numerous auks (Meissner 1989). Parts of the Polish Baltic coast and beaches along Gdansk Bay, in all 500 km long, have been investigated regularly during the 1970s (Górski 1975, Górski *et al.* 1976, 1977, 1978, 1979, 1980, Szczepski 1976). Surveys for beached birds commenced in the 1940s (Szczepski 1976), but particularly the regular studies in the 1960s and 1970s have provided good data. Three different coastal areas were covered: Western (1, Swinoujscie to Dziwnow), central (2, Ustronie Morskie to Rowy or to Czolpino) and Eastern (3, Wladyslawowo to Krynica Morska; Wlodzimierz Meissner in litt.; figure 7.7), with visits every 2-3 weeks between Oct/Nov and Apr/May. Beached bird surveys have continued ever since in the central coastal region, and results of these surveys are planned to be published in the Baltic Birds Conference No. 6. Data are still collected systematically in the Gdansk Bay region, where the Waterbird research group 'KULING' has conducted surveys since 1984. Here, 130 km of coastline is surveyed monthly between September and April. Interestingly, now that the Baltic has turned into a '*Special Area*' under MARPOL Annex 1, mortality due to oil pollution in Poland is much lower nowadays as compared to 20 years ago. During 1947-70, 56.0% of the auks in Gdansk Bay were oiled (n= 141; Szczepski 1976), whereas during 1980-87 of the same three species in the same area only 6.3% were oiled (n= 238; Meissner 1989). Titles in Polish are followed by an English translation ([ ]) whenever known. The Canadian Wildlife Service has translated several of these

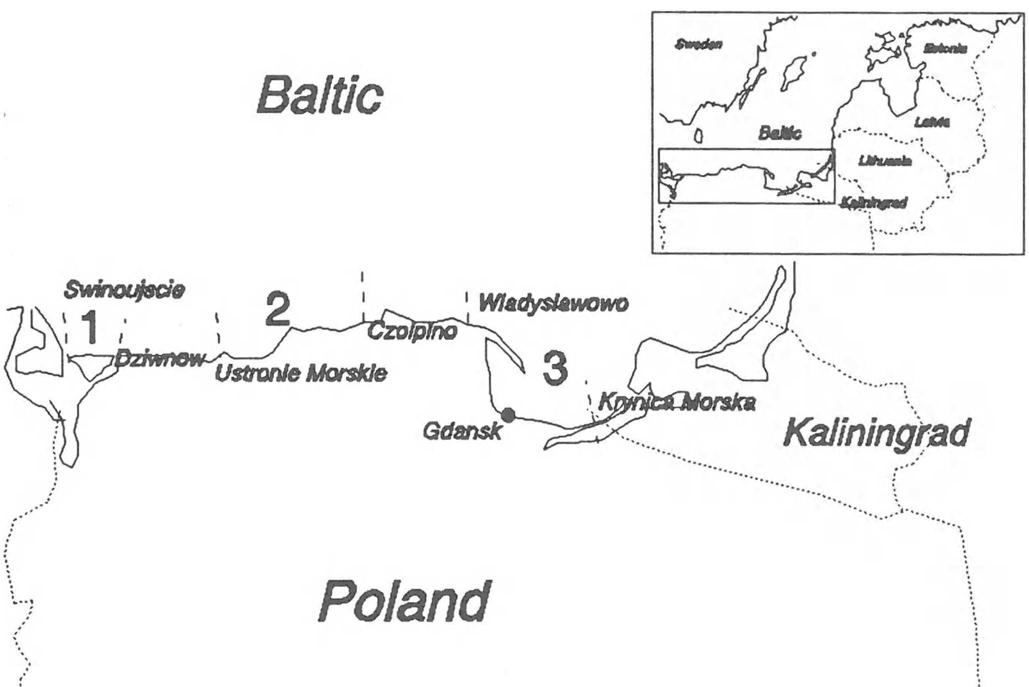

Figure 7.7 Polish coast and study regions (according to Górski *et al.* 1979).

publications (e.g. Górski papers, Kocwa & Szewczyk 1969, Misiewicz 1980, Szczepski 1975, 1976; see for abstracts Hooper, Vermeer & Szabo (1987; listed in chapter 11).

Address Włodzimierz Meissner, Dept. of Vertebrate Ecology and Zoology, Legionów 9, PL-80-952 Gdansk, Poland.

Bleszynski J. 1971. Kaczki morskie gina w Kolobrzegu. Wszechswiat 10(2096): 268.

Brewka B., Meissner W., Sikora A. & Skakuj M. 1978. Four years of the activity of Waterbird Research Group 'KULING'. Ring 11: 339-347.

Dzieczkowski A. 1960. Tragedie "zarazy oliwnej". Przyroda Polska 4(10): 7.

Ferens B. 1952. Zaraza oliwna - jej geneza i skutki. Chronmy przyr. ojcz. 5(5): 12-22.

Górski W. 1969. Badania nad skutkami "zarazy oliwnej" na wybrzezu morskim pod Koszalinem. Not. Przyr. 3(3): 2-8.

——— 1975. Badania przyczyn i skutków wodnych na polskim wybrzezu Baltyku w latach 1969-1972. [Investigations on causes and consequences of oily poisonings of water birds on the Polish sea coast of the Baltic Sea in the years 1969 to 1972]. Rocznik Akad. Roln. Poznaniu, Ornit. Stos. 87: 89-106.

Górski W. & Antczak J. 1990. Smiertelnosc ptaków wodnych z powodu zanieczyszczen ropopochodnych w srodkowej czesci polskiego wybrzeza Baltyku. Proc. conf. "Ornitologia Polska w setna rocznice smierci Wladyslawa Taczanowskiego", Lodz.

Górski W., Jakuczun B., Nitecki W. & Petryna A. 1976. Badania smiertelnosci ptaków wodnych na polskim wybrzezu Baltyku (dane za lata 1970-1974) [Investigations on oil pollution on the Polish coast of the Baltic Sea 1970-1974]. Przegl. Zool. 20: 81-87. *[In Polish - English summary; Report of Polish BBS between 1970 and 1974. Coastline covered increased from 18 km in 1970/71 to 212 km in 1973/74. Some 3900 corpses were found, mostly oiled, including 28 species. Most numerous were Long-tailed Duck (65.8%), Common Scoter (15.3%), Velvet Scoter (7.6%), Herring Gull (2.6%), Eider (1.3%), Black-headed Gull (1.2%), and Black Guillemot (0.9%) - CJC]*

——— 1977. Badania smiertelnosci ptaków wodnych z powodu zanieczyszczen ropopochodnych na polskim wybrzezu Baltyku w sezonie 1974/75 [The Investigation on oil pollution on the Baltic coast in 1974/75]. Przegl. Zool. 21(1): 20-23.

——— 1979a. Badania smiertelnosci ptaków wodnych z powodu zanieczyszczen olejowych na polskim wybrzezu Baltyku w sezonie 1975/76 [The Investigation on oil pollution on the Baltic coast in 1975/76]. Notatki Orn. 20(1-4): 35-44.

——— 1979b. Smiertelnosc ptaków wodnych na polskim wybrzezu z powodu zanieczyszczen ropopochodnych. [The mortality of aquatic birds on the Polish coast as result of oil pollution]. Stud. i Mat. Oceanol. 28: 41-58.

——— 1980. Smiertelnosc ptaków wodnych na polskim wybrzezu Baltyku w sezonach 1976/77 i 1977/78 [Mortality of waterfowl on the Polish coast in the seasons 1976/77 and 1977/78. Notatki Orn. 21(1-4): 23-32. *[In Polish - English summary; BBS results of 1976/77 and 1977/78. Most numerous oil victims were seaduck, gulls, Coot, Great Crested Grebe, Mute Swan and Black Guillemot. Long-tailed Duck dominated in all three subregions. Highest densities are recorded Mar-Apr, lowest densities May-Aug - CJC]*

Halba R. 1966. Na Baltyku gina ptaki of "zarazy oliwnej". Chronmy przyr. ojcz. 25(1): 54-55.

Kocwa E. & Szewczyk J. 1969. Mewy, ich biologia i rola higienicznosanitarna [Sea gulls, their biology and role in health and hygiene]. Wszechswiat 3: 72-74.

Laskowski E. 1970. "Zaraza oliwna" u wybrzezu wyspspy Wolin i Kolobrzegu. Chronmy przyr. ojcz. 26(1): 32-34.

Manikowski S. 1971. Badania nad smiertelnoscia ptaków zimujacych na Baltyku. Chronmy przyr. ojcz. 27(4): 32-39.

Meissner W. 1989. Alkowate (Alcidae) na zatoce Gdanskiej w latach 1980-1987 [Auks in the Gulf of Gdansk, 1980-1987]. Notatki Ornit. 30(3-4): 13-28. *[In Polish - English summary; Summary of winter counts of auks from ships and along the coast in Gdansk Bay during 1980-87. The prevailing wind and current in this region practically precludes the drifting of corpses from the open sea. Most (56%) of the 78 Razorbills, 57 Black Guillemots, and 103 Guillemots which were found dead had drowned in fishing nets, only 6.3% were oiled. Compared with the 1970s, the proportion of Razorbills is now higher, while the proportion of Black Guillemots has declined - CJC]*

——— 1990. Present knowledge about seaducks wintering on the Polish Baltic coast. Summ. lect. Joint Meeting IWRB's Western Palearctic Seaduck Database. IWRB Newsletter December 1990: 22.

Misiewicz A. 1980. Skutki "zarazy oliwnej" w rejonie portu w Ustce. [Oil pollution in the port at Ustka] Chronmy Przyr. ojcz. 36(4): 68-71.

Szczepski J.B. 1975. Niektóre aspekty ochrony ptaków Baltyku. [Some aspects of bird conservation in the Baltic] Wszechswiat 3: 62-65.

——— 1976. Raport o zarazie oliwnej u ptaków w Zatoce Gdanskiej [Account of oil pollution damaging the seabirds in Gdansk Bay]. Przeglad Zoologiczny 20(1): 75-81. *[In Polish - English summary; Review of BBS results obtained during 1947-70 (mainly 1957-70) in Gdansk Bay. In all, 1141 corpses were found, including 23 species, 70.6% of which were oiled. Waterfowl predominate the list, with Long-tailed Duck (720 corpses, of which 75.0% were oiled and 62.5% males), Black Guillemot (93 corpses, 56.9% oiled), and Velvet Scoter (80 corpses, 68.7% oiled) as the most numerous species - CJC]*

Wolk K. 1966. Znów "zaraza oliwna" na polskim wybrzezu. Chronmy przyr. ojcz. 22(5): 54-55.

——— 1975. Zaraza oliwna na polskim wybrzezu Baltyku. [Oil pollution on the Polish coast of the Baltic Sea] Ochr. Przyr. 40: 227-246.

7.9 Denmark and Færøerne

Danish waters include the North Sea in the West, the Skagerrak in the north, the Kattegat in the Northeast and the Baltic in the Southeast. Besides the mainland coast (or Jylland) and the larger islands (Fyn, Sjælland, Lolland and Falster), also the rather isolated island Bornholm in the Baltic is included in the surveys (figure 7.8). Oil incidents or other mass strandings of seabirds were studied rather opportunistically in Denmark until the mid 1970s (Joensen & Hansen 1977). However, several comprehensive reviews were written, dealing with the period 1935-76 (Joensen 1972abc, 1973ab, Joensen & Hansen 1977). In the mid 1970s, some beached bird surveys were carried out to collect additional information on the problem. The sometimes massive seaduck mortality due to oil received much attention by the Danes (Joensen 1978a). In the late 1980s, 7 subregions were identified, including the Southwest coast (1), the Northwest coast (2), the Northeast coast (3), the East coast (4), the Great Belt (5), Bornholm (6), and the Little Belt (7; figure 7.8; Christensen 1989). Beached bird surveys were organized on a more systematic basis since 1984 by the Oliefuglgruppen of the Danish Ornithological Society. Currently, beached bird surveys are organized by Ornis Consult in Copenhagen, which are basically the same people. Two national surveys are organized each year (February and March), each covering some 1000 km (Skov in litt.). Oil is considered a major threat to seabirds in Danish waters, with very high oil rates (50-100% oiled) for divers *Gavia* spp., Fulmar *Fulmarus glacialis*, Gannet *Sula bassana*, seaduck, Kittiwake *Rissa tridactyla* and auks Alcidae. Drowning in fishing nets is only locally a problem. Interesting reports of the more recent phase of Danish work are not as abundant as these activities may indicate, but include those of Danielsen, Durinck & Skov (1986), Christensen (1989), Danielsen, Skov, Durinck & Christensen (1990), and Skov, Andell, Danielsen & Durinck (1990). Since 1986, Ornis Consult acts as the international co-ordinating body

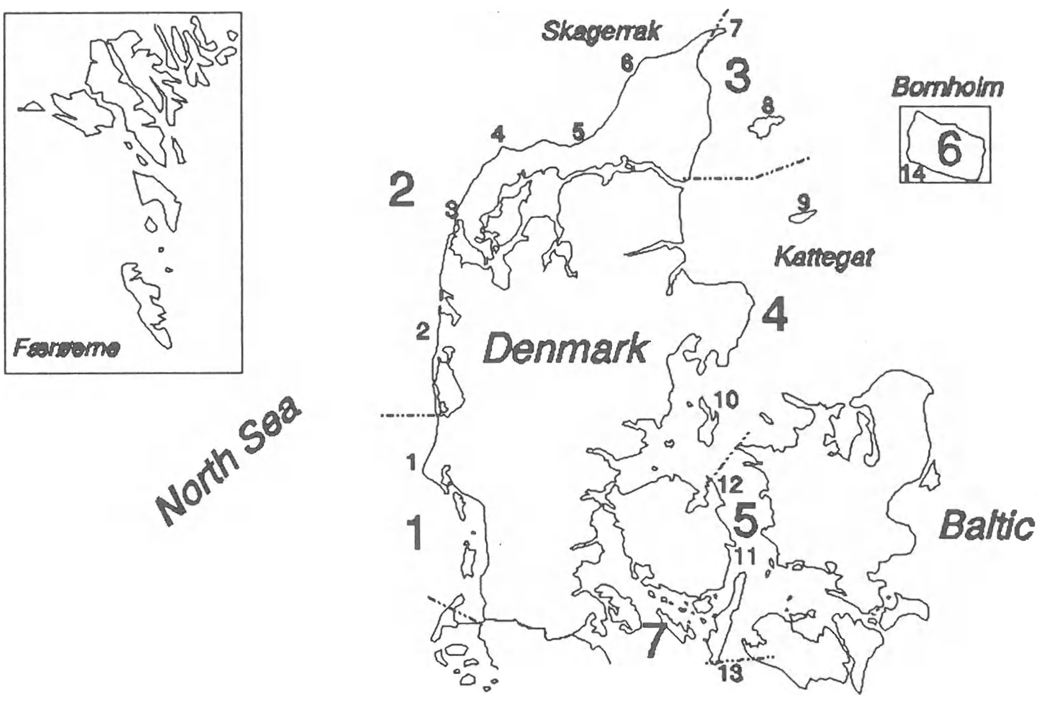

Figure 7.8 Subregions in Denmark after Christensen 1989 (large figures), and proposal for EBBS subregions after Skov in litt. (small figures). Færøerne in inset.

of the International Beached Bird Survey (IBBS). Papers discussing IBBS results include Skov, Danielsen & Durinck (1989) and Skov & Durinck (1991). Danish interest in the EBBS is considerable. Skov in litt. proposed some 14 subregions for future studies, including (1) Blåvandshuk-Vejers, (2) Ringkøbing county, (3) Agger Tange, (4) Hanstholm and Klitmøller, (5) Blokhus - Løkken, (6) Hirtshals, (7) Skagen, (8) Læsø, (9) Anholt, (10) Samsø, (11) Great Belt, (12) North Funen, (13) South Langeland, (14) Bornholm), or roughly some 10% of the Danish coastline. On Færøerne there have not been any (systematic) beached bird surveys so far. The possibilities to set up an organization, comparable to that on the Shetland Islands, are currently investigated.

Addresses (Denmark) Henrik Skov, Ornis Consult, Vesterbrogade 140 DK-1620 København, Denmark;
(Færøerne) Bergur Olsen, Fiskirannsóknarstovan 100, Tórshavn, Færøerne.

Alexandersen K. & Lamberg K. 1971. Oliedøden ved Samsø. Feltornithologen 13: 90-91.
Anonymous 1973. Tienduizenden vogels stierven door olie. Vogeljaar 21(5): 429.
Asbirk S. 1978. Tejsten Cepphus grylle som ynglefugl i Danmark. Dansk Orn. Foren. Tidsskr. 72(4): 161-178.
Bech A. 1966. Olieforurening ved Agger Tange. Feltornithologen 8(4): 161.
Christensen K.D. 1989. Beached Birds Survey. Monitoring the Effects of Oil Pollution on Birds. Report to EEC Comm., Ornis Consult/Dan. Orn. Soc., Copenhagen pp1-45. *[In English; Report of the results of BBS in late February and late March 1987, 1988, and 1989. Highest oil rates were recorded in Northern Denmark on North Sea beaches, mainly as a result of tank washing of vessels leaving the Baltic. The lowest oil contamination levels were recorded in Baltic waters.*

Some Danish key words

Andel	Proportion
Antal	Number
Brændselsolie	Fuel oil
Død	Dead (hence, Døde havfugle = dead seabirds)
Dødelighed	Mortality
Farvande	Waters (Danske farvande = Danish waters)
Havfugle	Seabirds
Ilanddrevne	Stranded (hence, Ilanddrevne havfugle = beached seabirds)
Katastrofe	Disaster
Kyst	Coast (Danske kyster = Danish coast)
Offer	Victim
Olie	Oil
Olieforurening	Oil pollution
Oliefugle	Oiled birds (informal term)
Olieindsmurt	Covered with oil
Olietruslen	Threat of oil
Olieudslippet	Oilspill
Område	Region, area
Opskyl	Tideline
Råolie	Crude oil
Skib	Ship, vessel
Smøreolie	Lubricating oil
Tælling	Survey
Undersøgelse(r)	Research
Registrering	Count, survey

Report contains many maps, tables and diagrams and includes results of chemical analysis of 10 oil samples - CJC]
Clausager I. 1979. Olieudslippet efter Thun Tank III's grundstødning 1979. Vildtbiol. Stat., Kalø.
——— 1983. Oil pollution in Danish waters. Orn. Fenn. Suppl 3: 110-111.
——— 1985. Olieforureningen ved Læsø august 1985. Rep. no 3 Vildtbiol. Station.
Dahlmann G. & Timm D. 1991. First analytical results of the EC-project "Oiled Seabirds". *In* C.J. Camphuysen & J.A. van Franeker, Oil pollution, Beached Bird Surveys and Policy: towards a more effective approach to an old problem. Sula 5 (special issue): 12-14.
Danielsen F., Durinck J. & Skov H. 1986. Havfugle og Olieforurening i Danske Farvande 1984-85. Oliefuglegruppen Dansk Orn. Forening, Copenhagen. *[In Danish - English summaries; Results and discussions of BBS results Sep & Nov 1984, Jan & Mar 1985, the first well organized surveys in Denmark for years, and IBBS results for 1985. Numerous species were Guillemot (76% oiled, n= 300), Lesser Black-backed Gull (28.3% oiled, n= 343), Eider (35.4% oiled, n= 347), and Mute Swan (24.0% oiled, n= 233). Preliminary results of detailed examinations of collected auks are included. Studied were origin (race), moult, age, and sex - CJC]*
Danielsen F. & Skov H. 1984. Olie på vandene. Fugle 1984: 3.
Danielsen F., Skov H., Durinck J. & Christensen K.M. 1990. Seks års overvågning af døde havfugle. Dansk orn. Foren. Tidsskr. 84: 8-9. *[In Danish - English summary; Short paper with results of 7500 km of BBS during 1983/84-1988/89. Oil rates of coastal and pelagic species found on North Sea and Skagerrak beaches have been fairly constant, but declined in the Kattegat. Seabirds in the Skagerrak and Kattegat have been more affected by oil pollution than seabirds in other areas. Abundant species with very high oil rates were Razorbill (93% oiled, n= 324), Little Auk (91%, n= 125), Guillemot (82%, n= 1621), Great Crested Grebe (79%, n= 157), and Common Scoter (73%, n= 1115) - CJC]*
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——— 1978b. Bird mortality in the Wadden Sea caused by oil. The Danish Wadden Sea. *In* K. Essink & W.J. Wolff, Pollution of the Wadden Sea area, p. 59-60. Balkema, Rotterdam.
——— 1982. Seabird populations and negative factors in Denmark. *In* S. Myrberget, Negative Faktorer for Sjøfugl, NKV's Møte Høvikodden 1981. Viltrapport 21: 17-22. *[In English - Danish summary; Discussion of the major threats to Danish seabirds and waterfowl, including the annual hunting bag, drowning in nets and oil pollution. The species composition of birds killed in oil incidents in 1969, 1970, 1972, and 1979, with estimated losses of 10,000-50,000 birds, in the Danish Kattegat and Waddensea is given. It is concluded that the oil problem has been considerable in Danish waters since 1935, and that in spite of stricter legislation and improved surveillance in recent years, major oil disasters occur with too short intervals - CJC]*
Joensen A.H. & Hansen E.B. 1977. Oil pollution and seabirds in Denmark 1971-1976. Dan. Rev. Game Biol. 10(5): 1-31. *[In English - Danish and Russian summaries; Report contains detailed accounts of oil incidents in the Kattegat in March 1972 and in the Danish Waddensea in December 1972. Numbers of birds shot in oil incidents around Denmark between 1971 and 1975 are listed. Detailed accounts of BBS along the West coast of Jutland in 1973 are given. In*

these surveys, Eider and scoters were most numerous (33% oiled, n= 819). Highest oil rates were found in auks (85%, n= 89), divers (74%, n= 27), and Gannet (71%, n= 17). From questionnaires distributed among Danish hunters, it is concluded that the number of oiled birds declined between 1968/69 and 1975/76 - CJC]

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7.10 Germany

Germany borders the North Sea and Wadden Sea in the Northwest and Baltic waters in the Northeast (figure 7.9). Several different groups have collected data. Beached bird surveys were conducted regularly in the 1950s and 1960s (e.g. Bub & Henneberg 1954, Drost 1959, Goethe 1961, Heldt 1969). Most information is available of the former West German coastline. Hence, most information is available for the North Sea coast. Perhaps the longest scheme was run by Vauk on Helgoland (1960-87; Vauk & Pierstorff 1973, Vauk & Reineking 1980, and annual reports 1980-87). Surveys on the Wadden Sea islands were not as uniformly organized and co-ordinated, but a lot of activities have been going on in recent years (e.g. Becker & Schuster 1980, Kuschert 1981, Hartwig & Drossel 1984, Reineking 1984, Vauk 1984, Vauk *et al.* 1990, Averbeck 1991, Plaisier 1991, Vauk *et al.* 1991). Impressive is the list of publications by Vauk and his colleagues, studying oiled seabirds as 'bio-indicators' of marine oil pollution, including several comprehensive reviews (e.g. Reineking & Vauk 1982, Vauk 1978, 1984a, 1986, Vauk *et al.* 1983, 1987a, 1989c). Since the early 1980s, oil sampling and chemical analysis of oil is a crucial part of the German work (Dahlmann 1984, 1985a, Vauk *et al.* 1987a). Oil is still considered a very important cause of death along the North Sea coast of Germany, but the oil rate is thought to decline in response to improvements made in harbour reception facilities (Averbeck in litt.). The Baltic beaches have been studied occasionally, indicating that chronic oil pollution was widespread in these waters (Kuhlemann 1953, Ecke 1957, Goethe 1961, Müller 1970ab). In recent years, systematic surveys are carried out on a small number of beaches, including oil sampling. The German national co-ordinator is Christiane Averbeck. For the EBBS, 5 subregions and 21 study beaches were identified (figure 7.9). There is considerable interest to participate within the EBBS scheme, but BBS funding in Germany will possibly stop in March 1993.

