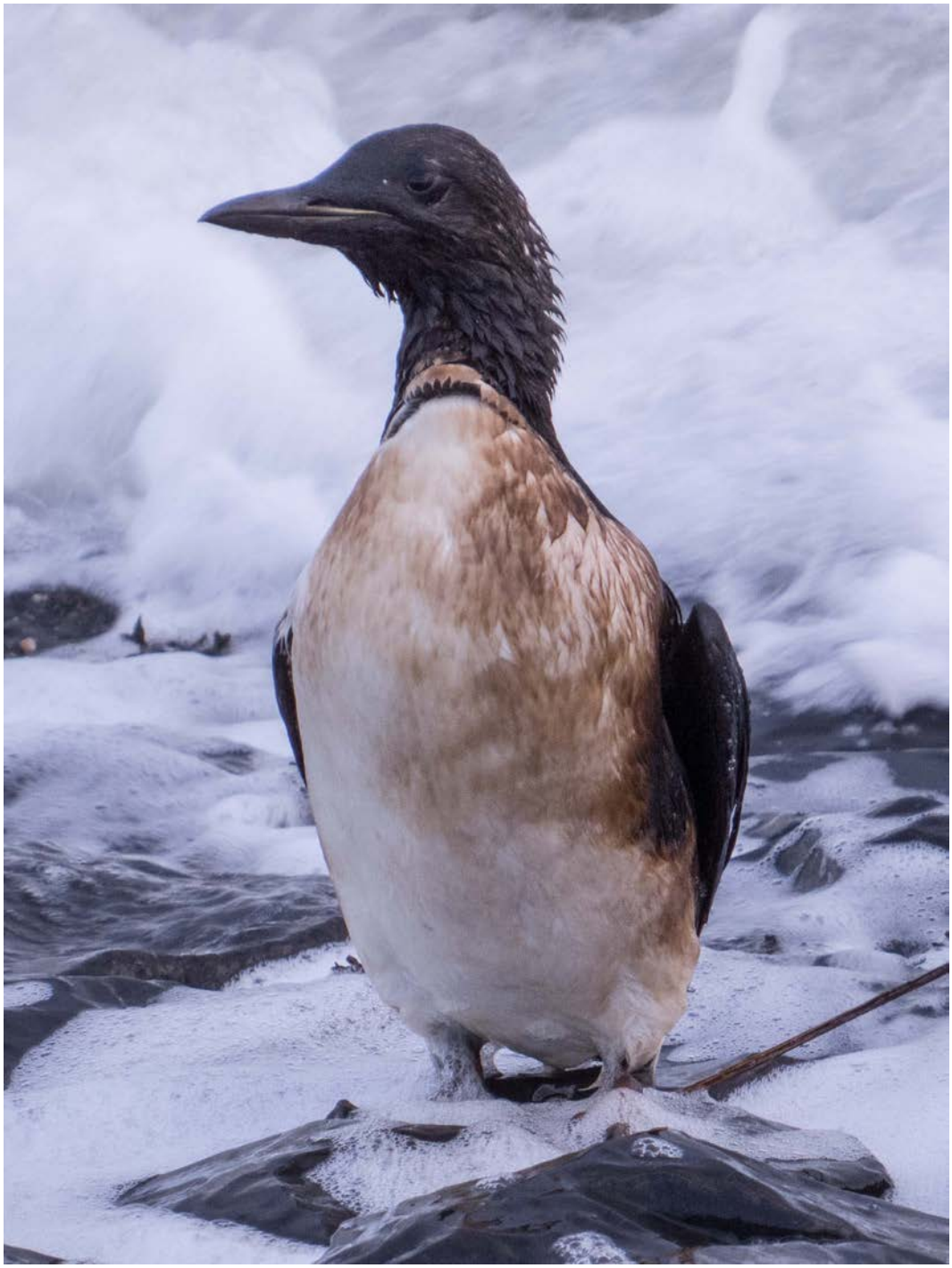
Monitoring and assessment of the proportion of oiled Common Guillemots from beached bird surveys in The Netherlands: annual update winter 2015/16



C.J. Camphuysen 2017

Royal Netherlands Institute for Sea Research and the Dutch Seabird Group

Front cover:

Oiled Common Guillemot, stranded alive, 25 December 2015 Texel. Photo Jan Andries van Franeker