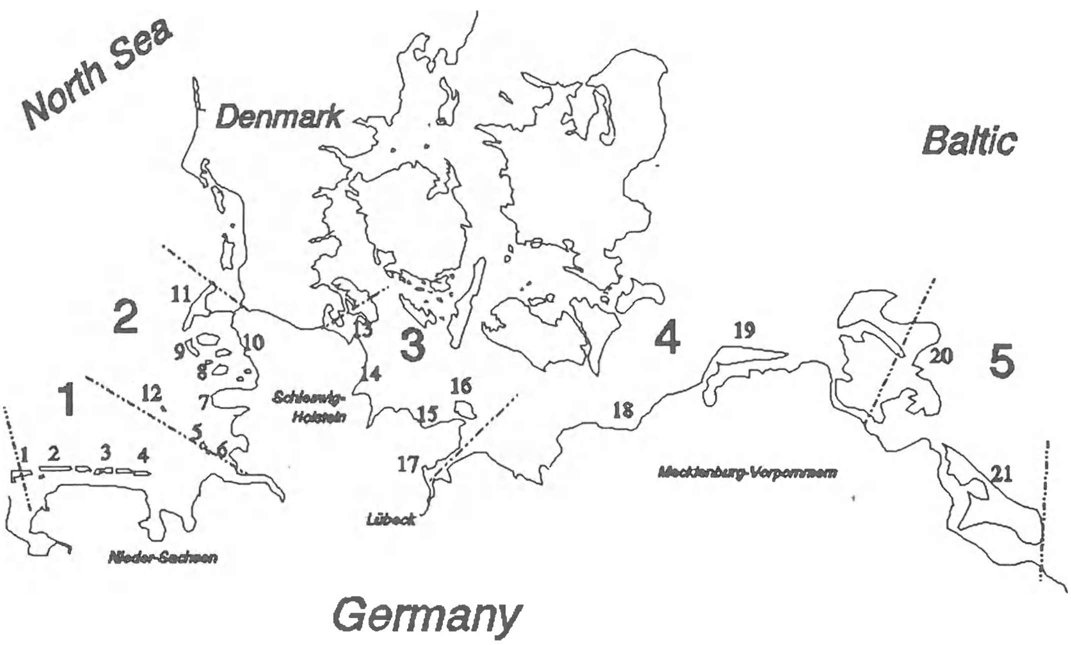

Figure 7.9 Proposed subregions and selected beaches in Germany (Averbeck in litt.).

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Some German key words

Beobachtung(en)	Observation(s)
Erfassung	Count, survey
Küste	Coast (often as der deutschen Nordseeküste = German North Sea coast)
Das Meer	The sea
Öl	Oil (verölung = oil contamination)
Ölopfer	Oil victims
Ölopfer erfassung	Count of oiled birds
Ölpest	Oil pollution (also Ölpestopfer = oil victims)
Ölpestbericht	Report on oiled birds or oil pollution
Ölverschmutzungen	Oil pollution, oil contamination
Schleichende Ölpest	Chronic oil pollution
Spülsaum	Tideline, beach
Tot	Dead (often as tote Vögel = dead birds)
Untersuchungen	Research, study (also Langzeituntersuchung = study over many years)
Verluste	Mortality, die off (often as Vogelverluste = die-off of birds)
Verölt	Oiled
Verschmutzung	Pollution, contamination
Vogel/Vögel	Bird(s) (also Seevogel = seabird)

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numerous (22.5%), followed by Guillemot (19.3%), Common Scoter (11.2%), and Kittiwake (9%). Some 45% of all birds were oiled during these years. Of the auks, 78.3% were oiled. Remarkable is the conclusion that 80% of the oiled birds had oil in the digestive track. Of unoiled birds (n= 1791), 365 specimens were oiled internally. 1846 oil samples from feathers were analysed. Of these, 91.2% were attributed to 'normal' shipping operations (discharges of fuel oil). Only 1.2% of the birds were contaminated with crude oil - CJC]

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7.11 Netherlands

The North Sea washes the Netherlands' mainland coast and Wadden Sea islands (figure 7.10). Surveys have been carried out since the early 1950s (Mörzer Bruijns & Brouwer 1959, Tanis & Mörzer Bruijns 1962, Platteeuw 1987, Camphuysen 1989). Major oil incidents in Netherlands' coastal waters, well documented with respect to seabird strandings, occurred in 1969 (Wadden Sea; Swennen & Spaans 1970) and 1988 (Borcea, Delta area, Camphuysen *et al.* 1988). Many smaller incidents and wrecks have been recorded and documented (Camphuysen 1989). Oil pollution was, and is the major factor responsible for seabird mortality off the Dutch coast. Very high oil rates are found in divers, Fulmar, Gannet, scoters, Kittiwake, and auks. Since 1980, densities of pelagic seabirds on Dutch beaches have increased considerably. Many of these birds were only slightly oiled. Backgrounds of these wrecks have been described and discussed in Camphuysen 1989b and 1990e. Drowning in nets is a minor factor in the Dutch marine environment, but within the IJsselmeer, massive numbers of grebes, cormorants and ducks are known to get entangled and drown. National Beached Bird Surveys (NBBS) in February have been carried out since 1965. Only in 1974, the survey had to be cancelled. From 1965-78, the NBBS was organized by the Netherlands Youth Organisation for Nature Studies (NJN), during 1980-90 by Netherlands Beached Bird Study Group (NSO) and since 1991 by the Dutch Seabird Group (NZG). A survey for 1979 could be compiled using the NSO database. Six subregions were identified: (1) Delta area, (2) mainland coast Zuid-Holland, (3) Noord-Holland, (4) Texel and Vlieland, (5) Terschelling-Rottumeroog, and (6) mainland coast Waddensea area (figure 7.10). NBBS data are included in the IBBS database since 1972. For participation in the EBBS, sufficient experience is available for surveys, dissections and oil sampling schemes.

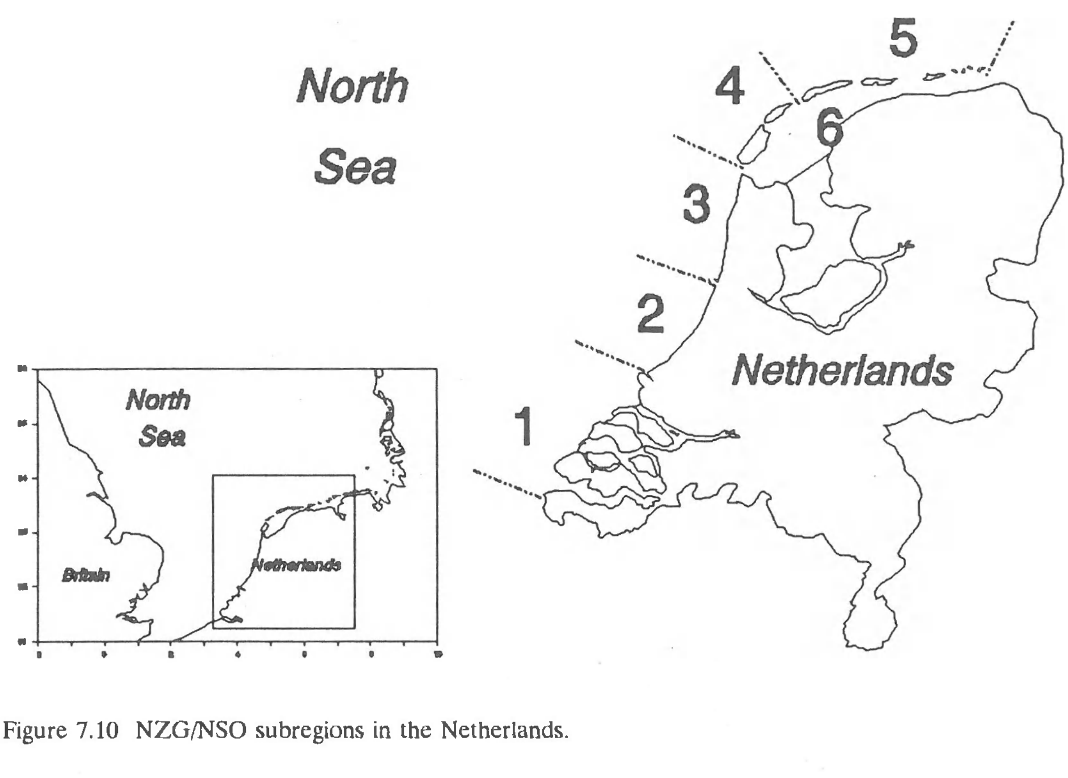

Figure 7.10 NZG/NSO subregions in the Netherlands.

Some Dutch key words

Dood	Dead (often as Dode vogels = dead birds)
Kust	Coast (often as Nederlandse kust = Dutch coast)
Landelijk	National (hence, Landelijke telling = national survey, or Landelijke stookolieslachtoffertelling = national beached bird survey)
Olie	Oil
Onderzoek	Research, study
Ramp(en)	Disaster(s)
Slachtoffer	Victim (hence, Olieslachtoffer/stookolieslachtoffer = oil victim)
Sterfte	Mortality, die off (often as Vogelsterfte = die off of birds)
Stookolie	Fuel oil (often used to indicate just oil)
Stookpiet	Informal term for an oiled bird
Strand	Sandy beach
Stranding	Stranding (also Massastranding = mass stranding)
Teer	Tar (often used to indicate just oil: teerslachtoffers = oiled birds (oil victims))
Telling	Count, survey (hence, Stookolieslachtoffertelling = count of oiled birds)
Verontreiniging	Pollution, contamination
Vervuiling	Pollution (hence, Olievervuiling = oil pollution)
Vogel(s)	Bird(s)
Vondst(en)	Find (usually means 'birds found' with a species name following as 'vondsten aan duikers' = divers found)

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Swennen C. & Spaans A.L. 1970. De sterfte van zeevogels door olie in februari 1969 in het Waddengebied. Vogeljaar 18: 233-245. *[In Dutch - English summary; Report of one of the more dramatic oil incidents in the Netherlands. Following a discharge of oil just north of the Waddensea islands, tens of thousands of birds were killed in the Waddensea. Some 14,564 corpses were recorded, with Eider (4591) and Common Scoter (8580) as most numerous species. It was estimated that between 35,000 and 41,000 birds were killed in this incident - CJC]*

Tanis J.J.C. & Mörzer Bruijns M.F. 1962. Het onderzoek naar stookolievogels van 1958-1962. Levende Nat. 65: 133-140. *[In Dutch - No summary; Results of BBS in the Netherlands during 1958-62 (2542 km, 57 species, 4953 oiled corpses). Most numerous were Common Scoter (1570), Kittiwake (248), Razorbill (406), and Guillemot (1325). Unoiled birds were not included in the analysis. Results of experiments to assess the time a corpse can be found on the beach are given. On average, a corpse will stay 25 days on the beach - CJC]*

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Zoun P.E.F., Baars A.J. & Boshuizen R.S. 1991. A case of seabird mortality in the Netherlands caused by spillage of nonylphenol and vegetable oils, winter 1988/89. Sula 5(3): 101-103.

Zoun P.E.F. & Boshuizen R.S. 1992. Gannets victim to spillage of lubricating oil and dodecylphenol in the North Sea, winter 1990. Sula 6(1): 29-30.

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7.12 Belgium

Beached bird surveys in Belgium started in the 1960s, roughly at the same time as in the Netherlands, and were often carried out in close co-operation. As a matter of fact, Belgian volunteers often surveyed the Delta area and often surveyed considerable parts of Northwestern France (Blankena & Kuyken 1967, Kuyken & Zegers 1968). Reviews of longer series of data from Belgium were published by Kuyken and Verboven (Kuyken 1977, 1978, Verboven 1979). In the 1970s and the 1980s, the Belgian interest in BBS was reduced, or at least surveys were no longer co-ordinated nationally. Belgium did not participate in the IBBS, and it is still unclear whether or not any surveys were carried out in these years. Several papers on mass strandings in the 1980s showed that there were still activities going on (e.g. van Gompel 1981, 1984, Verboven 1985, van Gompel 1987). Since 1991/92, the national co-ordinator for beached bird surveys in Belgium is Patrick Meire of the Institute of Nature Conservation in Hasselt. Surveys are organized using the 67 km long coastline bordering the southernmost tip of the North Sea as one single subregion, but one 16.5 km long stretch is visited weekly (Nieuwpoort-Oostende; figure 7.11). Interest is shown in participation within an extended monitoring scheme (EBBS) and Belgium has joined the IBBS again in 1992.

Address Patrick Meire, Instituut voor Natuurbehoud, Kiewitdreef 3, B-3500 Hasselt, Belgium.

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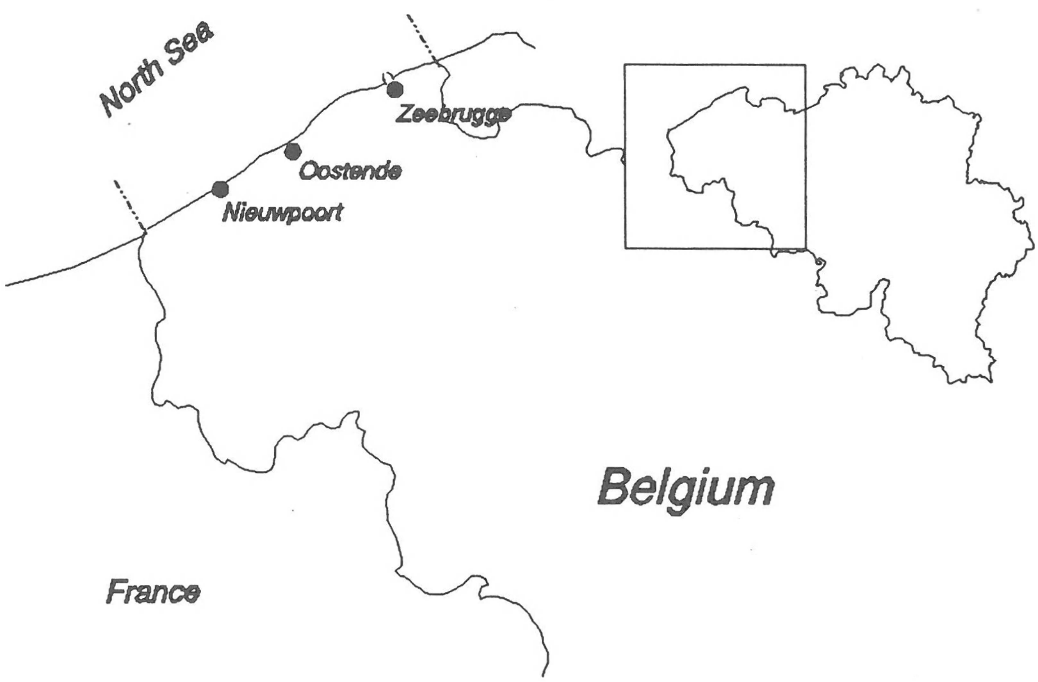

Figure 7.11 Belgian coastline and study area Oostende - Nieuwpoort.

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——— 1985. Stookolieslachtoffers aan de Belgische kust gedurende winter 1983-1984. Wielewaal 51: 2-9. *[In Dutch - French and English summary; Irregular weekly surveys between late Nov 1983 and late Mar 1984. 641 corpses were found, with Common Scoter (37), Kittiwake (115), Razorbill (85), and Guillemot (285) as most numerous species. 76% of the birds oiled - CJC]*
Verboven W. 1978. Internationale Stookolietellingen 25-26 februari 1978, verslag. Porzana 5(3-4): 20-30.
Vergaerde J. 1982. Manifestatie tegen de zeevervuiling. Vogeljaar 30(2): 67-68.
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7.13 Orkney and Shetland Islands

Standardised, monthly beached bird surveys were started in Orkney in March 1976 and Shetland in March 1979, in response to concern over the potential impact of oil industry activities on the seabirds of the region (Heubeck, Meek & Suddaby 1992). Survey methods are fully described in Jones (1980) and Heubeck (1987). The (monthly) Shetland and Orkney surveys are year-around. In Shetland surveys are on, or in the week following the last Sunday in each calendar month, in Orkney in the week following each full moon. The choice of beaches was planned to monitor the effects from the oil terminals at Flotta in Scapa Flow, Orkney and at Sullom Voe in Shetland (figure 7.12). In Orkney, most surveyed beaches were in the Southern half of the islands, while in Shetland beaches were scattered around the islands. Examples of publications for Shetland are Heubeck (1987, 1991), for Orkney Meek (1982, 1983), and for a combination of the two archipelago's Heubeck, Meek & Suddaby (1992). Apart from a three year period which followed the opening of the oil terminals at Flotta and Sullom Voe, the oil rates in auks in the islands were considerably lower than recorded in the Southern North Sea. Massive wrecks of (unoiled) auks have been recorded in the 1980s (Heubeck 1991b, Harris *et al.* 1991, Heubeck & Suddaby 1991, Heubeck, Meek & Suddaby 1992).

Addresses (Shetland) Martin Heubeck, University of Aberdeen, c/o Skelberry, Mansefield Dunrossness, Shetland ZE2 9JH, UK;
(Orkney) Erik (R.) Meek, RSPB Orkney Officer, Smyril Stennes, Orkney, UK

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——— 1980. Scenic in Shetland. Mar. Poll. Bull. 11: 58.

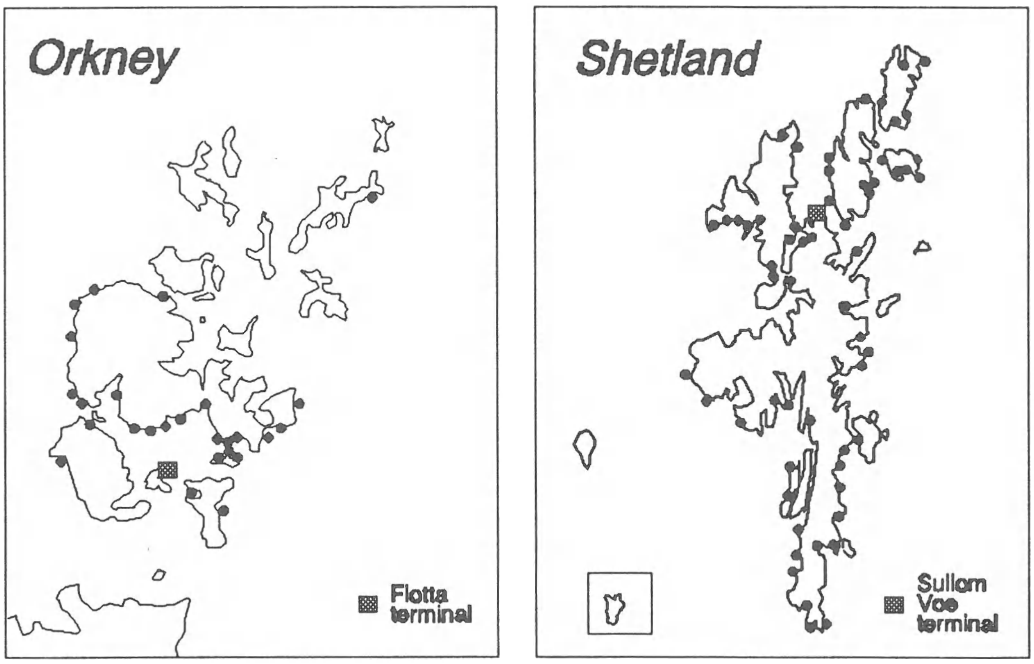

Figure 7.12 Selected beaches in Orkney and Shetland (from Heubeck, Meek & Suddaby 1992).

Harris M.P., Heubeck M. & Suddaby D. 1991. Results of an examination of Puffins Fratercula arctica washed ashore in Shetland in winter 1990-91. Seabird 13: 63-66.

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—— 1979b. Seabirds and recent oil pollution. Shetland Bird Report 1978: 47-51.

—— 1979c. Report to Shetland Oil Terminal Environmental Advisory group on Beached Bird Survey scheme in Shetland July to December 1978. Report to SOTEAG, Lerwick 9 p.

—— 1980. A Report to the Shetland Oil Terminal Environmental Advisory group on the Beached Bird Survey scheme in Shetland March 1979 to February 1980. Report SOTEAG, Lerwick 20 p.

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—— 1986. A Report to the Shetland Oil Terminal Environmental Advisory group on the Beached Bird Survey scheme in Shetland March 1985 to February 1986. Report to SOTEAG, Lerwick 39 p.

—— 1987. The Shetland Beached Bird Survey 1979-1986. Bird Study 34: 97-106. *[In English - English abstract; Results of 7 years of monthly BBS in Shetland (March 1979-February 1986). Most numerous were Guillemot (4979 corpses, 25.7% of all birds found, 15.6% oiled), Fulmar (3791, 19.6%, 6.9% oiled), Kittiwake (2942, 15.2%, 3.1% oiled), Herring Gull (1488, 7.7%, 3.9% oiled), Shag (1101, 5.7%, 6.6% oiled) and Great Black-backed Gull (1064, 55%, 3.2% oiled). Seasonal patterns and time trends are described. Most oil pollution was considered to have originated from offshore sources, particularly to the East of Shetland - CJC]*

—— 1990. The Shetland Beached Bird Survey, March 1987 - February 1990. Rep. Shetland Oil Term. Env. Adv. Group, Univ. Aberdeen, Aberdeen.

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—— 1992. The occurrence of dead auks on Shetland beaches, March 1979 to February 1992. *In* K. Osborn, Shetland bird report 1991, p. 94-103. Shetland Bird Club, Lerwick.

Heubeck M. & Dymond J.N. 1987. The Shetland Beached Bird Survey, March 1986 - February 1987. Report to SOTEAG, Lerwick 30 p.

Heubeck M., Meek E. & Suddaby D. 1992. The occurrence of dead auks (Alcidae) on beaches in Orkney and Shetland, 1976-91. Sula 6(1): 1-18. *[In English - Dutch summary; A review of auk strandings in Orkney (1976-91) and Shetland (1979-91). Oil rates were comparatively high in the late 1970s, in coincidence with the opening of the Sullom Voe oil terminal in Shetland, and the Flotta terminal in Orkney. Since winter 1981/82, repeated Guillemot wrecks have been witnessed on both archipelagos. Wrecks of Razorbill were recorded in Feb 1983, spring 1990, and winter 1990/91, Little Auks wrecked in winter 1990/91, together with Puffins. Another mass stranding of Puffins was witnessed in Jan/Feb 1984. Oil rates in auks were 8% in Puffin, 12% in Guillemot, 15% in Razorbill, 13% in Black Guillemot, and 17% in Little Auk - CJC]*

Heubeck M. & Richardson M.G. 1980. Bird mortality following the Esso Bernicia oil spill Shetland December 1978. Scott. Birds 11(4): 97-108. *[In English - English summary; Some 1174 tonnes of heavy fuel oil leaked into the sea from the 190,000 tonne tanker Esso Bernicia when it struck the jetty at Sullom Voe Terminal, just one month after opening the terminal. Between 31 December 1978 and 13 March 1979, 3702 oiled birds were recorded, including 49 species. Particularly affected were Great Northern Diver (146), Shag (683), Eider (570), Long-tailed Duck (306), Guillemot (336), and Black Guillemot (633). These species made up over 85% of the observed mortality - CJC]*

Heubeck M. & Suddaby D. 1991. Post-mortem examination of Little Auks *Alle alle*, Shetland, December 1990. Seabird 13: 51-53.
Jones P.H. 1980. Beached birds at selected Orkney beaches 1976-8. Scott. Birds 11(1): 1-12. *[In English - English summary; Report on (roughly) monthly BBS in Orkney between Mar 1976 and Feb 1978. Seasonal patterns are described and explained. Most numerous oiled birds were Guillemot (403, 47.1% oiled) and Razorbill (108, 51.9% oiled). Numerous, but mainly unoiled, were Fulmar (378, 0.8% oiled), Herring Gull (291, 0.7% oiled), and Kittiwake (765 ()omitting juveniles Jul-Oct), 0.9% oiled) - CJC]*
Lea D. 1979. The Orkney beached bird survey. Bull. Orkney Fld. Cl. 3: 8-9.
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Sage B.L. 1979. Disaster at Sullom Voe. New Scientist 82(1151): 183-184.
Tinker T. 1975. Oil and seabirds: storm off Shetland. New Scientist 67(958): 131.

7.14 British mainland and Northern Ireland

In Britain, co-ordinated beached bird surveys were set up in the 1960s, in response to the activities in Belgium and the Netherlands. Similar to these countries, stranded oiled seabirds had received attention already for many years before that (e.g. Gray 1871, Anonymous 1922, Wild 1925, Adam 1936, Brown 1959). The stranding of the Torrey Canyon obviously was a great stimulus for co-ordinated beached bird surveys, and oiled seabirds received worldwide public attention. Following the Torrey Canyon wreckage, many reviews were published (listed separately). British experts were involved in investigations in the Amoco Cadiz incident in France in 1978 (Jones *et al.* 1978, 1982ab; see Amoco Cadiz list) and the mass mortality following an oil discharge in the Skagerrak (Stylis incident) in 1981 (e.g. Blake 1983, Anker-Nilssen *et al.* 1988; see list for Norway). In 1972, the IBBS was set up, co-ordinated by the Royal Society for the Protection of Birds (RSPB). A very large number of publications, including IBBS results and reports on oil incidents, appeared from the early 1970s to 1985 after which the nationally co-ordinated scheme was discontinued. Interesting papers are Bourne (1969), Bourne & Bibby (1975), Andrews & Standring (1979), Stowe (1982), Baillie & Stowe (1984), Stowe & Underwood (1984). Within the RSPB, Jane Sears is currently responsible for any activities around beached bird surveys. Only if BBS are included (again) on the list of 'high priorities', the RSPB may join a European monitoring scheme. However, the British Trust for Ornithology expressed its interest to act as UK co-ordinator for this project (David Hill in litt.). BBS have continued in Highlands, West Scotland and NE England. In recent years, Highland beaches were surveyed once monthly between November and February. Jane Sears suggested to adopt the earlier subregion division in 6 parts, including the NE, SE, S, SW and NW regions plus Northern Ireland (figure 7.13). Study plots have been proposed by the RSPB as South Devon, North Norfolk, Northumberland and Moray Firth (Sears in litt.).

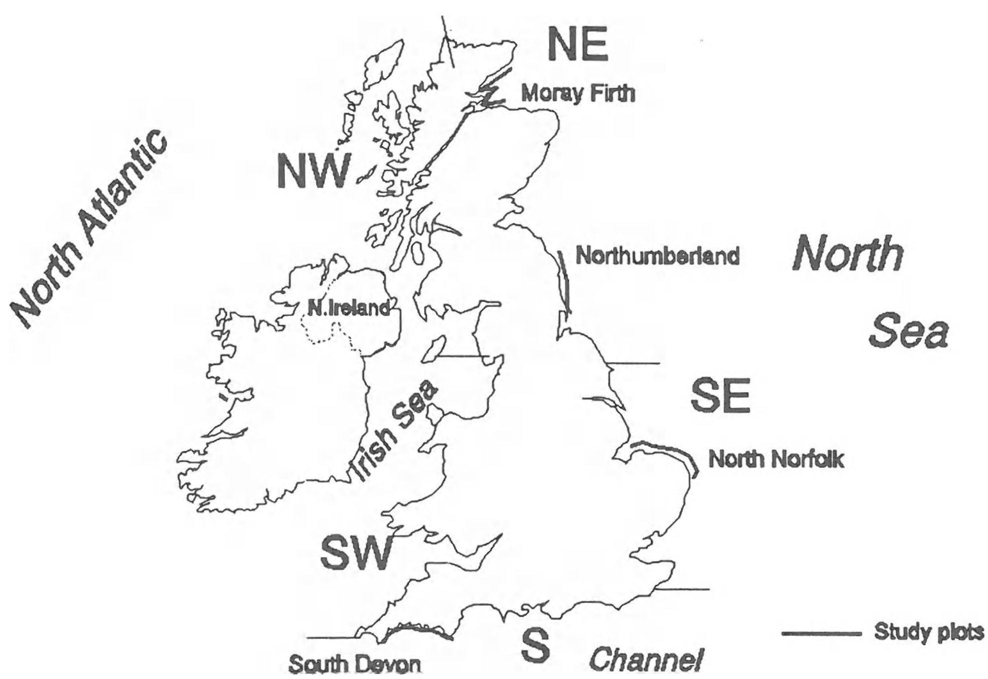

Figure 7.13 Subregions and study areas (thick solid lines) in Britain, excluding Orkney and Shetland (Sears in litt.).

Addresses UK Dr Jane Sears, Royal Society for the Protection of Birds (RSPB), The Lodge, Sandy Bedfordshire SG19 2DL, UK or
Dr David A. Hill, British Trust for Ornithology (BTO), The Nunnery, IP24 2PU Thetford, Norfolk, UK

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Bibby C.J. & Lloyd C.S. 1977. Experiments to determine the fate of dead birds at sea. Biol. Conserv. 12: 295-309.
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Bourne W.R.P. 1965. The weather, oil, and seabirds cast ashore. Seabird Bull. 1: 42-43.
——— 1968a. Observation of an Encounter between Birds and Floating Oil. Nature 219: 632.
——— 1968b. Oil pollution and bird populations. *In* J.D. Carthy & D.R. Arthur, The biological effects of oil pollution on littoral communities. Field Studies (Suppl.) 2: 99-121.
——— 1968c. Arctic auks on the Scottish coast. Scott. Birds 5: 104-107.
——— 1969a. The Birdkill in the Irish Sea. Seabird Rep. 1969(1): 5-6.
——— 1969b. Chronological list of ornithological oil pollution incidents. Seabird bull 7: 3-9.
——— 1971. The Threat of Oil Pollution to North Scottish Seabird Colonies. Mar. Poll. Bull. 2: 71.
——— 1972a. Ducks die in the Forth. Mar. Poll. Bull. 3(4): 53.
——— 1972b. Dewdale Oil Spill. Mar. Poll. Bull. 3(5): 66-67.
——— 1974a. Eiders and oil pollution. Mar. Poll. Bull. 5: 53-54.
——— 1974b. Guillemots with damaged primary feathers. Mar. Poll. Bull. 5(6): 88-90.
——— 1974c. Scotched birds. Mar. Poll. Bull. 5(4): 52.
——— 1975a. Birds and oil. Br. Birds 68(5): 216.
——— 1975b. Warren Springs Laboratory Cause First North Sea Oil Pollution Incident. Mar. Poll. Bull. 6(9): 132-133.
——— 1976. Seabirds & pollution. *In* R. Johnston, Marine Pollution, p. 403-502. Academic Press, London.
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——— 1977b. Oil kills North Sea birds. Mar. Poll. Bull. 8(8): 173.
——— 1977c. Oil Pollution in N.E. England. Mar. Poll. Bull. 8(4): 73-74.
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Torrey Canyon (Land's End, 1967)

The *Torrey Canyon* was a Liberian oil tanker, 297m in length, sailing from Mina al Ahmadi, Kuwait, to Milford Haven, Wales. On Tuesday 14 March 1967, after passing between Tenerife and the Grand Canary Island, the Torrey Canyon's course was set at 018°, in order to pass 5 nautical miles (nm) West of the Scilly Isles, which were then about 1400 nm away. When the Scilly Isles were detected on the radar, on Saturday 18 March, the vessel was several miles east of her intended track, but there was plenty of time for correction to compensate for this displacement. Course was altered in order to pass through the five-mile-wide passage between the Scilly Isles and Seven Stones Reef. At 08.50 GMT, the ship grounded on Pollard Rock, Seven Stones Reef, about 7 nm North-east of the Scilly Isles (figure 7.14). At the time of the stranding, the ship was fully loaded with over 199,000 tonnes of crude oil. A number of cargo tanks were ruptured on the impact and crude oil began to spread around the vessel immediately (after Couper 1983).

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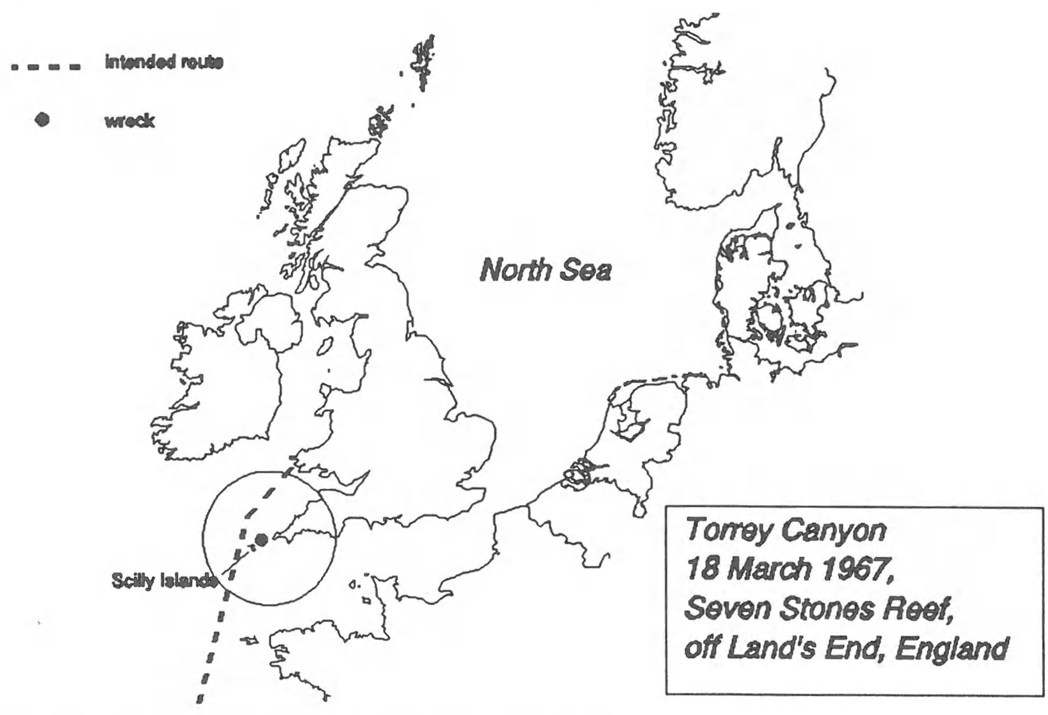

Figure 7.14 Stranding of Torrey Canyon off Land's End, March 1967.

7.15 Republic of Ireland

Irish coastal waters include the North Atlantic in the West, the Celtic Sea in the South and the Irish Sea in the East. Very little is known about beached bird surveys and related activities in the Republic of Ireland. Obviously, some serious oil incidents occurred in Irish waters or nearby, including the Key Trader incident in 1974, and the Betelgeuse incident in 1979 (Cross *et al.* 1979). After a small start in 1973 and 1974 (10 and 26 km respectively), Ireland participated in the IBBS as organized by the RSPB (1973-85; Stowe 1982, Underwood 1983-85, Partridge 1986). O'Keeffe (1978) reported on the first full-scale BBS, which was held in winter 1977/78, and finished the paper by expressing the hope that the BBS could be made an annual event. The Irish coast was then divided into 5 subregions, including 'East' (counties Louth, Meath, Dublin and Wicklow), 'South-east' (Wexford and Waterford), 'South' (Cork, Kerry, and Limerick), 'West' (Clare, Galway and Mayo), and 'North-west' (Sligo, Leitrim, and Donegal). It is currently not known if any surveys were conducted in Ireland after 1985, when the RSPB gave up co-ordination of the IBBS.

Address No contact address available.

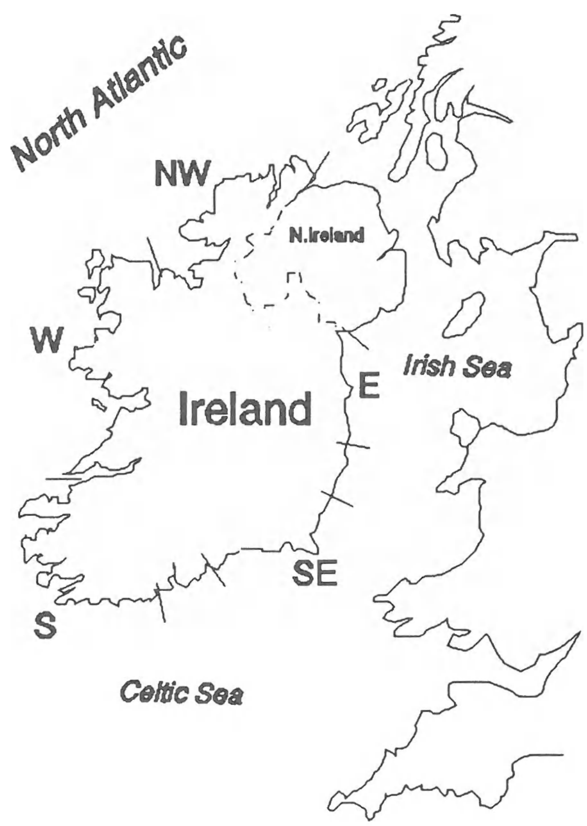

Figure 7.15 Subregions in Ireland (after O'Keeffe 1978).

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O'Keeffe C. 1978. Oil pollution and seabirds on Irish coasts. Irish Birds 1(2): 206-211. *[In English - no summary; Report on the first full-scale BBS in Ireland, held in four weekends (Dec 1977, Jan, Feb, and March 1978). Some 943 km were covered and 162 birds were found of which 25.9% were oiled. Guillemots and Razorbills were the species most frequently found oiled, and in many cases were heavily oiled, while 25% of the oiled birds were gulls. From this survey, it was concluded that mortality of marine wildlife due to oil in Irish waters appears to be low - CJC]*
Partridge K. 1986. International beached bird survey, dead birds found February 1985. Unpublished data summary, Royal Society for the Protection of Birds, Sandy.
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7.16 France

In France different groups have been running BBS schemes in Brittany and Normandy. Pascal Raevel has offered to act as a national co-ordinator for the Groupe d'Etudes en Ecologie Numérique et Statistique Appliquée à l'Environnement (Eco-Num) in Villeneuve d'Ascq (Univ. de Lille), in co-operation with Christophe Aulert and B. Lang of the Groupe Ornithologique Normand, Université de Caen, in Caen. With 8 designated study areas, France seems ready for participation in an EBBS (Raevel in litt.): (1) Northern France (Côte d'Opale), (2) Normandy, including Côte de Nacre, (3) Britanny, Côte Sauvage and Côte d'Emeraude, (4) Vendée - Côte d'Amour, (5) Aquitaine, Côte d'Argent and Côte Basque, (6) Languedoc/Roussillon, Côte vermeille and Côte d'Améthyste, (7) Provence - Côte d'Azur, (8) Corsica (figure 7.15). Total coast length is 5,533km (35% sandy beaches, 28% rocky beaches, 24% coastal marshes and mudflats, 13% cliffs). Without islands, islets and estuaries total coast length is 3120 km (North Sea 75km, The Channel 1045km, Atlantic coast 615km, Mediterranean 1385 km; figure 7.15). Beached bird surveys have been carried out on many places, at least since the late 1960, but particularly along the coasts of Northwestern France (Brittany, Normandy, Channel and North Sea coast). The stranding of the Amoco Cadiz received worldwide attention and the effects were carefully studied and documented (see separate list). Brittany was also hit by slicks from the Torrey Canyon, some ten years earlier. Several papers on the effect in seabird colonies on Les Sept Iles following these to oil incidents were published. In the French list, as presented below, 10 important references were selected and summarized by Pascal Raevel (PR).

Address Pascal Raevel, Groupe d'Etudes en Ecologie Numérique et Statistique Appliquée à l'Environnement (EcoNum), Villeneuve d'Ascq (Univ. de Lille), c/o Résidence du fief, Route d'Hazebrouck, F-59270 Bailleul, France.

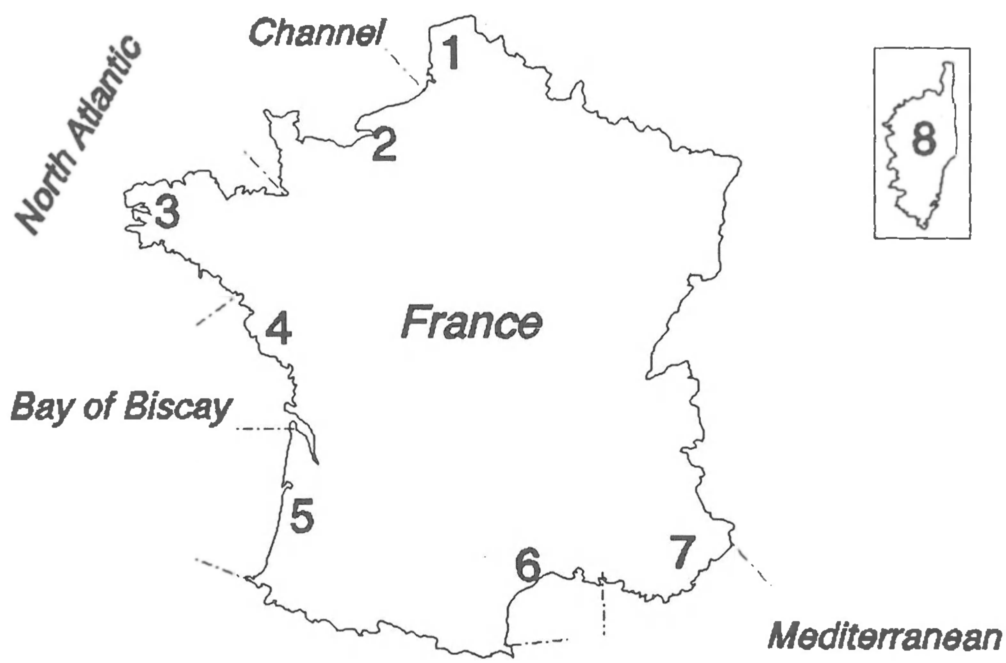

Figure 7.16 Subregions in France (proposed, Raevel in litt.).