Commissioners contact details:

Ministry of Infrastructure and the Environment (I&M), Postbus 5023 | 2600 GA | Delft, The Netherlands.
Contact: Mervyn Roos, RWS-CIV mervyn.roos@rws.nl

RWS Centrale Informatievoorziening BM 17.21

Author's contact details:

Royal Netherlands Institute for Sea Research and the Dutch Seabird Group, P.O. Box 59 | 1790 AB | Den Burg, Texel, The Netherlands.
Contact: Dr Kees (C.J.) Camphuysen, senior researcher, E-mail kees.camphuysen@nioz.nl
+31 222 369488

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Monitoring and assessment of the proportion of oiled Common Guillemots from beached bird surveys in The Netherlands: annual update winter 2015/16

Summary - This is the annual update for OSPAR of the beached bird survey (BBS) results in The Netherlands (winter 2015/16). The Dutch BBS provides data for OSPAR area's 8, 9 and 10, but data from Belgian and German colleagues will have to be merged to arrive at the final values for these areas. For the Dutch North Sea region, significant declines in oil rates were reported over a long study period (1977/78-2014/15) as well as (clearly accelerating) over the last 10-15 years, but the last seasons was unique in the series.

In winter 2015/16, while the densities of pelagic seabirds washing ashore were not particularly low (hence, the sample size was excellent), the oil-rate (percentage of oiled Common Guillemots of all complete Common Guillemots found dead) reached an all-time low of only 3% (n= 165) for all studied areas, or 2.9% (n=140) for the North Sea coast of OSPAR areas 8 and 9 combined. The five-year running mean in (Dutch) national Common Guillemot oil rates (over 2011/12-2015/16; mean ± SD) arrived at 23.5 ± 15.7% (OSPAR 8-9). The results obtained over the last decade(s) suggest a continuation of low oil rates in Common Guillemots in Dutch waters.

Following the significant trends in the most recent data set (2001/02-present), a projection for 2020 would arrive at *c.* 5%, meaning that the OSPAR target is within reach. A poorly treated oil-spill within the western Wadden Sea casted a shadow over this otherwise excellent beached bird survey result, but fortunately, few birds were affected.

Monitoring en vaststelling van het percentage met olie besmeurde Zeekoeten door middel van systematische strandtellingen in Nederland; jaarlijkse rapportage, winter 2015/16

Samenvatting - Dit is de jaarlijkse weergave voor OSPAR van de resultaten van systematische strandtellingen langs de Nederlandse kust, met een verslag over het seizoen 2015/16. Middels deze tellingen verzorgt Nederland haar bijdragen voor de OSPAR deelgebieden 8, 9, en 10. Om een compleet beeld te krijgen voor deze deelgebieden zullen Belgische en Duitse gegevens moeten worden toegevoegd en gecombineerd. In deze rapportage worden alleen de Nederlandse gegevens besproken. Voor de Nederlandse Noordzeekust kon de lange termijn afname in oliebevuilingspercentages (1977/78-2014/15) bij de Zeekoeten worden bevestigd. Over de laatste jaren versnelt deze afname.

In de winter van 2015/16 spoelden behoorlijke aantallen zeevogels aan, waaronder ook Zeekoeten, en de monstergrootte is dan ook ruim voldoende om tot betrouwbare uitspraken te komen. Het (Nederlandse) nationale oliebevuilingspercentage van de Zeekoet bedroeg in de winter van 2015/16 slechts 3% (n= 165) indien berekend over alle gebieden en 2.9% (n=140) indien berekend over de Noordzeekust van OSPAR gebieden 8 and 9 gecomibineerd, hetgeen de laagste waarde is die ooit in Nederland werd gemeten sinds het olieslachtoffervraagstuk werd onderzocht (dat is sinds 1910). Het vijfjaarlijks lopend gemiddelde over 20011/12-2015/16 (gemiddeld ± SD) bedroeg 23.5 ± 15.7% (OSPAR 8-9). De oliebevuilingspercentages lijken de afgelopen jaren steeds sneller af te nemen. Op basis van de lineaire regressie berekend over de logit-oliebevuilingspercentages in deze eeuw (2001/02-2015/16) waarover een significante dalende trend werd gevonden, zou het bevuilingspercentage in 2020 uitkomen op ±5%, waarmee, aangenomen dat dit niveau zich over een periode van vijf seizoen handhaaft, één van de door OSPAR gestelde doelen wat betreft milieuvervuiling voor Nederland bereikt zou zijn. Het lage niveau en de voortzetting van de dalende trend wat betreft olievervuiling werd enigszins overschaduwd door een onprofessioneel afgehandeld olie-incident in de westelijke Waddenzee waarbij gelukkig weinig olieslachtoffers vielen.