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Bargain B., le Floc'h P. & Thomas A. 1986. Oiseaux échoués. Penn Ar Bed 16(1) 120: 1-32. [*In French - no English summary; This article summarizes briefly the results obtained in Britanny in 4 years of IBBS. The average density was 1.7 birds/km during this 4-year study. The highest %-oiled were found in Guillemot (75%), Razorbill (65%), Gannet and divers (>50%), and Puffin (45%). The main part of this article deals with a kind of 'wide public' field guide for the identification of dead birds on beaches; A copy may be obtained at S.E.P.N.B., B.P. 32, F-29276 Brest Cedex, France - PR]*
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——— 1984. Les décomptes d'oiseaux échoués: 1974-1982. Cormoran Special issue: 1-3. [*In French - no English summary; This article presents and discusses briefly the results of the 9 first years of IBBS in Normandy. The five top species are Guillemot, Razorbill, Herring Gull, Black-headed Gull, and Kittiwake; A copy may be obtained from Groupe Ornithologique Normand, c/o Université de Caen, F-14032 Caen Cedex, France - PR]*
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Some French key words

Echoués	Stranded, beached
Littoral	Tideline, coast
Marée noire	Oil washed ashore
Marins	Marine (hence, oiseaux marins = seabirds)
Mazout	Fuel oil
Mortalité	Mortality, die off
Mort	Dead (hence, des oiseaux morts = dead birds
Oiseaux	Birds
Recensements	Counts, survey
Relevé	Review
Trouvé	Found (oiseaux trouvé morts = birds found dead)

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Amoco Cadiz (Brittany, 1978)

The *Amoco Cadiz* was a Liberian oil tanker, 334m in length, sailing from Kharg Island, Iran, to Rotterdam, Netherlands, via Lyme Bay, English Channel (figure 7.16). The Amoco Cadiz was fully loaded with crude oil, part of which was for discharge at Lyme Bay. On the morning of 16 March 1978, she passed through the traffic separation scheme off Ushant, Brittany, though her exact path is uncertain. At 09:46 GMT the steering gear system failed in a rough sea with a strong South-westerly wind, about 8 nautical miles (nm) off Ushant. The engine was stopped and radio warnings were transmitted that the ship was not under command, but outside assistance was not requested. The engineers on board tried to repair the steering gear. At 11:20 GMT, the engineers reported failure in repairing the steering gear, for in the heavy seas the rudder swung about and could not be locked for them to carry out the work. The captain radioed for tugs. The tug *Pacific* responded promptly and arrived at the ship at 12:20 GMT. The tug could not stop the Amoco Cadiz drifting away and the anchor did not hold either. At 21:00 GMT, the Amoco Cadiz struck ground off Portsall and the ship was doomed only two hours later. The entire cargo was lost and the resulting pollution was far in excess of the previous worst case, i.e. the Torrey Canyon (after Couper 1983).

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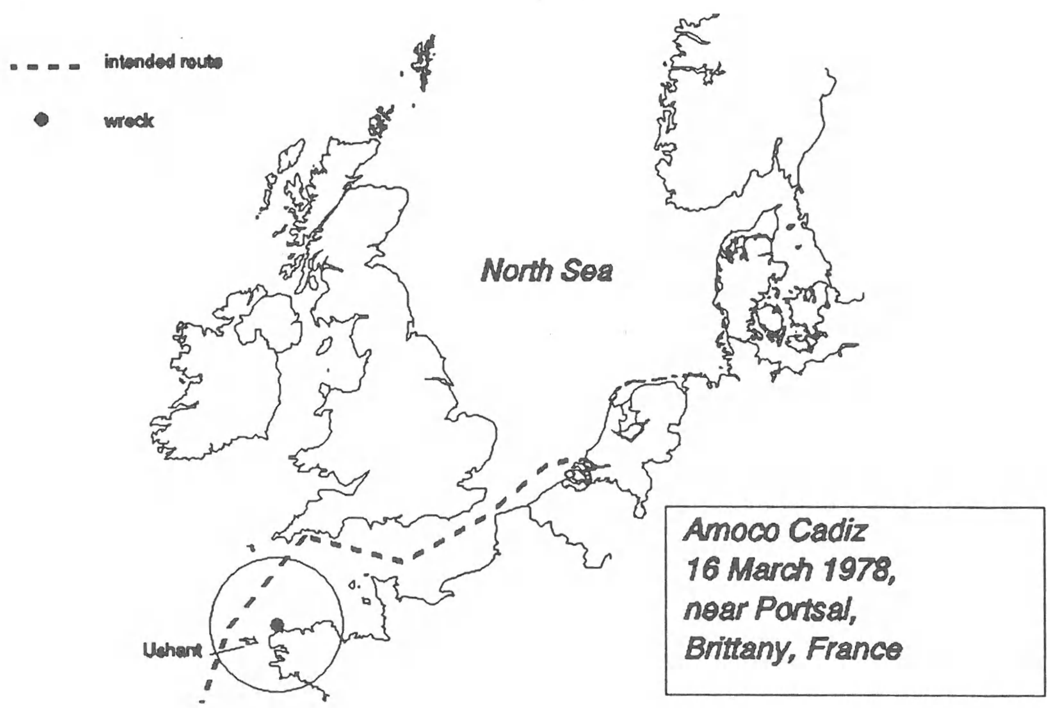

Figure 9.17 Stranding of Amoco Cadiz off Portsall, Brittanny, March 1978.

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7.17 Spain

Beached bird surveys in Spain are currently organized by Francisco Arcos, national co-ordinator for the Grupo Ibérico de Aves Marinas (GIAM) in Vigo, Spain. For the IBBS of 1990 and 1991, surveys were conducted in Guipuzcoa, Bizcaia, Cantabria, Asturias, Coruña, Pontevedra, Huelva, Cadiz, Málaga, Murcia, Valencia and Castellon, Tarragona, Barcelona, and Gerona. Most local co-ordinators showed considerable interest in the EBBS proposals, while several seem able to extend their activities to collect data on a monthly basis (Guipuzcoa, Bizcaia, Cantabria, Asturias, Coruña, Pontevedra, Huelva, Malaga, Valencia and Castellon, and Barcelona), to join an oil sampling programme, and to do dissections on a regular basis (Arcos in litt.). Subregions for an EBBS programme have been proposed by Fransisco Arcos, including (1) Pais Vasco (provinces Bizkaia and Guipuzkoa, split from subregion 2 because of periodic cleaning of beaches), (2) Pais Vasco to Cabo de Estaca de Bares, (3) Estaca de Bares to Cabo Touriñán, (4) Cabo Touriñán to river Miño estuary (Portuguese border), (5) Portuguese border to Punta de Tarida, (6) Punta de Tarifa to Cabo da Gata, (7) Cabo da Gata to Cabo de la Nao, (8) Cabo de la Nao to French border (figure 7.17). The Balearic islands and the Canary Islands will be considered as separate subregions (9 and 10 respectively). The information about earlier surveys is extremely scant. Spain participates in the IBBS since 1980 (Stowe 1982). Only for 1989, no data were received at Ornis Consult (Skov in litt.). Many of the reports listed below were internal publications, of which copies may be obtained from or via:

Address Francisco Arcos, Grupo Iberico de Aves Marinas, Insp. Costera de Orilladas (ICAO), Apdo. 317, E-36200, Vigo (Pontevedra), Spain.

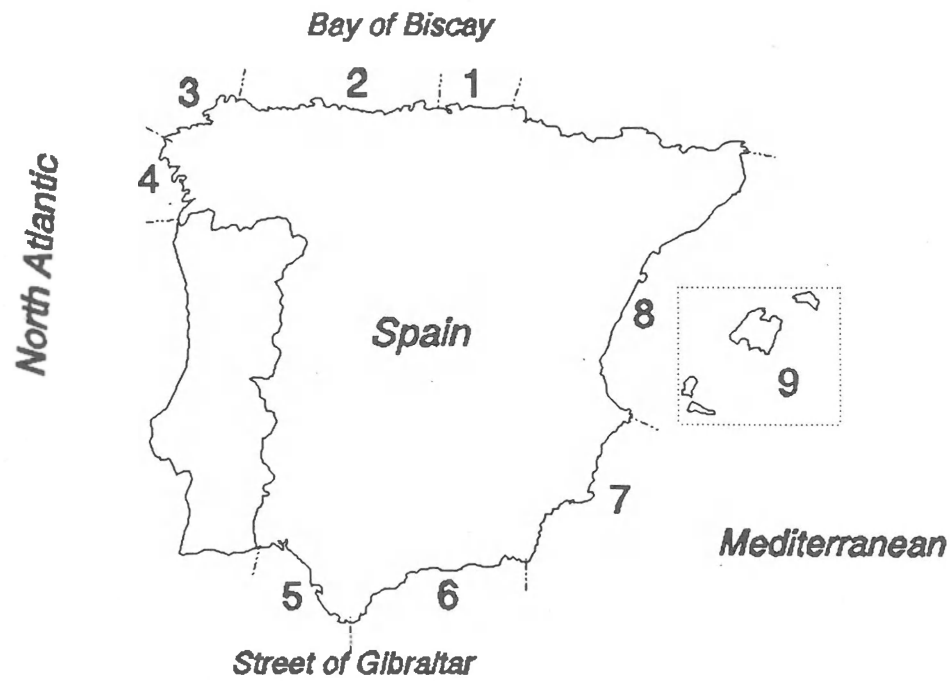

Figure 7.18 Iberian peninsula and subregions in Spain (Arcos in litt.).

Some Spanish key words

Ave(s)	Bird(s)
Causa de la muerte	Cause of death
Contaminación	Pollution
Costa	Coast
Cuerpos/cadáveres	Corpses/Carcasses
Encontrar/recoger	Found
Edad (de las aves)	Age (of birds)
Fecha(s)	Date(s)
Grado de petroleado	Amount of oil (Nulo = clean, leve = slight, alto = heavy)
Grandes pegotes	Big patches of oil on the beach
I.C.A.O.	Inspección costera de aves orilladas = beached bird survey
I.C.A.P.	Inspección costera de aves petroleadas = oiled beached bird survey
Inspección	Survey
Kms recorridos	Kilometres surveyed
Línea alta de marea	High tide line
Línea baja de marea	Low tide line
Muertas	Dead
Mortalidad	Mortality
Número de playas/tramos	Number of beaches/sections
Petróleo	Oil
Petróleo pringoso	Greasy oil (referring to oil on the beach)
Pequeñas bolas	Small tar bolls (referring to oil on the beach)
Playas/tramos costeros	Beach/coast sections
Playa	Beach
Restos/alas	Bird remains/wings
Superficies contínuas	Continuous surface (referring to oil on the beach)
Total aves	Total birds
Víctima	Victim
Viento(s)	Wind(s)

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7.18 Portugal

The Portuguese coast borders the North Atlantic Ocean. Beached bird surveys commenced in the early 1980s (Teixeira 1985c), but the interest for stranded seabirds was not in the first place because of problem with oil pollution, but rather because of considerable numbers of Razorbills drowning in fishing nets (Teixeira 1985d, 1986b) and seabird wrecks (Teixeira 1987). Portugal participated in the IBBS in 1984 and 1985 (RSPB unpublished data), and again in the early 1990s. Beached bird surveys in Portugal are currently organized by José Pedro Granadeiro and Mário Silva of the Serviço Nacional de Parques, in co-operation with Walter Gomes, co-ordinator for Quercus in Porto. The Portuguese coast is some 700 km long, with 450-500 km accessible for surveys. Surveys are organized monthly, between October and March, but only between Nazaré and Lagos, using 3 subregions (figure 7.18). The beaches are selected because there are some important upwelling areas nearby, and because these beaches have the longest retention time (Granadeiro in litt.). There has been no oil sampling in connection with beached bird surveys, but dissections have been carried out opportuinistically. For all seabirds, less than 10% were oiled and there have been only few serious oil incidents in Portuguese waters during the last 10 years. Gill nets pose a problem in some areas, but the impact has not been adequately assessed for the whole area. The most recent publication is dealing with surveys in winter 1990/91 (Granadeiro & Silva 1992), while an important review of the earlier Portuguese work can be found in Teixeira (1986c).

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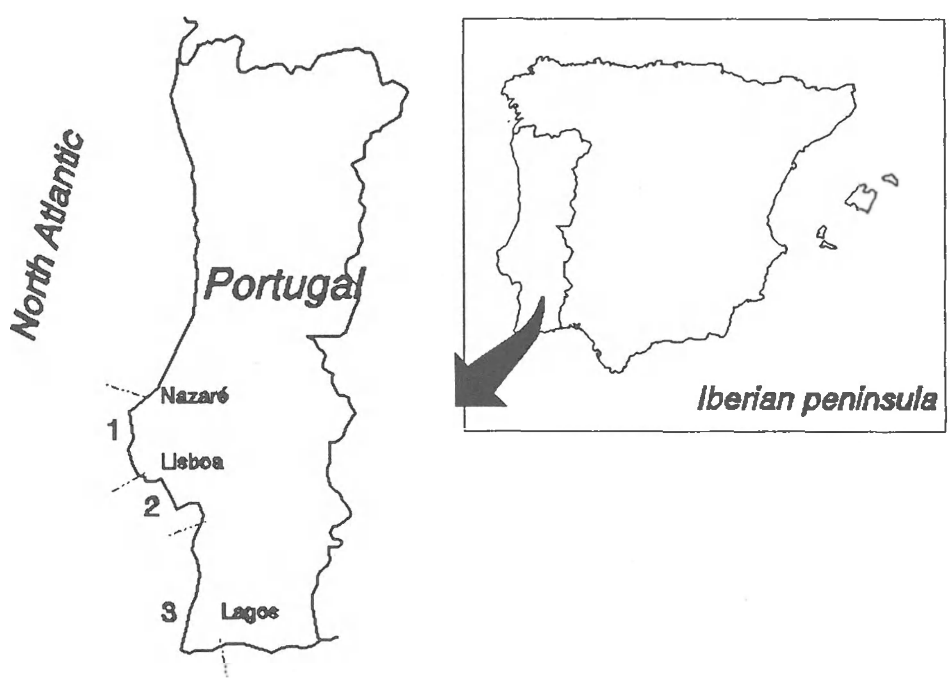

Figure 7.19 Subregions in Portugal (according to Granadeiro & Silva 1992).

Some Portuguese key words

Arrojamento	Stranding/wreck
Ave	Bird
Ave Marinha	Seabird
Costa	Coast
(ave) Emalhada	Entangled (bird)
Inspecções	Coastal surveys
Invetigação / Estudo	Research / Study
Morto	Dead
Petróleo	Oil
Poluição	Pollution
Redes de emalhar	Gill nets
Troço arenoso	Sandy stretch

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7.20 General papers

There is an enormous wealth of publications on oil pollution and oil induced mortality of marine birds. In the next list, it is tried to include the more important reviews, methods papers, publications dealing with the rehabilitation of oiled seabirds, non-mineral oils and other lipophilic substances, and results of chemical analyses of samples from beaches.

General

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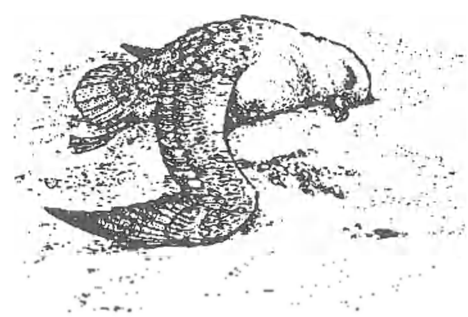

Beached Fulmar *Fulmarus glacialis* (F.J. Maas)

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8. DISCUSSION

Beached bird surveys and oil pollution

The objective of the project *Oiled Seabirds and Oil Pollution* was to answer the question whether beached oil victims can be used as indicators for levels of marine oil pollution in the bordering seas. Various examples of beached bird surveys over the last thirty years support the overall conclusion that indeed birds are adequate monitors of marine oil pollution (chapter 4.1). Natural factors, such as wind, ambient temperatures or food shortages, may cause strong variations in densities of corpses found on beaches. However, when data are analysed carefully, the oiling rate among such corpses proves to be a rather stable figure, that is characteristic for particular species or regions, and most importantly for pollution levels at sea.

Examples of analyses of beached bird survey data show that marine oil pollution has not declined significantly in the Southern and Eastern North Sea or in the Channel area. In these areas, the proportions of oiled seabirds are so high that larger accidental oil spills may remain unnoticed in the constant stream of illegal 'operational' oil discharges from ships and offshore industry. Only chemical analysis of oil samples can then trace the various sources of oil pollution. However, there are also examples where beached bird surveys demonstrate that locally, policy measures to reduce oil pollution have been successful.

In the Northwestern North Sea, most notably in Orkney and Shetland, but also along the mainland coast of East Scotland, oil pollution increased following the opening of oil terminals in the two archipelagos. Regional authorities were successful in their attempts to discourage visiting tankers to discharge oil just before entering the terminals. As a result, oil pollution in Orkney and Shetland is presently at a rather low level, with fluctuations of oil rates on beached birds in response to the few oil-incidents still occurring in the area. Hence, the massive seabird populations of the North Scottish coast and islands are now relatively safe, at least for chronic oil pollution.

Oil pollution in the Baltic proper was a most serious threat to the millions of waterfowl and seabirds during the 1950s, 1960s, and 1970s. Particularly of the Long-tailed Duck *Clangula hyemalis* and Common Scoter *Melanitta nigra*, very large numbers were killed in oil incidents and from chronic oil pollution in the region. The information on recent years is still incomplete, but strongly points in the direction of a substantial cleaner Baltic Sea in terms of oil pollution. The Baltic was designated as a Special Area when MARPOL 73/78 Annex I came into force in 1983. A further evaluation of BBS data from the Baltic is required to investigate the possible positive effects of the Special Area status.

A very recent example of a succesful local policy to reduce marine oil pollution may develop in the German part of the North Sea. In this area, that has a long history of very high oiling rates of seabirds, new measures have been taken, most importantly the provision of free port reception facilities in harbours. In a few years time, oiling rates among seabirds have declined strongly. Such a decline is definitely not consistent with trends in the Netherlands or Denmark, where free port reception facilities do not exist and where oiling rates of seabirds continue to be very high.

Marine pollution by oil may originate from a variety of sources. Therefore, control measures to limit the discharge or escape of oil from ships, however restrictive they may be, would not completely eliminate marine pollution by oil. In the North Sea (Denmark, Germany and Netherlands), pilot studies in the early 1990s have shown that heavy fuel oils from ships, illegally discharged under MARPOL 73/78, are the most important type of oil found on bird corpses and beaches. Locally, crude oils occur more frequently (most notably at the entrance of the Skagerrak, in Northern Denmark). Hence, if measures to eliminate illegal discharges from ships are successful, an immediate effect on oil rates on beached birds in this region may be expected. However, when monitoring the effectiveness of these measures, insight in oil types, to assess the source of pollution, is essential. Chemical analysis of oils (and other substances) is therefore an essential part of a future integrated monitoring programme (chapter 4.2).

Comparisons have been made between the results of aerial surveillance and BBS as monitoring schemes for oil pollution. Both schemes, as currently organized, provide information on source and scale of oil pollution but are complementary rather than overlapping. The distribution of oil slicks at sea is obviously best studied from an aircraft. However, the limitations of remote sensing equipment to detect slicks from the air, particularly in more windy conditions, do lead to a number of 'surprises' on the beach. Moreover, crews from ships can easily adapt to the aerial surveillance, by discharging oil in wind force 5 or more or during holidays and weekends, when the chance to be detected is very small. The effect of oil pollution can best be studied in BBS. When coupled with systematic (oil) sampling of oiled birds or birds with a disrupted plumage, BBS provides a better idea of sources of marine oil pollution, and also of the scale and frequency of pollution wih non-mineral oils and chemicals (chapter 4.3).

Beached bird surveys and seabird mortality

To assess the impact of oil pollution on seabird populations, much more detailed information is required than BBS provide. In the past, the mere comparison of trends was considered sufficient to validate the conclusion that oil-induced mortality was an insignificant threat to seabird populations. Although the stress on individual birds was acknowledged, the fact that many colonies expanded and populations increased was considered a clear demonstration of the fact that these populations could cope with annual winter losses of many tens of thousands of birds due to oil pollution.

In fact, the damage of oil pollution on seabirds, if any, was overshadowed by another factor influencing population-size. An overwhelming food supply in the 1970s, and the contraction of wintering populations into areas with low levels of chronic oil pollution, led to a much better 'wintering success' of pelagic seabirds in the North Sea. In the 1980s, massive wrecks of seabirds were witnessed, while the Southern North Sea gained importance as a wintering area for these birds. Apparently, food supplies were reduced in the Northern North Sea. The weakened birds entering the Southern North Sea, with its very high levels of marine oil pollution, died by the thousands between November and April. Detailed investigations were necessary to assess the origin, age, sex, and condition of the wrecked birds. Several colonies, from which these wrecked birds originated, experienced reductions in recruitment of new breeders into the breeding stock and these populations declined despite a consistently high breeding success.

Discussing the value of BBS, it was acknowledged that surveys (i.e. counts of corpses on beaches and the assessment of oil rates) alone are an insufficient tool to study seabird mortality. When coupled with systematic dissections, studies of factors responsible for the observed mortality, and studies aiming to trace the origin of the beached birds, results become considerably more conclusive. When these data are collated with other information (e.g. seabird distribution at sea, population trends in colonies, recruitment into the breeding stock, breeding success), the impact of oil pollution on seabirds can be evaluated (chapter 5).

Standard BBS methods and data exchange

During three workshops, BBS methods have been discussed, together with the system of international data transfer as currently used for the IBBS scheme. Particularly the data transfer was a source of errors and proposals to improve the system have been adopted (spreadsheet and standard form for data transfer). The opportunity was taken to compare methods in different countries and to standardize these where possible. Especially the methods concerned with oiling rates needed standardization, and proposals are put forward in this report. The planning of surveys was studied and priorities were identified for timing and spacing of surveys (Nov-Apr, monthly surveys; subregions and study areas) As a result, a new monitoring programme will have a European network of highly comparable sets of data.

Special investigations, coupled with BBS, were discussed at the same time. The examples in this report clearly illustrate the wealth of information that can be derived from systematic dissections and increased efforts to study the origin of beached birds. There is a general agreement that these investigations should not be too detailed, unless there are very good reasons to do so. Pathological and veterinary research, DNA studies and the analysis of organs for organochlorines or heavy metals, as a standard routine on beached birds, are not recommended. Instead, a 'low-budget' dissection system of target species, in which sex, age, physical condition, diet and cause of death are studied routinely, are very valuable. A knowledge of age, sex and origin of the birds involved in mortality incidents is important in contexts of conservation and of population biology. When birds are not collected for dissection, special investigations on the beach include notes on plumage of corpses which are not collected, again to try and assess age and sex of the birds and to helf identifying the origin (using colour phase proportion, bridling, subspecies, etc.). For both, dissections and plumage investigations on beaches, specialists are needed. Obviously, in the volunteer networks, many very keen ornithologists participate. However, using volunteers is rather unreliable when the quality of the data has to maintain a certain standard over time. Hence, professional input in a monitoring programme is required, not only for carrying out the surveys within study areas, but particularly for these special investigations and for proper sampling, of corpses and oil alike (chapter 6).

Current activities in Europe: base-line data

The current status of BBS in Europe has been described in chapter 7. To collect and collate all these data was a rather unique exercise that has shown how vast the amount of base-line data in fact is. At the start, the extensive literature of Britain, France, Germany and the Netherlands was pretty well known. However, very encouraging, it appeared that also in countries like Spain and Poland BBS schemes are maintained with a fair number of relevant publications. Obviously, there is a lot of expertise and base-line information available around Europe. Moreover, most countries showed a keen interest in future co-operation.