Introduction

In the early 21st century the number of detected oil spills has markedly declined and levels of chronic oil pollution are currently rather low. Most detections of oil slicks are still concentrated around the major shipping lanes and off major ports such as Rotterdam and IJmuiden (leading to Amsterdam; Camphuysen & Vollaard 2015). The Marine Strategy Framework Directive demands in the Commission Decision of 2010, Chapter 8.2, Effects of contaminants, an indicator for oil pollution (EU 2010). The information need for the monitoring and assessment of oil fouling of seabirds was first established in the OSPAR organization in the form of an OSPAR Ecological Quality Objective (EcoQO). In the legal Dutch Kader Richtlijn Marien document (page 78; "Vervuilende stoffen"; Anon. 2012), the EcoQO indicator is explicitly implemented. In the EcoQOs for the North Sea, "the Proportion of oiled Common Guillemots among those found dead or dying on beaches" was subsequently listed Under Issue 4 (Seabirds), EcoQO element (f). The "Oiled Guillemot EcoQO", as agreed by the 5th North Sea Conference, was defined as: *"The proportion of such birds should be 10% or less of the total found dead or dying, in all areas of the North Sea"* (Anon. 2002), later refined to target mean proportions of 20% in 2020 and 10% in 2030 over periods of at least 5 years (Anon. 2012).

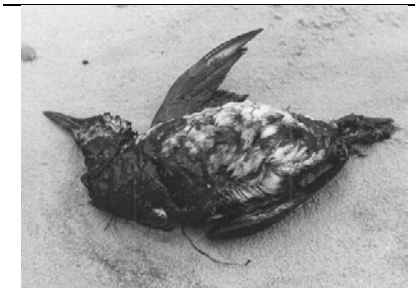
Species-specific oil rates (proportion of birds oiled; Furness & Camphuysen 1997, Camphuysen & Heubeck 2001) reflect the risk for various species of marine birds to become oiled at sea, with high oil rates being more characteristic for seabirds that are particularly common in areas with frequent oil spills and that have a behaviour that puts them at risk (a swimming and diving life-style); lower oil rates were found in more aerial seabirds, especially those wintering away from the busiest shipping lanes (Furness & Camphuysen 1997, Camphuysen 2010). Common Guillemots, abundant and widespread wing-propelled pursuit seabirds in NW European waters, are particularly useful in this context. By monitoring the occurrence of oil on carcasses of guillemots washing ashore around Europe, spatial and temporal trends in chronic oil pollution can be derived over large geographical scales and over long time-series.

The emphasis of this study is on Common Guillemots, but similar data are collected for all stranded birds and in this report details are provided for five other species: two offshore seabirds (the Black-legged Kittiwake *Rissa tridactyla* and the Razorbill *Alca torda*) and coastal species (Herring Gull *Larus argentatus*, Common Eider *Somateria mollissima*, and Common Scoter *Melanitta nigra*). The first group is meant to evaluate trends in chronic oil pollution at greater distances from the nearest coast, the second group would reflect nearshore oil pollution.

This is the annual update for The Netherlands for winter 2015/16. All data collected since winter 1976/77 are incorporated in this report. Oil-rates (% oiled) of Common Guillemots are provided for the Dutch North Sea coast as a whole, and

for the Dutch contributions to OSPAR areas 8 (238 km), 9 (61 km), and 10 (299 km; see Methods). Raw data are provided in Appendices. Given the nature of the underlying database (historical data can be merged with earlier published material whenever they emerge to enlarge earlier sample sizes), the exact values may deviate slightly from earlier publications.