In chapter 7, base-line data are available in the form of 'current status' descriptions and lists of publications. Clearly, this is only a step in the right direction. In some countries, BBS information is readily available, as papers, comprehensive reports, or as computer file. In others, a bit of work needs to be done to summarize the data and to write a current status report. Many of the papers listed are very difficult to obtain, indeed, many were previously unknown to foreign countries. The contact addresses, listed in the accounts and in appendix D, may be of use in this respect. The future requires a proper data exchange, with regular updates of status reports and bibliographies by national co-ordinators. One very important task of the international co-ordinator of a future BBS monitoring programme will therefore be a frequent contact with all national co-ordinators and the preparation of updates of chapter 7 from this report.

Possibilities for future monitoring

There is little doubt about the value of BBS data coupled with special investigations and oil sampling to evaluate the current state of the sea in terms of oil pollution. In fact, there is some monitoring going on already, in the form of many independent BBS schemes and even with international co-operation within the IBBS scheme. One of the short-comings of the present situation is that the information obtained is not directed towards the authorities in a way that action can be undertaken.

In the next chapter, a monitoring programme is proposed. The structure of this monitoring programme is such, that the information becomes available in a format that can be used by politicians and governmental bodies. The first aim is an analysis, year after year, of the state of the sea with respect to oil pollution and changes therein. Therefore, data have to be channelled through a number of procedures and discussions which lead to high quality and clear conclusions which can be used for future management decisions.

9. PROJECT PROPOSAL FOR MONITORING MARINE OIL POLLUTION AND SEABIRD MORTALITY: THE EUROPEAN BEACHED BIRD SURVEY

A European beached bird monitoring project (further abbreviated EBBS), as proposed here, should consist of a number of individually run beached bird survey schemes in European countries or (larger) regions. At least the current International Beached Bird Survey (IBBS; see chapter 6) should be continued with it. EBBS aims to collect data from a number of countries ('participants' in the EBBS scheme), to store these in a central European database and to produce an annual report. It is a monitoring programme, meant to investigate trends in marine oil pollution as it can be recorded on the beach, as an aid for (future) policy decisions. The strong point of the scheme should be a regular feed-back of information: a data exchange and stimulation between countries, and up to date information supply and evaluation of results for governmental bodies and politicians. Hence, the 'product' of the EBBS programme is an annual evaluation of the situation (annual report) and, whenever possible, advice to set further steps to eliminate the oil problem rising from illegal discharges.

The first proposal of European co-ordination was to set up a regular exchange of data which are already collected and to stimulate further research in BBS schemes (Camphuysen 1991b). However, most countries rely on volunteer networks for surveys. Since the maintainance of a large scale monitoring project in the longer term is essential to answer questions now rising (Anonymous 1990, Anonymous 1991, and Final declaration 3rd International Conference Protection North Sea, Den Haag, March 1990), and because schemes based totally on volunteers tend to ebb and flow in response to oil incidents or mass strandings, professional co-ordination is inevitable. Whether further personnel is needed, depends on the components of research included in the project. Detailed studies in study plots, dissections, selection of birds and oil to be collected on beaches, chemical analysis of oil samples, and the analysis of data require experienced ornithologists and/or chemists.

With EBBS, an international co-ordinator is required and a central database is to be set up and maintained. For standardization in chemical analysis of oil samples, one central, specialized and experienced laboratory is preferred. A steering committee, including a number of national co-ordinators, the international co-ordinator and a representative from the laboratory, will be formed to discuss and analyse the results and plan further procedures. A monitoring project should run at least a number of years to provide the information needed. The project is meant to be international in terms of co-operation ànd funding. There will be an overall budget, with funds raised from common sources (e.g. EC, industry, ...), but participants will have their own national budgets and will have to raise part (*c.* 50%) of their funds on a national basis.

In this chapter, the framework of the monitoring project and the different research components are discussed in detail. Finally, after an analysis of the financial requirements, three possible EBBS scenarios are proposed.

9.1 General framework: research components and study areas

The framework of an EBBS monitoring programme consists of (a) fieldwork, (b) research in laboratories, and (c) data analysis. The following components can be considered separately within this framework:

(a) (1) Monthly recording stranded seabirds on beaches
(2) Collecting selected species on study plots;
(3) Routine oil sampling;
(b) (4) Dissection of corpses;
(5) Oil analysis;
(c) (6) Data analysis;
(7) Production annual report.

Of these components, 1-4 are the responsibility of the participants (national BBS schemes). The analysis of oil samples (5) will be centralized in one or few experienced laboratories. National co-ordinators will obviously analyse their own data and probably produce (annual) reports or other publications. However, more important within the EBBS scheme is a thorough check of the data and data transfer to the international database. The international co-ordinator is responsible for the centralized analysis of data and, together with a steering committee, for the production of the annual EBBS report.

Recording beached birds

Beached Bird Surveys have mainly been carried out by networks of volunteers. However, running a BBS in a month for the EBBS programme can either mean a 'full' national survey (sampling all subregions sufficiently with the volunteer network), or a survey of study areas (surveying and sampling fixed areas with experienced ornithologists), or both at the same time. The quality of the data and the continuation of the surveys over the years in fixed areas cannot be guaranteed with volunteers alone. A professional national co-ordinator is required to organize continuity if surveys and to fill gaps in field surveys. The quality demands of the EBBS scheme require further professional input by field-assistants for surveys and sampling in study areas. These study areas have to supply the core of the EBBS data, with supplementary information from volunteers elsewhere. If small numbers of volunteers are to be activated, the national co-ordinator and the field assistant may be one and the same person, or the contracts may be on a part time basis. Obviously, when just a 50km study area is surveyed, perhaps even without volunteers, less time is needed for co-ordination and planning. In most countries, it does not make sense to organize a full BBS in summer (chapter 6), while a 'general look-out' for oil incidents in these months can be maintained with little effort. The cost for the volunteer network will include a compensation for travel expenses. The national co-ordinator will have to spend time on the planning, organization and supervision.

Field assistant

Collecting birds, special investigations beaches, oil sampling, and dissections

When corpses or oil are collected on the beach in the study area (or rather 'sampled'), a skilled ornithologist is required (field-assistant). The same is true for systematic dissections (see chapter 5). Hence, for surveys and sampling in each study area, 1 full time field assistant is needed during the field work season (on contract basis 6 months per year). The national co-ordinator will have to spent some of his/her time on the planning and supervision. Besides salaries, further costs include consumables and travel expenses.

National co-ordination, data analysis and output

The information has to be computer processed and stored into a national database, meteorological data have to be collected from meteorological institutions, preliminary reports should be prepared (essential feed-back to volunteers). According to the questionnaire which was completed by the participants in the Glasgow workshop, the standard computer should be IBM-compatible, with Lotus 1-2-3 or dBase as application software. National co-ordination is estimated to occupy one person *c.* two months, for each month of field work. Besides a salary for the co-ordinator, costs include travel expenses, housing, computer facilities, and consumables.

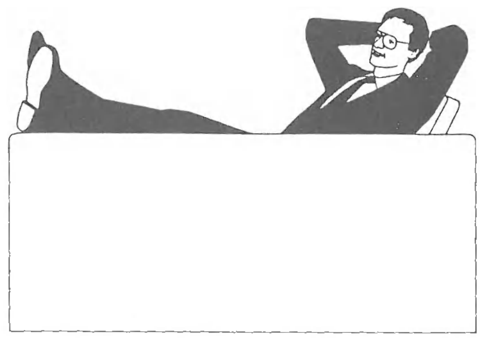
National co-ordinator

Oil analysis

Assuming 100 samples per year to be collected per country, and a total estimate of 1000 samples to be analysed per year, required are 1 engineer (12 months, full time), 1.5 technician (12 months, full time), and 0.1 scientist (12 months, 1/10 time; estimates from Bundesamt für Seeschiffart und Hydrographie, Hamburg (BSH)). Besides salaries, costs include depreciation of durable equipment, consumables, travel expenses and additional costs for the management of the laboratory (maintainance, administrative expenses etc.). During the project it should be evaluated regularly whether or not 1000 samples per annum is a sufficient sample, or whether additional funding is required.

International co-ordination

An international co-ordinator should stimulate activities in the different countries and assist during fund raising procedures. If, at the start of EBBS, only a number of European countries was able to participate, he or she should try and expand the scheme further. The international co-ordinator will set up and maintain an international database, supervise the project, organize and chair annual workshops/meetings with a steering committee, consisting of national co-ordinators of at least five North Sea countries, and will be responsible for the output of the project: the annual EBBS report and evaluation of results. This international annual report will be compiled by a the international co-ordinator and the steering committee. The report should preferably also include, or at least discuss, results from aerial surveys for oil slicks (governmental input).



International co-ordinator

Subregions and proposed network of study areas

Each country is asked to divide its coastline into a number of subregions, mainly using geographical characteristics (see proposals and current situations as described in chapter 7). A network of study areas, selected from these subregions, will be used in Western Europe for detailed, systematic studies on seabird strandings and oil pollution. Sampling of oil and corpses will be organized in study areas. All corpses of birds will be identified as to the lowest taxon, and (where possible) routinely aged and sexed in the field using plumage characteristics (age, sex, plumage, phase) by skilled ornithologists (field assistant or national co-ordinator). The network of study areas is the core of the monitoring project: relatively few people are needed to collect high quality data, while densities and proportions oiled can be compared (and checked for representativity) with the larger dataset as result of volunteer input in a wider area. As an absolute minimum, one *c.* 50 km study area should be chosen at every 500 km of coastline. In the below scenarios (chapter 9.4), several densities of networks are worked out. The minimum is one study area in each country (hence, insufficient coverage in larger countries), the maximum includes a larger number of study areas in larger countries. It should be realised that, particularly when study areas in countries are far apart, one field assistant may be needed per study area. In table 9.1 and figure 9.1, a proposal for a study area network is given. It should be realized, that as yet, there is no firm agreement on the distribution of study areas. Some are proposed by the national co-ordinators themselves, others are chosen by the author to fill in gaps. It was tried to choose study areas in places where activities had been going for a while (baseline data; e.g. Poland, Rogaland, Shetland & Orkney, Netherlands, Helgoland), or where local groups are known to be very active (e.g. South Devon, Moray Firth). In this proposal, the North Sea is 'covered' in ten study areas. This sea area is considered highest priority for the EBBS scheme. The Channel, second highest on the priority list, is studied in two plots, the Baltic and the Atlantic seaboard in six, and the Western Mediterranean in two study areas.

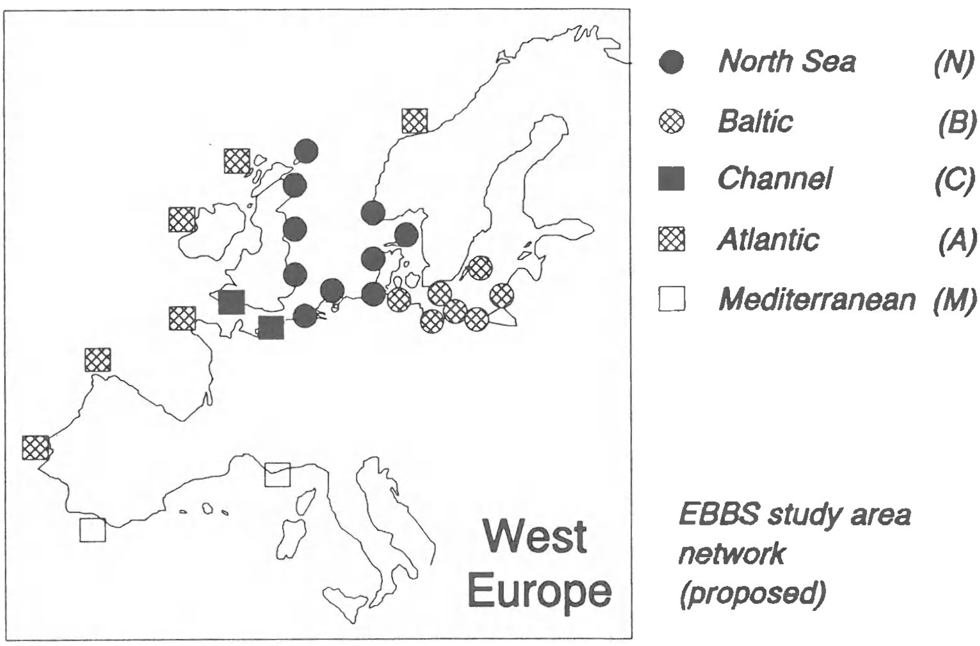


Figure 9.1 Proposal for a study area network in the North Sea, Channel area, Baltic, along the Atlantic coast and in the Western Mediterranean (see table 11.1).

Table 9.1 Proposal for study area network in Western Europe

North Sea (N)	
Orkney & Shetland (figure 9.9)	UK
Moray Firth (figure 9.10)	UK
Northumberland (figure 9.10)	UK
North Norfolk (figure 9.10)	UK
Belgian coast (figure 9.8)	Belgium
Noord-Holland, Texel & Vlieland (subregions 3 & 4; figure 9.7)	Netherlands
German Bight (plots 5-12; figure 9.6)	Germany
Danish West coast (plot 2, Ringkøbing county; figure 9.5)	Denmark
Danish North coast (plots 5-7, Blokhus-Skagen; figure 9.5)	Denmark
Rogaland and Lista (figure 9.1)	Norway
The Channel (C)	
Northern France (subregion 1; figure 9.11)	France
South Devon (figure 9.10)	UK
Baltic (B)	
Gotland (figure 9.2)	Sweden
Bornholm (figure 9.5)	Denmark
Kieler Bucht (plots 13-17; figure 9.6)	Germany
Rügen & Usedom (plots 20-21; figure 9.6)	Germany
Polish Baltic coast (plots 3-10; figure 9.4)	Poland
Zatoka Gdanska (plots 11-21; figure 9.4)	Poland
Lithuanian coast (subregions 1, 2 & 3; figure 9.3)	Lithuania
Atlantic seaboard (A)	
Vega, Vikna & Haroey (figure 9.1)	Norway
Western Isles, Scotland (subregion NW; figure 9.10)	UK
Ireland, West coast	Ireland
Brittany (subregion 3; figure 9.11)	France
Estaca de Bares to Cabo Touriñán (subregion 3; figure 9.12)	Spain
SW Portuguese coast (subregions 1-3; figure 9.13)	Portugal
Western Mediterranean (M)	
Punta de Tarifa to Gabo da Gata (subregion 6; figure 9.12)	Spain
Provence to Côte d'Azur (subregion 7; figure 9.11)	France

9.2 Organizational structure of EBBS

Proposed priorities in survey planning

Beached bird surveys are organized in subregions (1-10 per country) and study areas. The latter are highest priority for the EBBS project. The EBBS could include monthly national surveys (complete surveys in all subregions), which is a lot of work and requires massive volunteer input, or it could only include monthly surveys in study areas, or a combination of both. The work to run a BBS in a given month is represented by 4 boxes in figure 9.2:

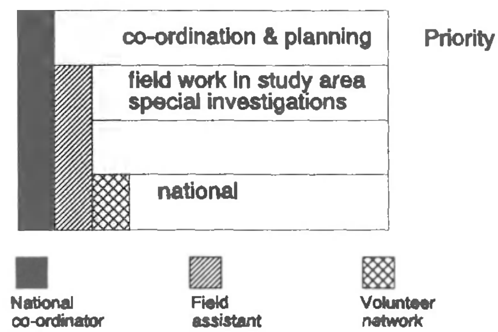


Figure 9.2 Research components for a BBS scheme in a given month.

(1) national co-ordination and planning,
(2) surveys and special investigations on beaches in study areas, including sampling of birds and dissections by professionals (nat. co-ordinator/field assistant),
(3) oil sampling in study areas (nat. co-ordinator/field assistant), and
(4) counts on the beach in all other subregions by volunteers.

It is considered that the organization of 1-4 is the responsibility of the national co-ordinator, activities 2-4 are the work for a field assistant within a study area (on contract for the duration of a season's work), and 4 is work for the volunteer network outside study areas. The data analysis and the contribution to the EBBS annual report are the responsibility of the national co-ordinator. Countries can participate if any of these activities are organized, while priority has to be given (in descending order) to:

(1) national survey in February (continuation of IBBS)
(2) systematic surveys in study plots (including detailed notes on birds found; professionals: nat. co-ordinator/field assistant)
(3) systematic oil sampling in study areas (professionals: nat. co-ordinator/field assistant)
(4) surveys in other subregions Nov-Jan, Mar-Apr (volunteer network)
(5) dissections of collected birds (professionals: nat. co-ordinator/field assistant)

If participation, either with professional work in study areas or with surveys by volunteers in other subregions, is not possible in all months, the priority ranking for Nov-Apr is: (1) Feb, (2) Jan, (3) Mar, (4) Dec, (5) Apr, (6) Nov. The current proposal is to organize monthly surveys in study areas (professional input, BBS, oil sampling, special investigations) between November and April, coupled with routine surveys of volunteers in (all) other subregions at a more variable level. A complete national survey is organized in late February as the continuation of the current IBBS programme (mainly volunteer input, oil sampling and special investigations only by professionals in study areas).

In figure 9.3 this proposal is illustrated, following the presentation of figure 9.2. Country A represents a country participating in all proposed activities (full national survey February, field assistant surveying study area, bird and oil sampling, and dissections Nov-Apr in study area, volunteers involved in routine BBS during Nov-Apr). As examples of other possibilities for participation within an EBBS scheme, B represents a country which is unable to organize anything in November and April, C is a country in which a volunteer network is maintained (and co-ordinated), but where professional input in a study area (including detailed investigations, oil sampling, and

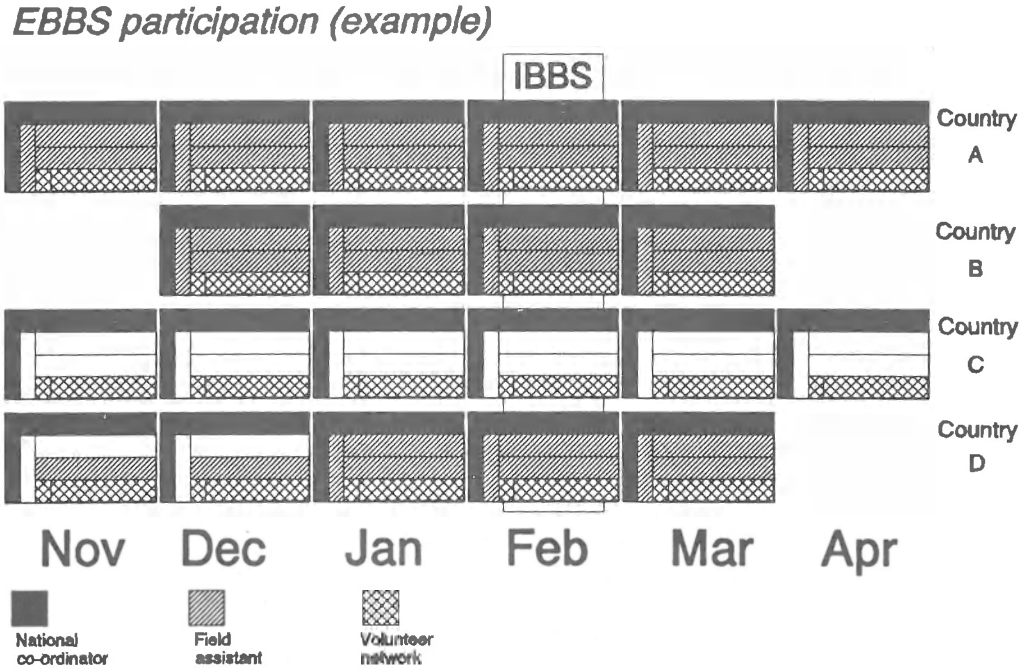


Figure 9.3 Examples for participation in an EBBS scheme (see figure 9.1 for conventions).

dissections) was impossible; hence, excluding the employment of a field assistant), and D is a mixture, with full participation Jan-Mar, no field assistant Nov-Dec, but oil sampling by the national co-ordinator, and no any activities in April.

Participants

It will be tried to include some 19 countries/regions within the EBBS scheme (table 9.2). So far, 14 countries/regions have agreed to try to participate in the EBBS scheme (* in table 9.2) whenever possible, that is when sufficient funds can be raised. In some countries, BBS networks are only just set up (e.g. Estonia, Lithuania), in others there are established schemes (e.g. Orkney & Shetland, Portugal, Spain, France, the Netherlands, Germany, Denmark, Norway). In the Netherlands, with its long established scheme, activities will cease and volunteer networks disintegrate if no immediate action, that is sufficient funding for professional co-ordination, is undertaken. In Britain, as yet there is no final decision as to who will take the lead in national co-ordinatorship (either the RSPB again, or the BTO). However, in most countries there is a keen interest for future co-operation and most organizations are either still running satisfactory, or in a condition that volunteer networks can be re-activated, or that new activities are easily set up. A more comprehensive description of past and current activities is given in chapter 7. The expertise, which is esstential for a high quality EBBS, is available, at least in all countries where contacts have been established (listed in table 9.2). Contact addresses, as used during this project, are listed in appendix D.