Selected offshore seabirds



Common Guillemot
Uria aalge

Razorbill
Alca torda

Black-legged Kittiwake
Rissa tridactyla

Selected nearshore or coastal seabirds

Common Eider
Somateria mollissima

Common Scoter
Melanitta nigra

Herring Gull
Larus argentatus

Fig. 1. The emphasis of this study is on Common Guillemots *Uria aalge*, but similar data are collected for two other offshore seabirds (the Black-legged Kittiwake *Rissa tridactyla* and the Razorbill *Alca torda*) and three coastal species (Herring Gull *Larus argentatus*, Common Eider *Somateria mollissima*, and Common Scoter *Melanitta nigra*). The first group is meant to evaluate trends in chronic oil pollution at greater distances from the nearest coast, the second group would reflect nearshore oil pollution.

Methods

The significance of chronic oil pollution in particular sea areas is assessed by means of beached bird surveys, in which stranded dead or dying seabirds (notably Common Guillemots) are checked for the presence or absence of mineral oil in their feathers (OSPAR "Oiled Guillemot EcoQO", Camphuysen & Heubeck 2001). Surveys are conducted in winter (Nov-Apr), when the effects of chronic oil pollution are most pronounced and when (illegal) discharges at sea under cover of darkness (*i.e.* at night) are

frequent (Vollaard 2013, Camphuysen & Vollaard 2015). Stranded seabirds are identified, aged if possible, and the carcass is examined for the presence of oil in the feathers. Other evident causes of death are recorded simultaneously and in case of mass strandings, a special investigation is organised in order to try and explain the event. The "Oiled Guillemot EcoQO" uses ratios (the proportion of birds oiled from the total number of birds found) rather than absolute numbers of birds washing ashore.

In order to evaluate trends in oil rates, as described in earlier proposals (Camphuysen 2002, 2004, OSPAR 2004, Camphuysen 2005ab, OSPAR 2005), all incomplete carcasses were excluded from the analysis of beached bird survey results (the presence or absence of oil in the feathers cannot reliably be studied in incomplete remains of birds). The remainder (nTotal) was split in fractions of unoiled (nUnoiled) and oiled (nOiled) individuals. An acceptable oil rate (nOiled/nTotal*100) for Common Guillemots is based on at least 25 complete carcasses of stranded seabirds per annum per area (i.e. quality code 01, see Appendices) and is otherwise considered less 'reliable' (quality code 00). Annual winter values (% oiled) are provided in bar graphs, with a running (arithmetic) mean calculated over five-year periods (i.e. the mean of five annual values preceding and including a particular value), superimposed with a line graph to illustrate the most recent trends. Lower quality assessments (00, percentages based on less than 25 complete carcasses) are indicated with a lighter shading. To facilitate a trend analysis by means of linear regression, the oil-rates were logit-transformed in order to obtain normalised data distributions, following recommend-ations in Camphuysen & Van der Meer 1996 (=LOG((x/100)/(1-(x/100))); see also Camphuysen 1995, 1997). For this part of the analysis, lower quality data (quality code 00) were excluded.

The Dutch beached bird surveys contribute to three OSPAR areas, but additional data are required from neighbouring countries in each case:

OSPAR 8 → Eastern Southern Bight mainland coast Belgian/French border to Texel (B, NL)

OSPAR 9 →Southern German Bight North Sea coast Frisian Islands Texel to Elbe (NL, FRG)

OSPAR 10 → Western Wadden Sea mainland and Wadden Sea coast Frisian Islands Texel to Elbe (NL, FRG)

The NZG/NSO beached bird survey monitoring of these areas consists of 106 discrete sections of coast over 680 km (OSPAR area 8, 38 sections, 238km; area 9, 24 sections, 143km; and area 10, 44 sections, 299 km). Just over half that area (56%) consists of coastline bordering the North Sea, the other 44% borders the Wadden Sea (*i.e.* more sheltered waters with particularly intense controls of the occurrence of marine pollution). A "national value" of oil rates is provided by lumping all censuses conducted along the North Sea coast (*i.e.* a combination of the Dutch contributions to OSPAR areas 8 and 9).

Observer effort

Since winter 1977/1978, beached bird surveys have been organised by the Dutch Seabird group. Effort peaked in the 1980s, as a result of the enormous numbers of oiled seabirds washing ashore and an army of environmentally concerned volunteers searching beaches. Over the last 10 years, (arithmetic) mean (± SD) observer effort amounted to 897 ± 309 km per winter. In recent years, effort is compromised as a result of extremely low numbers of birds washing ashore (**Appendix 1**). In this season, no less than 37 counts (26%, n= 145) were received during which not a single corpse of a bird was found. It is difficult to activate volunteers for beached bird surveys if the rewards (finds) are low. Therefore, data were added from www.waarneming.nl, to compensate for the low observer effort, in order to obtain a larger data set for analysis, and to achieve a wider coverage over the entire Dutch coast. The people reporting their finds in waarneming.nl were all acknowledged and the presence of oil was judged from published photographic material. For Common Guillemots, however, the obtained data from the systematic surveys over the Dutch North Sea shoreline as a whole were in fact sufficient to calculate reliable oil rates, but the waarneming.nl material certainly enhanced both area coverage and the sample size.

I am very grateful to the following observers that have provided information on stranded seabirds in 2015/16: F. Arts, N. Bekema, S. van den Berg-Blok, A. van den Berge, M. Bierman, T. de Boer, J. Bom, R. Bos, H. Bouma, M. Broos, M.F. Brugge, H. Bruggink, D. Dooyewaard, G. van Duin, C.J. Dullaart, A. Eggens, J.A. van Franeker, P.R. van Franeker, G.J. Georg, N. Godijn, C.J. Grobbe, A. Groenenberg, A. Gronert, N. Guse, Y. Hermes, J. van den Heuvel, Y. van den Heuvel, L. Hofstee, J. ten Horn, J. Huizenga, F. Janssens, G.O. Keijl, T. Kiewiet, J. Koster, S. Kühn, D. Kuiken†, L. Kuiper, W. van Laarhoven, M.F. Leopold, D. Liefhebber, H. Loobuyck, P.L. Meininger, M. Mulders, RANOX Natuuraannemer, T. van Noort, A. Offerhaus, R. Ploeg, S. van den Prins, R. Rotscheid, E. Soldaat†, R. van der Starre, D. Swiers, L. Swiers, D. Veenendaal, E. Velilla, B. van Vliet, J. de Vries, M. van Wieren, M. Zondervan, C.J. Zuhorn, and www.waarneming.nl

Graag sta ik even stil bij het trieste feit dat twee van de vaste tellers, Dirk Kuiken en Edward Soldaat, dit afgelopen seizoen kwamen te overlijden. Hun gewaardeerde bijdragen aan het langjarige onderzoek zal node gemist worden in de komende jaren.

Results

Oil rates in Common Guillemots - The annual oil rate in Common Guillemots along the North Sea coast declined steadily, and significantly since the late 1970s (earlier reports and **Figs. 2-3**). Along the North Sea coast of The Netherlands as a whole, in line with numerous earlier reports, a significant decline in oil rates can be demonstrated, leading to a National oil rate that was lower than recorded ever before since the oil problem started in the early 20th century. In winter 2015/16 the national oil rate (OSPAR subregions 8 and 9 combined) arrived at only 2.9% (n= 140). The exceptionally low value over 2012/13 (10.9%; n= 55) is no longer an outlier. The five-year running mean in (Dutch) national Common Guillemot oil rates (over 2011/12-2015/16; mean ± SD) arrived at 23.5 ± 15.7%. The results obtained over the last decade(s) suggest a continuation of low oil rates in Common Guillemots in Dutch waters. Declining oil rates were found in all three OSPAR regions covered by Dutch surveys (**Appendix 2**). The sample size within region 8 is too small to warrant a separate trend analysis for that subregion alone, but it should be realised that the data presented here are in fact all contributions to international datasets, that should be analysed in combination with Belgian and German data for regions 8-10.

The densities of Common Guillemots found along the Dutch North Sea shore are plotted in **Fig. 4**, and these data show highly variable numbers between seasons (the results of wrecks, weather and oil spills), but also a long-term decline leading to very low densities in recent years. The low level of strandings was unforeseen in the 1980s and 1990s when the Oiled Guillemot Eco-QO was developed, but this is an issue affecting the robustness of some recent data (as a result of a reduced sample size) in The Netherlands, just as it is in neighbouring countries (Stienen *et al.* 2014).