Organization

The organization of an EBBS monitoring programme is summarized in figure 9.4. Shown is one box as an example of an independent national organization (NBBS), the route of samples and data. The final output for external use, i.e. an annual EBBS

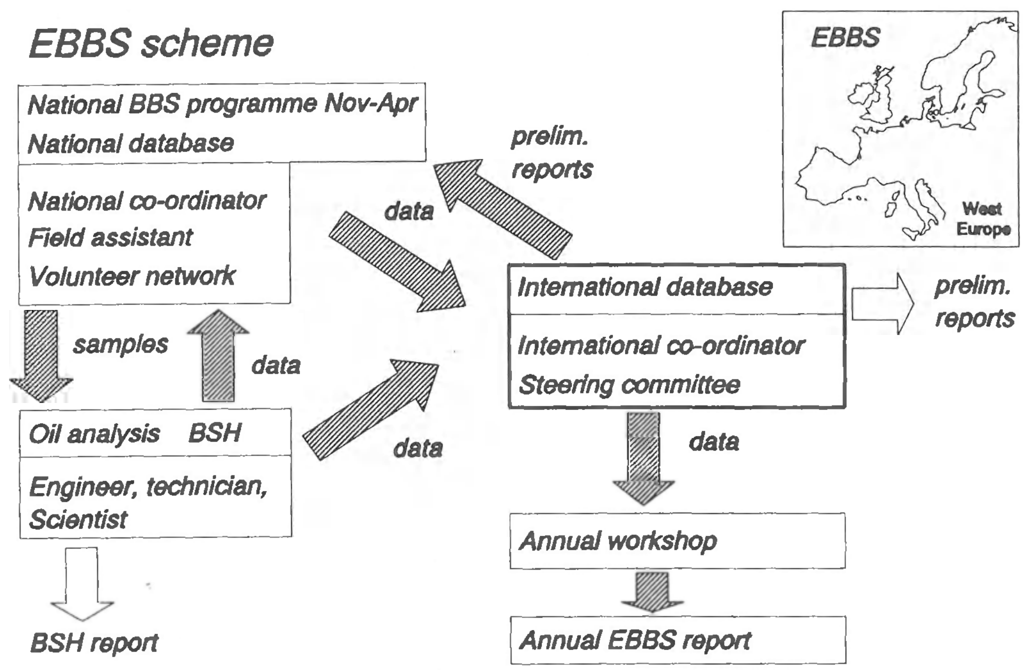
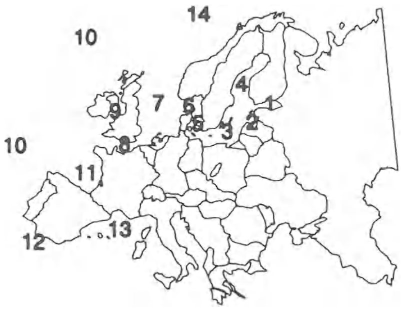


Figure 9.4 Organization, data and sample transfer, and output in the proposed EBBS scheme.

Table 9.2 Possible participants in the EBBS in Europe

Nation/region	Sea/ocean	Contact
Faeroe islands,	(10)	Bergur Olsen
Orkney & Shetland *,	(7, 10)	Martin Heubeck/Erik Meek
Britain[1] *,	(7, 8, 9, 10)	Jane Sears RSPB/David Hill BTO
Ireland,	(9, 10)	
Norway *,	(7, 14)	Kolbjørn Skipnes, Arne Follestad
Sweden,	(3, 4, 5, 6)	Sven Blomqvist
Finland,	(1, 3, 4)	
Russia,	(1)	
Estonia *,	(1, 2)	Vilju Lilleleht
Latvia *,	(2, 3)	Aleksey Kurockin
Lithuania *,	(3)	Gediminas Vaitkus
Poland *,	(3)	Włodzimierz Meissner
Denmark *,	(3, 5, 6, 7)	Henrik Skov
Germany *,	(3, 7)	Christiane Averbeck
The Netherlands *,	(7)	Kees Camphuysen
Belgium *,	(7)	Patrick Meire
France *,	(8, 10, 11, 13)	Pascal Raevel
Portugal *,	(10)	José Pedro Granadeiro
Spain *,	(10, 11, 12, 13)	Francisco Arcos

(1) Scotland, England, Wales & Northern Ireland; exluding Orkney & Shetland



Sea areas: (1) Gulf of Finland, (2) Gulf of Riga, (3) Baltic, (4) Gulf of Bothnia, (5) Kattegat, (6) Skagerrak, (7) North Sea, (8) The Channel, (9) Irish Sea, (10) North Atlantic, (11) Bay of Biscay, (12) Street of Gibraltar, (13) Mediterranean, (14) Norwegian Sea.

report, will include an evaluation of the results and recommendations for further measures to reduce the impact of oil pollution on seabirds. The annual report is in the first place meant to inform politicians and governmental bodies about the progress of the project and the monitoring results. The annual report will therefore be produced in an attractive lay-out, with clear table, diagrams and conclusions rather than lengthy descriptions of various details. For internal use, the final (annual) output is a copy of the European data, for each of the participants.

(1) Participating country
From a given participant, being a national scheme as stated, oil samples are sent to the Bundesamt für Seeschiffart und Hydrographie (BSH) in Hamburg each month (Nov-Apr). Results from surveys in study areas and subregions are sent to the international database, preferably, also each month or bi-monthly, following the requirements listed in chapter 6.2. National co-ordinators collect data on meteorological conditions and, if possible, the occurrence of oil slicks at sea following aerial surveillance, from the relevant institutions in their country. Meteorological data should be 'transformed' in a way that they can readily be used to test independent

subregion/study area results against wind and temperature (see chapter 6.2), before being transferred to the international data-base. Progress reports may be produced by national co-ordinators, as feed-back to volunteers.

(2) Laboratory for analysis of oil samples
After analysis of the oil samples, BSH transfers a complete set of results to the international database (at least once each season, more frequently in special cases), and separate sets to the national co-ordinators. In both cases, the highly technical information has to be accompanied with explanations which are understandable for non-chemists. Between BSH and national co-ordinators, there should be a regular contact so that the need for more detailed investigations (e.g. GC/MS analysis, or drift modelling; see chapters 6.2, 8.2) is recognized in time. Following each field season, a BSH report may be prepared.

(3) International co-ordinator
During the field season, the international co-ordinator will have to keep in touch with all participants as often as necessary to assure that all activities are continuing and give help, information and advice whenever possible. Survey results from study areas are received monthly or bi-monthly and stored into the international database and coupled with the additional meteorological information (wind and temperature as a routine). After storage, the national co-ordinators receive a print of their data, to check whether everything was properly loaded into the database. When the data are checked, this is followed by a first, rough analysis (prelim. reports). Similarly, chemical analysis results of oil samples are stored into the database and returned as a print to check for errors. After each field season and following a first analysis by the international co-ordinator, a workshop is convened with the steering committee and the representative of the laboratory, to discuss the results and to agree on the first drafts of the annual report.

9.3 Some basic annual budgets in an EBBS monitoring programme

EBBS participant (national budget)

With some 19 countries and regions possibly participating, it is quite impossible to calculate the costs for a salary or for consumables which is valid for all participants. Therefore, a standard amount was chosen which is considered valid for Belgium, Germany, the Netherlands and Denmark: countries with a relatively high standard of living in Europe. The number of volunteers involved in the project is estimated at 50 per country. Obviously, between countries there is considerable variation. In the UK, for instance, hundreds of volunteers are activated for nationwide surveys (Jane Sears in litt.), while in Belgium the number of volunteers on its 67 km coastline can be considerably smaller. The cost for beached bird surveys per country can be estimated using the following standard data:

- Salary national co-ordinator (12 month contract, full time):	ECU 32,000 per annum
- Additional costs (e.g. the costs for the management of the institution where the co-ordinator and assistant are based, maintainance, administrative expenses etc., these costs are usually about the same as total salary costs)	ECU 32,000 per annum
- Salary field assistant (6 month contract, full time):	ECU 15,000 per annum
- Travel expenses (2 pers., incl. 4 int. meetings)	ECU 8,000 per annum
- Travel expenses volunteers (based on 10 ECU per survey per volunteer; at 50 volunteers, calculated for 6 months)	ECU 3,000 per annum
- Computer analysis	ECU 3,000 per annum
- Consumables	ECU 2,000 per annum
Total	**ECU 95,000 per annum**

In figure 9.3, this would mean that full participation (country A) would cost *c.* ECU 95,000 per annum. Leaving 2 months out of consideration (country B) would lead to a 28.8% reduction (national co-ordinator on 8 month contract, field assistant on 4 month contract, travel expenses of volunteers reduced; hence, ECU 67,650 per annum). Leaving out special investigations and sampling by a professional field assistant (country C) would reduce the budget with 20% (hence, ECU 76,000 per annum). On the other hand, each extra field assistant (in larger countries with more than one study area), would cost an extra ECU 15,000 (or 15.8%; assuming they are not invited for the international meetings) extra. Finally, the alternative without a field assistant during Nov-Dec, full participation during Jan-Mar and no activities during Apr (country D) can be calculated to need a budget of ECU 69,000 per annum (or 27.4 % reduction compared to full participation).

International co-ordinator

The costs of the international co-ordinator include salary, costs of the organization of international meetings and workshops, costs of the production of an annual report and costs for maintaining the international database and library. Travel expenses for the steering committee (*c.* 5 national co-ordinators) are included in the national budgets. Total costs for the international co-ordinator can be estimated at:

- Salary full time international co-ordinator:	ECU 32,000 per annum
- Additional costs (see above)	ECU 32,000 per annum
- Travel expenses (incl. 8 int. meetings)	ECU 8,000 per annum
- Computer	ECU 3,000 per annum
- Maintaining database/library	ECU 2,000 per annum
- Production annual report	ECU 10,000 per annum
- Annual workshop	ECU 10,000 per annum
Total	**ECU 97,000 per annum**

Oil analysis

The Bundesamt für Seeschiffart und Hydrographie (BSH) was nominated as the central laboratory for chemical analysis of oil samples collected in all participating countries. To assess the cost of this part of the work, experiences of the Danish-German-Dutch three year project (1990-92) were used. Assuming 1000 samples per annum, including detailed investigations using coupled gas chromatography/mass spectrometry (GC/MS; see chapter 4.2) in certain special cases, oil analysis at BSH would cost:

- Salary full time engineer (ECU 32,000 per annum x 1.5)	ECU 48,000 per annum
- Salary full time technician	ECU 30,000 per annum
- Salary scientist (ECU 50,000 per annum on the basis of 1/10 time)	ECU 5,000 per annum
- Additional costs laboratory (see above)	ECU 83,000 per annum
- Depreciation GC	ECU 4,800 per annum
- Depreciation GC/MS	ECU 13,500 per annum
- Consumables	ECU 10,000 per annum
- Travel expenses (2 meetings p.a.)	ECU 4,000 per annum
Total	**ECU 198,300 per annum**

9.4 Three scenarios and budgets for EBBS

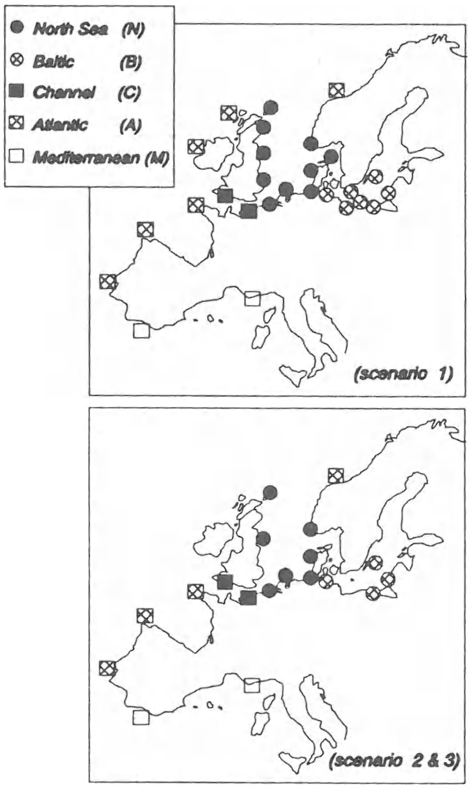


Figure 9.5 Proposals for study area networks following different scenario's.

The EBBS monitoring project can be designed in several ways, using the requirements and research components discussed earlier. Assuming 'full participation', i.e. including all activities listed earlier, each study area requires 1 field assistant. On top of that, each month BBS by volunteers in other subregions requires 2 months work for a national co-ordinator. Budgets for three scenarios are calculated. For practical reasons, all the basic calculations in chapter 9.3 have been strictly followed. The scenarios below assume participation of all countries and larger regions as listed in table 9.2. If particular sea areas (North Sea (N), Baltic (B), Channel (C), Atlantic seaboard (A) or Western Mediterranean (M)) are to be considered, only countries bordering these seas have to be taken into account. The number of study areas, the hard core of a EBBS scheme, was chosen as 27 in the first, most comprehensive scenario and as 19 in the second and third scenarios (figure 9.5). Working 19 study areas is an absolute minimum for a European network covering all sea areas. Obviously, other combinations can be made, for instance by using a high density study area network in the North Sea, but lower density elsewhere. With the data given below, it should be possible to calculate the financial consequences of other scenarios. Obviously, North Sea and the Channel are high priority areas, for which a long set of baseline data exists. To compare different scenarios in smaller settings, besides a 'European' budget (i.e. 19 participants), calculations have been made for 'European minus Mediterranean (NBCA)' (i.e. again 19 participants), and similarly for 'NBC' (15), 'NC' (8), and finally for the 'North Sea (N)' alone (7 participants) (see for details Appendix E).

EBBS scenario no. 1

The first scenario is obviously the most comprehensive, including monthly surveys in all subregions and detailed investigations in a dense network of study areas. In the study area network for this scenario, the North Sea is 'covered' in 10, the Channel in 2, the Baltic in 7, the Atlantic seaboard in 6, and the Western Mediterranean in 2 study areas (figure 9.1, table 9.1). Field work includes:

(1) national survey in February (continuation of IBBS)
(2) systematic surveys in 27 study plots (including detailed notes on birds found; professionals: nat. co-ordinator/field assistant)
(3) systematic oil sampling in study areas (professionals: nat. co-ordinator/field assistant)
(4) surveys in other subregions Nov-Apr (volunteer network)
(5) dissections of collected birds (professionals: nat. co-ordinator/field assistant)

Personnel required are one national co-ordinator per country (12 months, full time), 1 field- assistant per study area (6 months countract, full time). For the entire project:

international co-ordinator (12 months, full time), BSH engineer (12 months, full time), BSH technician (12 months, 1x full time, 1x half time), BSH scientist (12 months, 1/10 time). Individual and overall budgets have been calculated in table 9.3 (and more detailed, in appendix E).

Table 9.3 Study areas (n= 27) and the EBBS budget for scenario 1, assuming full participation in 19 countries/regions. Budget in ECUs per annum.

Participant	Study areas North Sea	Channel	Baltic	Atlantic	Mediterr.	Σ	Budget ECU p.a.
Faeroe islands	-	-	-	0	-	0	76,000
Orkney & Shetland	1	-	-	-	-	1	95,000
Britain	3	1	-	1	-	5	155,000
Ireland	-	-	-	1	-	1	95,000
Norway	1	-	-	1	-	2	110,000
Sweden	-	-	1	-	-	1	95,000
Finland	-	-	0	-	-	0	76,000
Russia	-	-	0	-	-	0	76,000
Estonia	-	-	0	-	-	0	76,000
Latvia	-	-	0	-	-	0	76,000
Lithuania	-	-	1	-	-	1	95,000
Poland	-	-	2	-	-	2	110,000
Denmark	2	-	1	-	-	3	125,000
Germany	1	-	2	-	-	3	125,000
The Netherlands	1	-	-	-	-	1	95,000
Belgium	1	-	-	-	-	1	95,000
France	-	1	-	1	1	3	125,000
Portugal	-	-	-	1	-	1	95,000
Spain	-	-	-	1	1	2	110,000
Total no. study areas	10	2	7	6	2	27	
Number of participants	7	2	9	7	2	19	
Total national budgets							1,905,000
Costs intern. co-ordinator							97,000
Costs oil analysis BSH							198,300
Total budget EBBS scenario 1 (NCBAM)							**2,200,300**
-Total budget (NCBA)							2,170,300
-Total budget (NCB)							1,764,300
-Total budget (NC)							1,115,300
-Total budget (N)							1,005,300

EBBS scenario no. 2

Within the second scenario, the number of study areas is reduced. In this proposal, the North Sea is 'covered' in 7 study areas, the Channel in 2, the Baltic in 4, the Atlantic seaboard in 4, and the Western Mediterranean in 2 study areas). The rest is similar to the first scenario, i.e. monthly surveys in all subregions and special investigations, including dissections and oil sampling, in stuy areas. Hence, field work includes:

(1) national survey in February (continuation of IBBS)
(2) systematic surveys in 19 study plots (including detailed notes on birds found; professionals: nat. co-ordinator/field assistant)
(3) systematic oil sampling in study areas (professionals: nat. co-ordinator/field assistant)
(4) surveys in other subregions Nov-Apr (volunteer network)
(5) dissections of collected birds (professionals: nat. co-ordinator/field assistant)

Personnel required are, one national co-ordinator per country (12 months, full time), 1 field assistant per study area (6 months countract, full time). For the entire project: international co-ordinator (12 months, full time), BSH engineer (12 months, full time), BSH technician (12 months, 1x full time, 1x half time), BSH scientist (12 months, 1/10 time).

Table 9.4 Study areas (n= 19) and the EBBS budget for scenario 2, assuming full participation in 19 countries/regions. Budget in ECUs per annum.

Participant	Study areas North Sea	Channel	Baltic	Atlantic	Medit.	Σ	Budget ECU p.a.
Faeroe islands	-	-	-	0	-	0	76,000
Orkney & Shetland	1	-	-	-	-	1	95,000
Britain	1	1	-	0	-	2	110,000
Ireland	-	-	-	0	-	0	76,000
Norway	1	-	-	1	-	2	110,000
Sweden	-	-	1	-	-	1	95,000
Finland	-	-	0	-	-	0	76,000
Russia	-	-	0	-	-	0	76,000
Estonia	-	-	0	-	-	0	76,000
Latvia	-	-	0	-	-	0	76,000
Lithuania	-	-	1	-	-	1	95,000
Poland	-	-	1	-	-	1	95,000
Denmark	1	-	0	-	-	1	95,000
Germany	1	-	1	-	-	2	110,000
Netherlands	1	-	-	-	-	1	95,000
Belgium	1	-	-	-	-	1	95,000
France	-	1	-	1	1	3	125,000
Portugal	-	-	-	1	-	1	95,000
Spain	-	-	-	1	1	2	110,000
Total no. study areas	7	2	4	4	2	19	
Number of participants	7	2	9	7	2	19	
Total national budgets							1,781,000
Costs intern. co-ordinator							97,000
Costs oil analysis BSH							198,300
Total budget EBBS scenario 2 (NCBAM)							**2,076,300**
-Total budget (NCBA)							2,046,300
-Total budget (NCB)							1,674,300
-Total budget (NC)							1,070,300
-Total budget (N)							960,300

EBBS scenario no. 3

Within the third scenario, the number of study areas is not further reduced (thus, the North Sea is 'covered' in 7, the Channel 2, the Baltic in 4, the Atlantic seaboard in 4, and the Western Mediterranean in 2 study areas), but all volunteer surveys are dropped, except during February (continuation of IBBS). Moreover, systematic dissections are dropped as activity in study areas. As a result, there is no need to maintain a volunteer network between Nov-Jan and Mar-Apr, and the national co-ordinator may either not be assisted for field work in the study areas or his contract will be reduced to only 7 months per year. Since the first solution (no field assistant, full time contract for 1 year) is 26% more expensive than the second solution (7 month contract for national co-ordinator, plus 6 month contract (half time) for field assistant), only the latter is considered in the calculations below. Field work in scenario 3 includes:

(1) national survey in February (continuation of IBBS)
(2) systematic surveys in 19 study plots (including detailed notes on birds found; professionals: nat. co-ordinator/field assistant)
(3) systematic oil sampling in study areas (professionals: nat. co-ordinator/field assistant)

Personnel required are, one national co-ordinator per country (7 months, full time), 1 field assistant per study area (6 months countract, half time). Travel costs for volunteers are reduced with 5/6 (now 500 ECU). For the entire project: international co-ordinator (12 months, full time), BSH engineer (12 months, full time), BSH technician (12 months, 1x full time, 1x half time), BSH scientist (12 months, 1/10 time).

Table 9.5 Study areas (n= 19) and the EBBS budget for scenario 3, assuming full participation in 19 countries/regions. Budget in ECUs per year.

Participant	Study areas North Sea	Channel	Baltic	Atlantic	Medit.	Σ	Budget ECU p.a.
Faeroe islands	-	-	-	0	-	0	46,850
Orkney & Shetland	1	-	-	-	-	1	58,350
Britain	1	1	-	0	-	2	65,850
Ireland	-	-	-	0	-	0	46,850
Norway	1	-	-	1	-	2	65,850
Sweden	-	-	1	-	-	1	58,350
Finland	-	-	0	-	-	0	46,850
Russia	-	-	0	-	-	0	46,850
Estonia	-	-	0	-	-	0	46,850
Latvia	-	-	0	-	-	0	46,850
Lithuania	-	-	1	-	-	1	58,350
Poland	-	-	1	-	-	1	58,350
Denmark	1	-	0	-	-	1	58,350
Germany	1	-	1	-	-	2	65,850
Netherlands	1	-	-	-	-	1	58,350
Belgium	1	-	-	-	-	1	58,350
France	-	1	-	1	1	3	73,350
Portugal	-	-	-	1	-	1	58,350
Spain	-	-	-	1	1	2	65,850
Total no. study areas	7	2	4	4	2	19	
Number of participants	7	2	9	7	2	19	
Total national budgets							1,084,650
Costs intern. co-ordinator							97,000
Costs oil analysis BSH							198,300
Total budget EBBS scenario 3 (NCBAM)							**1,379,950**
-Total budget (NCBA)							1,017,150
-Total budget (NCB)							814,750
-Total budget (NC)							479,300
-Total budget (N)							424,950

A further reduction, when field work only includes surveys in study plots, a national survey in February, skipping oil sampling, oil analysis and dissections from the monitoring programme, would require an overall budget of ECU 1,032,150 per annum (NCBAM). It is important to realize that a scenario this scale, without dissections and oil sampling is hardly more comprehensive than the current activities in the respective countries.

Summary of calculations

Detailed calculations are given in appendix E. These calculations include budgets for separate sea areas (North Sea, Channel, Baltic, Atlantic seaboard and Western Mediterranean), and combinations of sea areas (budgets for North Sea & Channel, and for North Sea, Baltic & Channel). To summarize, EBBS budgets following these three scenarios amount for (ECU per annum):

Scenario	NCBAM	NCBA	NCB	NC	N
1	2,200,300	2,170,300	1,764,300	1,115,300	1,005,300
2	2,076,300	2,046,300	1,674,300	1,070,300	960,300
3	1,379,950	1,017,150	1,139,550	769,600	703,750

Scenario 1 vs. scenario 2 (reducing the number of study areas)

The difference between these two scenarios is the number of study areas. Obviously, with only 2 study areas in the Western Mediterranean and Channel area, a sensible reduction was impossible. The denser networks in North Sea and Baltic have been reduced to an absolute minimum. It should be realized that, from a statistical point of view, even the network in scenario 1 is in fact not particularly dense. However, if for whatever reason, a study area cannot be maintained during the monitoring project, the loss would probably be rather insignificant in scenario 1, while such a loss is quite dramatic in scenario 2. A reduction of 8 study areas (one third) all over Europe makes a difference of just over 5% in the budget. Within the North Sea, the budget is reduced by only 4.5%, while the network is seriously weakened (30% reduction in number of study areas). A conclusion would be that, if there is a need to choose between scenario 1 and scenario 2, the first would be much better value for money.