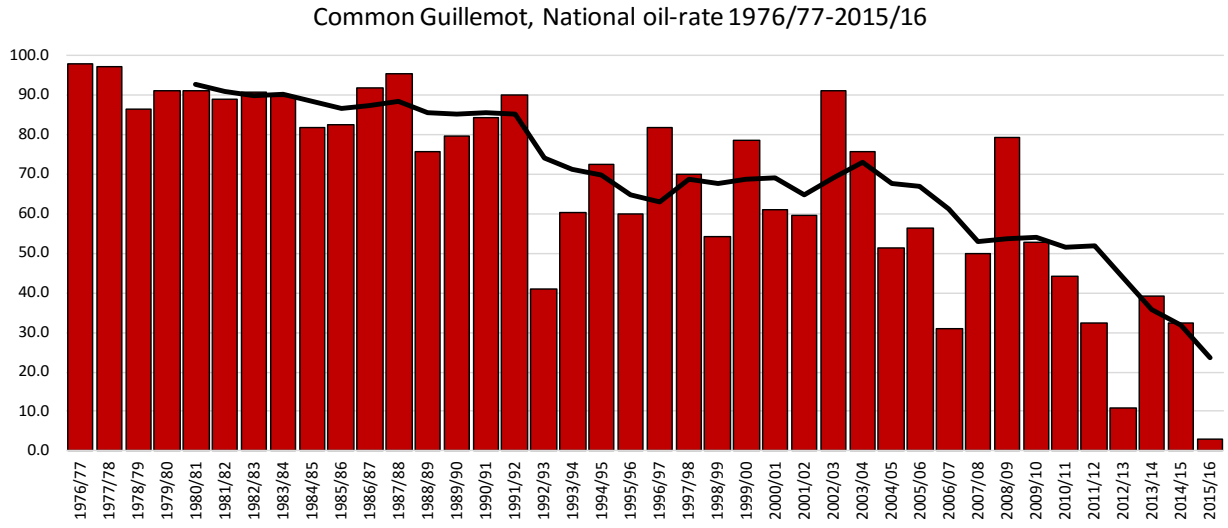


Fig. 2. *Annual oil rates in Common Guillemots (n >25 complete carcasses) found stranded along the North Sea coast in The Netherlands (OSPAR areas 8 and 9 combined) along the North Sea beach and 5yr running arithmetic mean oil rates since 1977/78. See Fig. 3 for the overall trend in oil rates.* ***Note: to conduct a trend analysis, these values were logit-transformed in Fig. 3.***