Scenario 2 vs. scenario 3 (reducing volunteer work and special investigations)

The number of study areas is the same in both scenarios. In order to reduce costs, several activities are removed from the list in the third alternative: dissections are dropped as activity in study areas, and field work only includes surveys and oil sampling in study plots, and a national survey in February (continuation of IBBS). This means, there is no need to maintain a volunteer network between Nov-Jan and Mar-Apr. Comparing these two options, the information loss is considerable following scenario 3. Oil incidents outside study areas will not be studied, there is no possibility for any activities outside the winter and the area covered is significantly reduced. Manning only (few) study areas, i.e. without complementary data collected in other subregions, will often mean that the sample size is too small to confirm trends statistically.

In scenario 3, dissections are no longer part of the work. Since dissections are particularly valuable within the North Sea area (following a decade of similar research in Britain, the Netherlands, Denmark and Norway), and because the reduction in the North Sea budget is negligable, a compromise could be to skip systematic dissections in B, A, and M, but to include this activity in the N and C.

Comparing different sea areas

The proposals in the previous sections have been made on the assumption that an EBBS programme should have a wide geographical coverage, including North Sea, Channel, Baltic, Atlantic seaboard, and Western Mediterranean. The writing of the report was instignated by decisions from the North Sea Ministers Conference. North Sea and Channel do have the highest priority for a monitoring programme, because oil pollution is severest in these areas and because new measures to reduce oil pollution have recently been introduced. A monitoring programme is required to investigate whether such measures are adequate. The other areas were added in the proposals because each of them has its intrinsic and overall value for the whole programme. Inclusion of the Baltic is considered important because the area may reveal the effects of the status as a 'Special Area' under MARPOL 73/78 Annex I. Also, there may be a possibility that illegal crude oil discharges in the North Sea to the West of Northern Denmark are related to the Special Area status of the Baltic. The Atlantic seaboard is included in the proposals, not because of urgen pollution problems, but as a reference for relatively clean sea areas to measure the scale of pollution elsewhere. A small amount of study is proposed for the Western Mediterranean as an inventory of the hitherto unknown scale and effects of oil pollution in this area. The budget tables in the previous sections all contain the effects on budgets if a full scale European project is reduced step by step to a monitoring programme in the North Sea only. Priority ranking of areas, in descending order, is North Sea, Channel, Baltic, Atlantic, and Mediterranean. The calculations of the different budgets should not be considered as a recommendation to reduce the geographical coverage of the project, but are given for insight in costs of various elements of the programme.

Recommendations

The above proposals depict a variety of possibilities for an EBBS monitoring programme. For reasons of clarity, in each of the scenarios, it was assumed that the same scenario would apply to each of the participating countries. However, in a final EBBS, there may be no need to follow such a pattern strictly. We recommend that an EBBS monitoring programme should include the whole geographical area (North Sea, Channel, Baltic, Atlantic, and Mediterranean). However, different levels of participation should be possible for countries, depending on financial resources and the need for monitoring. For example, in our opinion full monitoring of oil pollution and seabird mortality (scenario 1) is necessary and feasible for the North Sea and Channel area (with Orkney & Shetland, Britain, France, Belgium, Germany, Denmark, and Norway as participants). Some countries bordering the Baltic may have financial problems running a scenario 1 programme, but those states that have collected baseline data in the past (e.g. Poland) should be supported to run at least a scenario 2 programme. Countries that did not have beached bird surveys in the past, at least as far as we know now (Russia, estonia, Latvia, Lithuania) may start participation with a scenario 3 programme. At the Atlantic coasts and in the Western Mediterranean, the scenarios 2 and 3 may be sufficient to collect data required in the EBBS, though local interests may stimulate more thorough studies.

At the moment, it is not feasible to propose one single ideal structure and financial framework for an EBBS. We suggest a workplan in which an interim international co-ordinator improves and expands the current international co-operation between national programmes. This co-ordinator should fill in the details of the above recommendations and prepare financially and practically the start of an official EBBS programme by the end of 1995. Based on current calculations, the overall cost of a programme as recommended above could be roughly estimated at between 1.5 and 2 million ECU per annum. About half this amount should be covered by national budgets. The remainder of the funds will have to be sought for in budgets of for example the European Community, North Sea Task Force, or non-governmental bodies requiring or interested in oil pollution monitoring.

10. CONCLUSIONS

1. Beached bird surveys (BBS) are useful to indicate the occurrence of discharges of oil, which are illegal under MARPOL 73/78

2. BBS data, particularly the oil rates on beached birds, are useful to monitor the scale of oil pollution in bordering seas.

3. Recent examples have demonstrated the sensitivity of BBS when monitoring the effect of measures to reduce oil pollution at sea.

4. Chemical analysis of samples of substances found on beached birds and beaches, coupled with systematic BBS, is essential when conclusions need to be drawn on sources of pollution and on the impact of non-mineral oils or chemicals on the marine environment.

5. BBS and aerial surveillance are complementary as monitors of oil pollution at sea. BBS has a larger geographical coverage and has a longer base-line series.

6. Seabird mortality and the impact of oil pollution on seabird populations can not be properly studied from BBS alone. Additional information can be obtained by sampling (target species of) birds, systematic dissections of corpses and the exchange of data collected on beaches, at sea, and in breeding areas.

7. Methods of BBS, as developed during the past decades, are not exactly the same in all countries. The process of standardization has been started successfully but needs to be completed.

8. Many hundreds of publications in 19 countries are listed to show the activities with respect to BBS during the past decades. From these base-line data, the conclusion could be drawn that oil pollution is still a problem in many sea areas (Southern and Eastern North Sea and Channel), that the situation has recently been improved (Northwestern North Sea, Baltic), or that oil pollution is negligible (Portugal, Atlantic seaboard).

9. A future EBBS monitoring project will produce an annual report on the state of the sea with respect to oil pollution and changes therein, in a format that it can be used by politicians and governmental bodies.

10. A European Beached Bird Survey (EBBS) should be established as a monitoring system for marine oil pollution and seabird mortality. Different scenarios are possible. The recommended EBBS has 19 participating countries from the Baltic to the Mediterranean. About 50% of the estimated cost of between 1.5 and 2 million ECU per annum would be required from international funding bodies.

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APPENDICES

Appendix A. Conclusions of NZG/NSO Workshop "Oil pollution, Beached Bird Surveys and Policy", Rijswijk, 19 April 1991

The workshop was convened and organized by the working group Beached Bird Surveys of the Dutch Seabird Group (NZG/NSO) and took place on 19th April 1991 in Rijswijk, the Netherlands. Workshop and proceedings were generously supported by the (Dutch) Ministry of Transport, Public Works and Water Management. The meeting was a gathering of an international group of people from governmental bodies, research institutes and volunteer organisations. The aim was to stimulate exchange of information and co-operation between specialists from widely different disciplines. Such are basic requirements if ever the problem of marine oil pollution is to be solved. The workshop highlighted the potential use of seabird studies as a tool in the combat of marine pollution. A full report of papers, discussions, conclusions, and a list of participants is available as special issue of *Sula*, the journal of the Dutch Seabird Group (Camphuysen & van Franeker 1991). Here we will only repeat some of the conclusing remarks of the chairmans of the sessions (1) the use of analysis of samples of oil or other pollutants, (2) the value of beached bird surveys as a monitor of oil pollution, (3) measures to reduce pollution or risks for seabirds, and (4) coordination of beached bird surveys at incidents.

(1) Use of analysis of samples of oil or other pollutants
It was concluded that sampling of oil (or rather 'substances') from feathers and beaches is a valuable way of tracing and monitoring sources of pollution. There was a general feeling that oil sampling could improve future Beached Bird Surveys (BBS) and several participants suggested to expand the oil sampling project (now Netherlands, Germany and Denmark) with participants from other countries. It was recommended that sampling methods be improved to enhance the possibilities for statistical analysis, and that any sampling programme should be embedded in an international programme for BBS. It was noted that, in order to obtain a maximum effect in policy decisions and to secure funding of further projects, politicians (e.g. the North Sea Task Force) should be notified as early as possible about new initiatives and should be informed in reports in understandable language. Mark Tasker (JNCC) asked for better definition of the question behind BBS programmes, but concluded that analyzing oil on beached birds seemed to give satisfactory results. It was preferred to have one institution for analysis and (international) coordination. Belgium and Norway have expressed their wish to join a new oil sampling programme.

The effects on seabirds by non-mineral oils need further study and discussion. A large (random) sample is needed to make a prediction about seabird mortality caused by non-mineral oil. Because the discharge of non-mineral oil is legal, this problem must be solved. Sampling techniques, will require a technical workshop. The North Sea Directorate is certainly interested and would like to be involved in a sampling project for non-mineral oils. The result of all our efforts should mean a change of the law or regulation rather than just figures and data.

(2) Value of beached bird surveys as a monitor of oil pollution
One of the important things which turned up are the fluctuations in numbers of birds killed by oil discharges in certain areas. The proportion of contaminated birds shows a decline in the Western North sea. This may be caused by low sampling along the British coast. There was a general feeling that North Sea wide beached bird surveys and oil sampling would be very valuable. Most represented countries gave positive reactions. There are reservations and limitations and we need to know what mortality by oil means to the overall mortality. A longer, technical discussion will be required,

to discuss methods and the sort of information which should/could be derived from BBS. Additional to a European BBS plus oil sampling, there should be dissection of birds to study mortality factors in more detail. Veterinary analysis would also be required. A professional co-ordinator will be needed in the future. It would be valuable to take away all the doubts before we become "European" and to reach an international agreement on methods and aims of an EBBS. Names and adresses were requested of persons that might be interested in discussing this matter on a technical workshop, well before the next ministerial North Sea conference. It was remarked that the North Sea Task Force has sufficient contact points. Ministerial conferences take a long time to prepare, so recommendations have to be sent to the North Sea Task Force at least one year before date.

(3) Measures to reduce pollution or risks for seabirds
Important conclusions from this session were (1) the number of oil slicks at sea did not decrease since MARPOL Annex 1 entered into force, (2) methods to deal with trespassers varied between countries and international agreements were difficult to reach, (3) when the decision has to be made to clean up an oil slick, the presence of vulnerable concentrations of seabirds is generally not taken into account. There are several procedures to clean up beaches, but slicks at sea do more damage. The North Sea Directorate decides whether or not to clean up an oil slick. It usually is a matter of time. Small slicks disperse naturally. On average 10 slicks are cleaned up annually by Dutch authorities and 100 tonnes of oil is recovered in these operations. There are emergency plans for big spills. To get to a slick would take six to twelve hours by ship. Stationing a ship in areas with vulnerable concentrations of birds could be valuable. A governmental representative noted that slicks are cleaned up whenever possible. The penalties for discharging illegally plus the bill for cleaning up are presented to the polluter. Cleaning up is done especially if there is a chance to reclaim costs.

(4) Coordination of beached bird surveys at incidents
The situation with oil incidents needs better co-ordination, the need for a professional coordinator has been put forward. A meeting, to improve co-operation during oil incidents or mass strandings, will be convened by the Ministry of Agriculture, Nature Management, and Fisheries. The Dutch Seabird Group (NZG/NSO), the Netherlands Insitute for Sea Research (NIOZ), the North Sea Directorate and Vogelbescherming will be invited. Agreement is reached to co-operate with dissections in future. NZG/NSO will be informed by the authorities about incidents and clean up operations. In return, NZG/NSO will inform governmental bodies about mass strandings.

Appendix B. Conclusions of EBBS discussions at the IBBS workshop Copenhagen, 1 December 1991

The workshop was convened by Ornis Consult, as international co-ordinator of the International Beached Bird Survey (IBBS), to discuss methods and results of the IBBS scheme and to plan activities in 1992 and 1993. The 18 participants were:

Christiane Averbeck, Germany
Christophe Aulert, France
Kees Camphuysen, Netherlands
Gerhard Dahlmann, Germany
Jan Durinck, Denmark
Knud Falk, Denmark
Walter Gomez, Portugal
Martin Heubeck, Shetland (UK)
B. Lang, France
Patrick Meire, Belgium
Henning Nøhr, Denmark
Bergur Olsen, Færøerne
Pascal Raevel, France
Jane Sears, UK
Kolbjørn Skipnes, Norway
Henrik Skov, Denmark
Mark Tasker, UK
Dagmar Timm, Germany

Base-line data are very important when a new monitoring project is set up. Checks of Dutch national surveys (NBBS 1965-91) and of the IBBS database as stored in Copenhagen proved that the database is in a rather poor state. It was concluded that several long series of BBS data should be re-analysed or at least re-arranged. Germany, Britain, Norway, Belgium, Portugal, Normandy and the French Channel agreed to re-analyse their data. The deadline for finalising this check was set at December 1992.

Agreements on uniform methods in future were made. IBBS and EBBS survey methods were considered at the same time. It was proposed that only complete corpses were to be considered to calculate the oil rate, to avoid bias towards oiled specimens. Instead of fixed routes, a proposal to divide coasts in a number of subregions was adopted. Notes are to be made on the reliability of a particular survey result. If bad weather conditions hampered a survey, this information should be given together with the survey results. For future data transfer, a spreadsheet was prepared, so that species lists will always have the same format. It was agreed upon that a manual had to be written for field work and another for data analysis and data transfer. Deadlines for reporting IBBS results to the international co-ordinator were set at 1 July each year.

Appendix C. Minutes of the EBBS workshop 'Co-ordinated beached bird surveys in Europe: monitoring marine oil pollution and seabird mortality' (Glasgow, 1992).

This workshop was convened by the Dutch Seabird Group/working group Beached Bird Surveys (NZG/NSO), as part of the project *Oiled Seabirds and Oil Pollution: The value of beached bird surveys to assess the effect of measures meant to reduce oil pollution at sea*. The project was commissioned by the Netherlands' Society for the Protection of Birds. Workshop and project were funded by the Netherlands' Ministry of Agriculture, Nature Management and Fisheries. The workshop was held in the Zoology Department Library of the University of Glasgow, immediately following the International Seabird Group Conference which was held in Kelvin Conference Centre in Glasgow. Local organisation was provided by Bob Furness. Participants were (n= 26):

AF Arne Follestad, Norway
AS Alja Schmidt-van Dorp, England (UK)
CA Christiane Averbeck, Germany
CJ C. Joiris, Belgium
CJC Kees Camphuysen, Netherlands
DF David Fleet, Germany
DT Dagmar Timm, Germany
ERM Erik Meek, Orkney Islands (UK)
FH Fiona Hunter, England (UK)
GD Gerhard Dahlmann, Germany
HS Henrik Skov, Denmark
JAF Jan Andries van Franeker, Netherlands
JB John Bell, England (UK)
JD Jan Durinck, Denmark
JPG José Pedro Granadeiro, Portugal
JS Jane Sears, England (UK)
JSs Jan Seys, Belgium
KF Knud Falk, Denmark
KS Kolbjørn Skipnes, Norway
ME Morten Ekker, Norway
MFL Mardik Leopold, Netherlands
MH Martin Heubeck, Shetland Islands (UK)
MLT Mark Tasker, Scotland (UK)
PR Pascal Raevel, France
RWF Bob Furness, Scotland (UK)
WRPB Bill Bourne, Scotland(UK)

Prevented from coming were (n= 7):

Nancy Harrison, England (UK)
Vilju Lilleleht, Estonia
Patrick Meire, Belgium
Francisco Arcos Fernandéz, Spain
Sven Blomqvist, Sweden
Walter Gomez, Portugal
Bergur Olsen, Faroe Islands

The workshop was introduced by the chairman with an overview of the meetings leading to the Glasgow workshop, which was in fact the third meeting within one year. The first international workshop (April 1991, The Netherlands) was meant to demonstrate the usefulness of BBS programmes for government people and to discuss current trends in the results. In Rijswijk, the working group beached bird surveys of the Dutch Seabird Group (NZG/NSO) proposed an international data exchange and co-operation in beached bird surveys: the European Beached Bird Survey programme (EBBS). A second meeting was convened by Ornis Consult in November 1991 in Copenhagen, to discuss methods of the International Beached Bird Survey (IBBS). The EBBS proposal was discussed again and most countries showed their interest in this project. It was agreed upon that EBBS should replace (or rather 'include') IBBS, to avoid confusion within funding bodies. IBBS should be the hard core in any future programmes, because of its history of over 25 years (1965-92). The Glasgow meeting was mainly organized to obtain agreement on future co-operation, to discuss the structure of the future scheme and to assess the current status of beached bird surveys in Europe. The reasons behind the EBBS were discussed. In the first place EBBS should offer an indicator to assess the effectiveness of measures to reduce oil pollution.

Methods, study plots and subregions
IBBS is an annual mid-winter survey in late February, which has been organized in several countries since 1965. While there may be opposition against this date (JSs, HS), the long series of counts makes a change undesirable (WRPB, CJC). Flexibility with respect to the exact date of the count, including weekends before or after the planned date, will reduce regional or national problems caused by holidays or other problematic circumstances (MH). Within EBBS, the entire winter will be considered: proposed as Nov-Apr. This choice was discussed. First of all, it should be clear that participation within EBBS is 'open', which means that there does not have to be a survey in all these months. When it does not make sense to do a survey, as explained by JPG for Portugal in March and April (beaches are cleaned for tourists), one should not do a survey. The priority ranking, however, should be a guideline for national co-ordinators. Everybody agreed with the current ranking: (1) Feb, (2) Jan, (3) March, (4) Dec, (5) Apr, and (6) Nov. Since oil pollution is a year-round event rather than a winter problem, and not uniformly distributed, summer surveys and surveys outside study regions are required (WRPB). It was agreed that co-ordinators should make sure there is a general look-out for oil and seabird strandings in summer. Study regions could provide us with a large number of experienced people all over Europe who could co-operate in case of any emergencies (large incidents). Teams should be activated within hours rather than in days, while manuals should be ready to avoid confusion and to collect the data in an appropriate way (WRPB). With respect to summer awareness of strandings: consider a lookout in the form of a few people walking a kilometre or so every week, coupled with the possibility to call out people at short notice (WRPB). It appeared that the cleaning of beaches was a typical summer problem in many countries. Contacts with sanitary departments are to be considered, but this may be very difficult to achieve and maintain (HS, CJC, CJ, BF, MFL).

Within the IBBS programme, as agreed upon in Copenhagen 1991, data are now collected per subregion rather than per country. Within the EBBS programme, the same subregions will be used and each country will have to select a number of study areas. Within the study areas, systematic oil sampling will take place, and special investigations may be carried out. There was no proposal for study areas available at the workshop, but MH considered the number of subregions as given in the 'first scenario' of the draft of chapter 11 (page 7) appropriate. Highest priority within EBBS is a study region network covering the North Sea. With participation of the RSPB still being uncertain it was thought appropriate to indicate the minimum requirements. Finally, with EBBS we hope to study the Baltic, the North Sea, the Norwegian Sea, the French Channel, Bay of Biscay and the Atlantic seaboard, and perhaps even parts of the Mediterranean. Study regions, as proposed in the working papers for this workshop, are some 50km on each linear 500km of coastline. However, working papers of PR have shown that 10% is actually a rather small sample. Moreover, in archipelago's and in heavily indented coasts, or on coasts with cliffs and sandy beaches alternating, this percentage is not applicable. Hence, national co-ordinators were asked to designate one or more study areas within the subregions identified before. It should be kept in mind that (1) the study area is used as a representative sample out of a larger region, and (2) a study area is investigated by professionals (full time field assistant or/and the national co-ordinator).

Conclusions The EBBS monitoring scheme will focus on study areas in winter (Nov-Apr), with the Feb survey as highest priority. Besides professional input (study area surveyed by field assistants and/or national co-ordinator with few, experienced volunteers), there will be considerable volunteer input in the form of surveys in subregions, not being study areas. There has to be a look-out in summer when surveys are discontinued. National co-ordinators should be prepared to call out more people at short notice in case of oil incidents.

Live stranded seabirds
A point raised was the use of live stranded seabirds with respect to oil rates and comparisons to be made with corpses washing ashore. Working papers of PR showed some interesting results of comparisons. The general feeling was that rehabilitation centres should be asked (or forced?) to fill in logs in an appropriate way (finding place, date, oiling, species, weight, et cetera). A bound log was preferred above sheets or ring-bands, since loose sheets tend to get lost (WRPB). Arrangements have to be made on a national level. In some countries severe difficulties were foreseen.

Oil sampling
A description of the current German/Danish/Dutch oil sampling programme was provided (JD, GD), and some results were shown (DT). Oil sampling was unanimously considered a vital part of the EBBS proposals, in priority directly following beached bird surveys. The point of difficulties with respect to 'systematic sampling' was raised (CJC). Within study areas, either all corpses have to be sampled or other straightforward selection criteria for sampling have to be defined. Despite the three year experience, this problem was still not solved. The main objective is a constant check for sources and types of pollution. Apparently similar oiling often proved to originate from quite different sources (JD, GD). It was considered that one rather than a series of laboratories should be involved (CJC, JD and others), while intercalibration or contra-expertise should be stimulated to avoid problems with the acceptation of the data in the respective countries. A study group is formed including (JD, CA, CJC and GD) to examine the difficulties with respect to 'systematic sampling'. All participants agreed with the nomination of the Bundesamt für Seeschiffart und Hydrographie in Hamburg as the central laboratory for oil sample analysis.

Seabird mortality related studies / special investigations
Special investigations include routine ageing and sexing using plumage characteristics. Discussion is focussed on the use of dissections (which include biometrics). Within the political scope of the project, dissections are considered third priority (following beached bird surveys (1) and oil sampling (2). However, insight in other mortality factors is very important during the interpretation of BBS results and, hence, it should be tried hard to obtain sufficient funding to allow some 'low budget' dissections. Other 'obvious' causes of death and certain incidents may require more detailed investigations. Important during dissections are: sex, age, condition, (primary) moult, and biometrics (CJC, WRPB, MH). Of secondary importance, but not very expensive, is the possibility to x-ray corpses to find bullets or hail (shooting as cause of death; JD). Birds with 'clean feathers' and large fat resources may indicate drowning in nets as cause of death (JAF). The routine investigations will result into a considerable number of skilled ornithologists all over Europe, which may prove of great importance during larger oil/mortality incidents. Manuals should be provided for all aspects to make sure that standard methods are used (CJC), while intercalibration is important (JD, HS). WRPB suggests that wings are collected of corpses to keep as reference collections. Analysis of stomach contents may be valuable if larger numbers of birds are killed instantly (a large quantity of oil, shooting, drowning; MLT, CJC). Target species for dissections are identified as: 1) pelagic species (Guillemot *Uria aalge*, Razorbill *Alca torda*, Fulmar *Fulmarus glacialis*, Kittiwake *Rissa tridactyla*, Puffin *Fratercula arctica*, Little Auk *Alle alle*), 2) coastal species (divers, Eider *Somateria mollissima*, scoters, Shag *Phalacrocorax aristotelis*, Black Guillemot *Cepphus grylle*) (CJC, WRPB, MH, JD). Ringed specimens of all species are high priority. Of ringed species 'long bones' (tibia or bones from wings) should be collected an sent to Zoology Department, Glasgow University, to allow a reference collection to be set up for accurate ageing on growth rings (RWF). Next issue of Ibis will contain a paper on good growth ring ageing results with Bonxies *Stercorarius skua* and Fulmars. In

Belgium, detailed mortality studies include parasites, pathology, chemicals (CJ). Although it may be valuable to include such investigations, it is generally considered beyond the scope of the EBBS project. It is emphasized that it may occur that such investigations are required in certain incidents, but additional funding has to be found in these cases.

Conclusions It will be attempted to obtain data of live oiled seabirds in rehabilitation centres (numbers, oil rate), even though difficulties are foreseen in many countries. Oil sampling is essential in the future scheme, and BSH Hamburg is nominated as the central laboratory for chemical analysis. Dissections of target species are recommended, focussing on age, sex, (primary-)moult, condition, biometrics and obvious causes of death other than oil. Corpses of ringed birds should always be collected.

EBBS proposal: structure and organization

The current EBBS proposal was explained (CJC). EBBS is based on national BBS schemes. Study areas are to be surveyed by professionals, additional surveys are carried out using a volunteer network. Oil may be sampled either by volunteers or by the field assistant, dissections and special investigations on beaches are work for the field assistant (see draft chapter 11). There was general agreement that such a scheme might work. A steering committee was considered very important for the international co-ordinator, for frequent feed-back discussions, and to prepare the annual report. The steering committee should consist of (at least) 5 national (or large region) co-ordinators and a BSH representative. The production of the final report has to be the responsibility of the international co-ordinator (MLT, CJC, BF). The workload for the international co-ordinator is considerable (AS), and this person should perhaps not also be a national co-ordinator. The Dutch government seemed to show a preference for the Netherlands to apply for international co-ordination (CJC, JAF). The steering committee is informally formed, including Netherlands (CJC), Denmark (JD/HS), Shetland & Orkney (MH), Germany (CA), and France (PR). Belgium is perhaps interested to join in (JSs). It was agreed that the international database should be operated by the international co-ordinator. With present PC standards, there should be no problem in managing a complete database.

Budgets were briefly discussed. It was suggested that 50% funding from EEC could be raised, while the other 50% should be raised by volunteer input, salaries of people already employed on these matters, overhead in institutes etcetera. Each country was asked to contact its EC representative on possibilities for funding from the EC. A budget group was formed including Jan Durinck (Ornis Consult), Kees Camphuysen (NZG/NSO) and Alja Schmidt-van Dorp (WWF International).

It was worked out what activities are going on right now, using the scheme in draft chapter 11 of the final report. The result is shown in the enclosed figure 1. It should be noted that the Dutch scheme is gradually declining: funding for professional co-ordination is urgently required (CJC). In Orkney there are no dissections of corpses (ERM). National co-ordination in France is still uncertain (PR). National co-ordination is in hands of volunteers in France and in the Netherlands. In all other countries, professionals deal with that. The international co-ordinator (if based in the Netherlands) could find a place within an institute or in a consultancy (e.g. Ornis Consult).

Conclusions EBBS is based on national BBS schemes. Study areas are to be surveyed by professionals, additional surveys are carried out using a volunteer network. A steering committee will be formed consisting of at least 5 national co-ordinators and a BSH representative. The production of the final report is the responsibility of the international co-ordinator. Of the estimated cost of the monitoring programme, 50% will have to be raised on a national basis, while the remaining 50% will be applied for within one of the EC programmes. EBBS should be realized by 1995.

Appendix D. EBBS contact addresses

Belgium	Patrick Meire (Jan Seys, Koen Devos), Institute of Nature Conservation, Kiewitdreef 5, B-3500 Hasselt, Belgium (telephone:+ 32 11 210110, fax: + 32 11 242262)
Denmark	Henrik Skov, Ornis Consult Ltd, 140 Vesterbrogade, DK 1620 Copenhagen V, Denmark (telephone:+ 45 31 318464, fax: + 45 31 247599)
Estonia	Vilju Lilleleht, Eesti Teaduste Akadeemia, Zooloogia ja Botaanika Instituut, Vanemuise 21, EE-2400 Tartu, Estonia (fax 01434 33472)
Færøerne	Bergur Olsen, Fiskirannsóknarstovan 100, Tórshavn, Faroe Islands
France	Pascal Raevel, EcoNum, Residence du fief, Route d'Hazebrouck, F-59270 Bailleul, France (telephone:+ 33 204 36579, fax: + 33 204 36732)
Germany	Christiane Averbeck, Norddeutsche Naturschutzakademie, Hof Möhr, W-3043 Schneverdingen, Deutschland (telephone:+ 49 5199 318, fax: + 49 5199 432)
Latvia	Aleksey Kurochkin & Vladimir Smislov, Latvian Ornithological Society, c/o Dzirnavu 119-32, 226011 Riga, Latvia.
Lithuania	Gediminas Vaitkus, Institute of Ecology, Akademijos 2, 2021 Vilnius, Lithuania
Netherlands	Kees (C.J.) Camphuysen, Nederlandse Zeevogelgroep (NZG/NSO), c/o NIOZ, postbus 59, NL-1790 AB Den Burg, Texel, the Netherlands (telephone + 31 2220 69488, fax + 31 2220 19674)
Norway	Kolbjørn Skipnes, Stavanger Museum, Musegt. 16, N-4005 Stavanger, Norway (telephone:+ 47 4 526035, fax: + 47 4 529380)
Oil analysis	Dr Gerhard Dahlmann, Bundesamt für Seeschiffart und Hydrographie (BSH), Postfach 30 12 20, W-2000 Hamburg 36, Germany (telephone:+ 49 40 31903352, fax: + 49 40 31905033)
Orkney	Erik Meek, Orkney Officer, Royal Society for the Protection of Birds, Smyril, Stenness, KW16 3JX Stromness Orkney, UK (telephone:+ 44 856 850176)
Poland	Włodzimierz Meissner, Dept. of Vertebrate Ecology and Zoology, Legionów 9, PL-80-952 Gdansk, Poland
Portugal	José Pedro Granadeiro, Serviço Nacional de Parques, Reservas e Conservaçao da Natureza, Rua Filipe Folque 46 3°, P-1000 Lisboa, Portugal (telephone:+ 35 1 13523018, fax: + 35 1 1574771)
Russia	Yuri Krasnov & Alexander Koryakin, Kandalaksha Nature Reserve, Lineinaya 35, 184040 Kandalaksha, Murmansk Region, Russia
Shetland	Martin Heubeck, Aberdeen University, c/o Mansefield, Skelberry, ZE2 9JH Dunrossness Shetland, UK (telephone:+ 44 950 60304, fax: + 44 595 2565)
Spain	Francisco Arcos, Inspeccion Costera de Aves Orilladas, Grupo Iberico de Aves Marinas (GIAM), Apdo. 317, E-36200, Vigo (Pontevedra), Spain

Sweden	Sven Blomqvist, Dept. Systems Ecology, Sect. Marine Ecology, Stockholm University, S-106 91 Stockholm, Sweden
United Kingdom	Dr David A. Hill, British Trust for Ornithology (BTO), The Nunnery, IP24 2PU Thetford, Norfolk, England (telephone: + 44 842 750050, fax: + 44 842 750030)
	Dr Jane Sears, Research biologist, Royal Society for the Protection of Birds, The Lodge, SG19 2DL Sandy, Bedfordshire, England (telephone: + 44 767 68055, fax: + 44 767 692365)

Appendix E. Details of EBBS budget calculations in chapter 9

On the next pages, calculations of annual EBBS budgets are given in detail for a wide variety of different set-ups. The main division is into three scenarios, as discussed in chapter 9.4:

- Scenario 1	includes monthly surveys in all subregions and surveys, detailed investigations, dissections and oil sampling in 27 study areas
- Scenario 2	similar, but working 19 study areas
- Scenario 3	working 19 study areas, but no volunteer surveys in other subregions except february and no dissections of birds collected in study areas

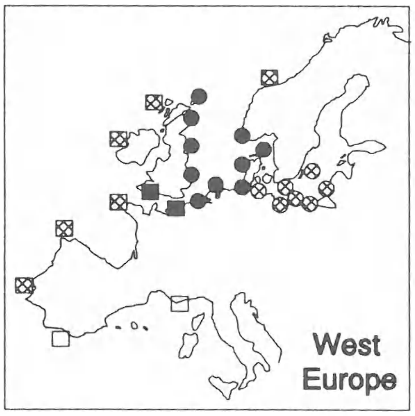
The tables include the number of study areas per country and per sea area (considering the North Sea (N), Channel (C), Baltic (B), Atlantic (A) and Mediterranean (M) separately). An important determinant for the variation in costs, both between and within different scenarios, is the number of study areas included in the programme. Therefore, each scenario starts with the calculation of a standard 'National budget', allowing for a variable number of study areas. The standard annual salary for a national co-ordinator is ECU 32,000. Considering the need of a similar amount for 'additional costs' (e.g. the costs for the management of the institute where the co-ordinator and assistant are based, maintainance, administrative expenses etc.), the amount per annum is set at ECU 64,000. For the field assistant, with a 6 months contract annually, there were no extra 'additional costs' included in the calculations. The number of volunteers is estimated at 50 per country. In certain cases, that is most definitely insufficient. For instance in Britain, hundreds of volunteers are activated. However, 50 can be considered as a reasonable average. Since only ECU 10 per volunteer per month are on the budget for travel expenses, even a significantly larger number will hardly influence the total budget. Consumables and costs for computers are estimated at standard annual costs of ECU 2,000 and ECU 3,000 respectively, also in the 3rd scenario (with considerably less activities). Since these amounts of money are only small, it was considered practical not to vary these sums in the different scenario's. Obviously, a smaller programme will require less equipment.

The tables give budgets for entire Europe for each of the three scenarios, but also for certain reductions in geographical coverage. 'NCBAM' is the total EBBS budget if all 5 sea areas, and all 19 participants will be included in the future monitoring programme, covering 27 (scenario 1), or 19 (scenarios 2 and 3) study areas. If EBBS should start without any activities in the Western Mediterranean (next column, abbreviated NCBA), this would still mean that 19 countries (participants) are involved, but covering 25 (scenario 1), or 19 (scenario's 2 and 3) study areas. Similarly, in the next columns the geographical coverage is further reduced (respectively: NCB, NC, and N)

To calculate the total EBBS budgets, the sum of national budgets has to be increased by costs for the international co-ordinator (ECU 97,000 per annum) and for analysis of oil samples (ECU 198,300 per annum; chapter 9.3). These costs do not depend on the scenario or geographical area covered, and are therefore always the same. However, costs for analysis of oil samples assume an annual input of 1000 samples. If all 19 countries do participate, this estimate may turn out to be too conservative.

It should be noted that the calculations give only an impression of the amount of money needed. During further preparations of EBBS, more detailed calculations have to be made for each of the participants.

EBBS scenario 1



EBBS study area network (scenario 1)

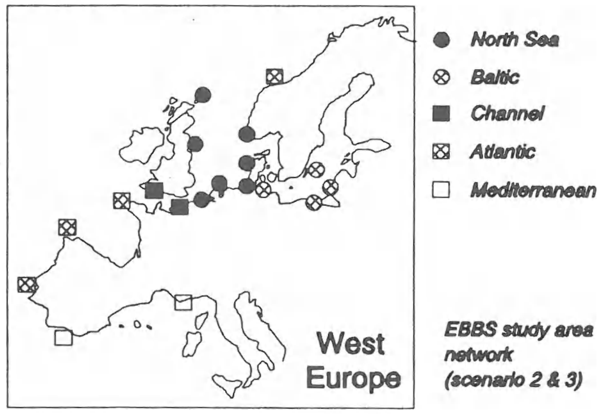
STANDARD NATIONAL ANNUAL BUDGET (ECU per annum)

National co-ordinator (salary)	32,000	(12 months, full time)
Additional costs	32,000	
-travel expenses	4,000	
Field assistant (contract)	15,000	(6 months, full time)
-travel expenses	4,000	
Travel expenses 50 volunteers	3,000	(6 months activity)
Computer/analysis	3,000	
Consumables	2,000	
Total budget per country per annum	76,000	(no study area)
	95,000	(1 study area)
	110,000	(2 study areas)
	125,000	(3 study areas)
	155,000	(5 study areas)

EBBS budget table:

Participant	Study areas per sea area N	C	B	A	M	Σ	Annual costs (ECUs) for EBBSs with decreasing geographical coverage NCBAM	NCBA	NCB	NC	N
Faeroe islands	-	-	-	0	-	0	76,000	76,000	0	0	0
Orkney & Shetland	1	-	-	-	-	1	95,000	95,000	95,000	95,000	95,000
United Kingdom	3	1	-	1	-	5	155,000	155,000	140,000	140,000	125,000
Ireland	-	-	-	1	-	1	95,000	95,000	0	0	0
Norway	1	-	-	1	-	2	110,000	110,000	95,000	95,000	95,000
Sweden	-	-	1	-	-	1	95,000	95,000	95,000	0	0
Finland	-	-	0	-	-	0	76,000	76,000	76,000	0	0
Russia	-	-	0	-	-	0	76,000	76,000	76,000	0	0
Estonia	-	-	0	-	-	0	76,000	76,000	76,000	0	0
Latvia	-	-	0	-	-	0	76,000	76,000	76,000	0	0
Lithuania	-	-	1	-	-	1	95,000	95,000	95,000	0	0
Poland	-	-	2	-	-	2	110,000	110,000	110,000	0	0
Denmark	2	-	1	-	-	3	125,000	125,000	125,000	110,000	110,000
Germany	1	-	2	-	-	3	125,000	125,000	125,000	95,000	95,000
Netherlands	1	-	-	-	-	1	95,000	95,000	95,000	95,000	95,000
Belgium	1	-	-	-	-	1	95,000	95,000	95,000	95,000	95,000
France	-	1	-	1	1	3	125,000	110,000	95,000	95,000	0
Portugal	-	-	-	1	-	1	95,000	95,000	0	0	0
Spain	-	-	-	1	1	2	110,000	95,000	0	0	0
Total no. study areas	10	2	7	6	2	27	27	25	19	12	10
Number of participants	7	2	9	7	2	19	19	19	15	8	7
Total costs participants							1,905,000	1,875,000	1,469,000	820,000	710,000
Costs intern. co-ordinator							97,000	97,000	97,000	97,000	97,000
Costs oil analysis BSH							198,300	198,300	198,300	198,300	198,300
Total budget (ECU per annum)							**2,200,300**	**2,170,300**	**1,764,300**	**1,115,300**	**1,005,300**
Proportion of total budget (%)							100	98.6	80.2	50.7	45.7

EBBS scenario 2



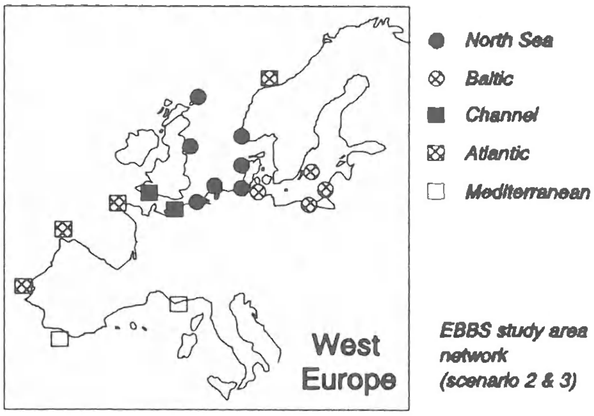
STANDARD NATIONAL ANNUAL BUDGET (ECU per annum)

National co-ordinator (salary)	32,000	(12 months, full time)
Additional costs	32,000	
-travel expenses	4,000	
Field assistant (contract)	15,000	(6 months, full time)
-travel expenses	4,000	
Travel expenses 50 volunteers	3,000	(6 months activity)
Computer/analysis	3,000	
Consumables	2,000	
Total budget per country per annum	76,000	(no study area)
	95,000	(1 study area)
	110,000	(2 study areas)
	125,000	(3 study areas)

EBBS budget table:

Participant	Study areas per sea area N	C	B	A	M	Σ	Annual costs (ECUs) for EBBSs with decreasing geographical coverage NCBAM	NCBA	NCB	NC	N
Faeroe islands	-	-	-	0	-	0	76,000	76,000	0	0	0
Orkney & Shetland	1	-	-	-	-	1	95,000	95,000	95,000	95,000	95,000
United Kingdom	1	1	-	0	-	2	110,000	110,000	110,000	110,000	95,000
Ireland	-	-	-	0	-	0	76,000	76,000	0	0	0
Norway	1	-	-	1	-	2	110,000	110,000	95,000	95,000	95,000
Sweden	-	-	1	-	-	1	95,000	95,000	95,000	0	0
Finland	-	-	0	-	-	0	76,000	76,000	76,000	0	0
Russia	-	-	0	-	-	0	76,000	76,000	76,000	0	0
Estonia	-	-	0	-	-	0	76,000	76,000	76,000	0	0
Latvia	-	-	0	-	-	0	76,000	76,000	76,000	0	0
Lithuania	-	-	1	-	-	1	95,000	95,000	95,000	0	0
Poland	-	-	1	-	-	1	95,000	95,000	95,000	0	0
Denmark	1	-	0	-	-	1	95,000	95,000	95,000	95,000	95,000
Germany	1	-	1	-	-	2	110,000	110,000	110,000	95,000	95,000
Netherlands	1	-	-	-	-	1	95,000	95,000	95,000	95,000	95,000
Belgium	1	-	-	-	-	1	95,000	95,000	95,000	95,000	95,000
France	-	1	-	1	1	3	125,000	110,000	95,000	95,000	0
Portugal	-	-	-	1	-	1	95,000	95,000	0	0	0
Spain	-	-	-	1	1	2	110,000	95,000	0	0	0
Total no. study areas	7	2	4	4	2	19	19	17	13	9	7
Number of participants	7	2	9	7	2	19	19	19	15	8	7
Total costs participants							1,781,000	1,751,000	1,379,000	775,000	665,000
Costs intern. co-ordinator							97,000	97,000	97,000	97,000	97,000
Costs oil analysis BSH							198,300	198,300	198,300	198,300	198,300
Total budget (ECU per annum)							**2,076,300**	**2,046,300**	**1,674,300**	**1,070,300**	**960,300**
Proportion of total budget (%)							100	98.6	80.6	51.5	46.3

EBBS scenario 3



EBBS study area network (scenario 2 & 3)

STANDARD NATIONAL ANNUAL BUDGET (ECU per annum)

National co-ordinator (salary)	18,675	(7 months, full time)
Additional costs	18,675	
-travel expenses	4,000	
Field assistant (contract)	7,500	(6 months, part time)
-travel expenses	4,000	
Travel expenses 50 volunteers	500	(1 month activity)
Computer/analysis	3,000	
Consumables	2,000	
Total budget per country per annum	46,850	(no study area)
	58,350	(1 study area)
	65,850	(2 study areas)
	73,350	(3 study areas)

EBBS budget table:

	Study areas per sea area						Annual costs (ECUs) for EBBSs with decreasing geographical coverage				
Participant	N	C	B	A	M	Σ	NCBAM	NCBA	NCB	NC	N
Faeroe islands	-	-	-	0	-	0	46,850	46,850	0	0	0
Orkney & Shetland	1	-	-	-	-	1	58,350	58,350	58,350	58,350	58,350
United Kingdom	1	1	-	0	-	2	65,850	65,850	65,850	65,850	58,350
Ireland	-	-	-	0	-	0	46,850	46,850	0	0	0
Norway	1	-	-	1	-	2	65,850	65,850	58,350	58,350	58,350
Sweden	-	-	1	-	-	1	58,350	58,350	58,350	0	0
Finland	-	-	0	-	-	0	46,850	46,850	46,850	0	0
Russia	-	-	0	-	-	0	46,850	46,850	46,850	0	0
Estonia	-	-	0	-	-	0	46,850	46,850	46,850	0	0
Latvia	-	-	0	-	-	0	46,850	46,850	46,850	0	0
Lithuania	-	-	1	-	-	1	58,350	58,350	58,350	0	0
Poland	-	-	1	-	-	1	58,350	58,350	58,350	0	0
Denmark	1	-	0	-	-	1	58,350	58,350	58,350	58,350	58,350
Germany	1	-	1	-	-	2	65,850	65,850	65,850	58,350	58,350
Netherlands	1	-	-	-	-	1	58,350	58,350	58,350	58,350	58,350
Belgium	1	-	-	-	-	1	58,350	58,350	58,350	58,350	58,350
France	-	1	-	1	1	3	73,350	65,850	58,350	58,350	0
Portugal	-	-	-	1	-	1	58,350	58,350	0	0	0
Spain	-	-	-	1	1	2	65,850	58,350	0	0	0
Total no. study areas	7	2	4	4	2	19	19	17	13	9	7
Number of participants	7	2	9	7	2	19	19	19	15	8	7
Total costs participants							1,084,650	1,069,650	844,250	474,300	408,450
Costs intern. co-ordinator							97,000	97,000	97,000	97,000	97,000
Costs oil analysis BSH							198,300	198,300	198,300	198,300	198,300
Total budget (ECU per annum)							**1,379,950**	1,364,950	1,139,550	769,600	703,750
Proportion of total budget (%)							100	98.9	82.6	55.8	51.0

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