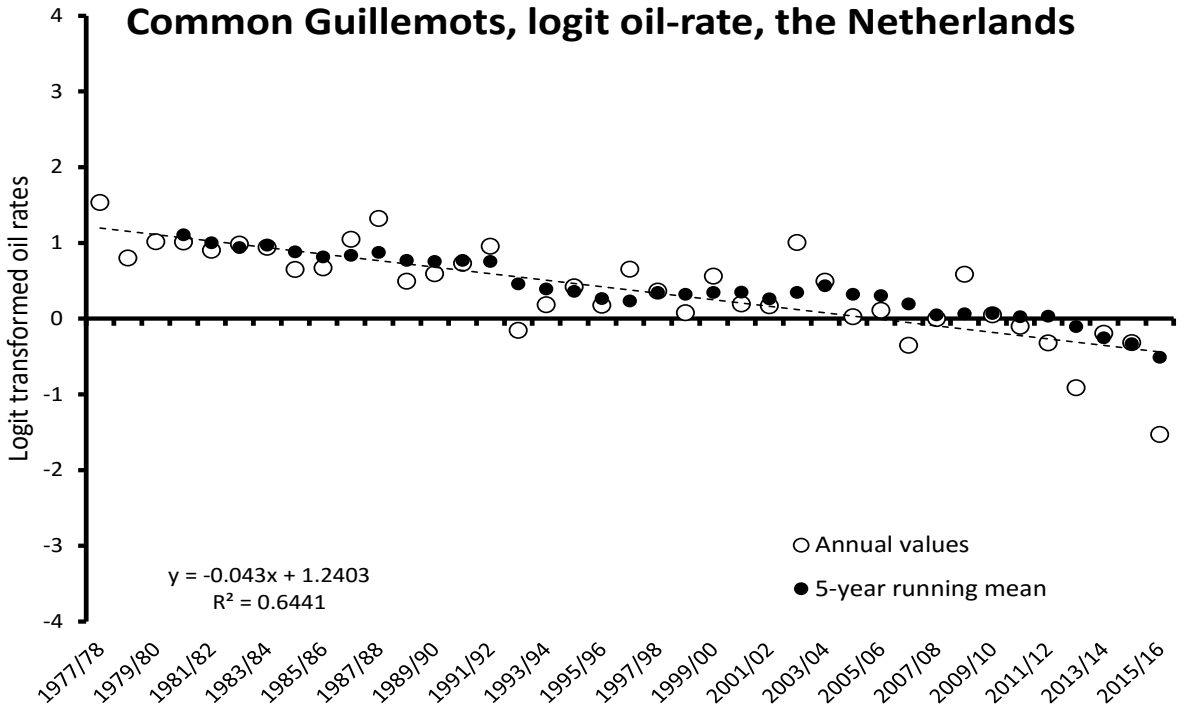


Fig. 3. *Logit-transformed annual oil rates in Common Guillemots (n >25 complete carcasses) in The Netherlands (OSPAR areas 8, 9 and 10) along the North Sea beach and 5-year running (arithmetic) mean oil rates since the late 1977/78. A linear regression was calculated over the annual values (dashed line; P< 0.001).*

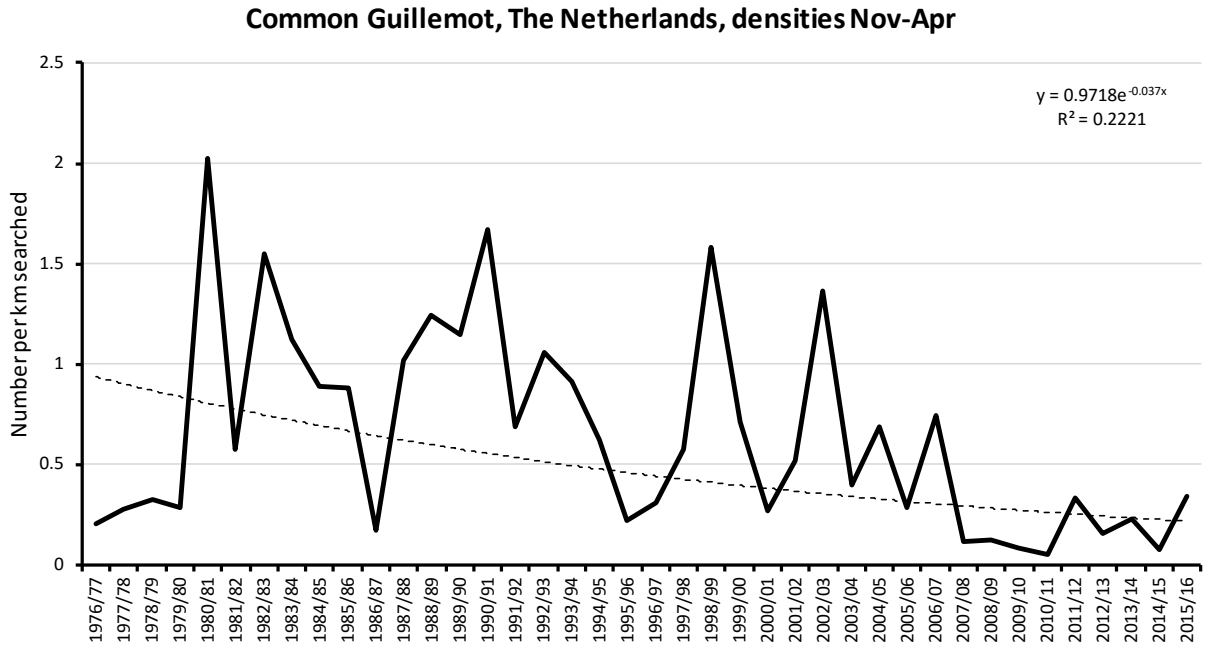


Fig. 4. *Overall densities (n km^{-1}) in Common Guillemots in The Netherlands (OSPAR areas 8, 9 and 10) along the North Sea beach since winter 1977/78. An exponential trend line was calculated over the annual values (dashed line), suggesting a long-term decline, but with highly variable numbers.*

Oil rates in other offshore seabirds - The other offshore seabirds are characterised by similar trends (**Figs 5-6**), but the numbers washing ashore are smaller, also in the recent absence of food-related or storm-driven mass-mortalities and associated wrecks. The most recent wreck occurred in winter 2011/12, resulting in reliable but also spectacularly low oil rates. It is this kind of mortality events that oil rates are artificially lowered and should be treated with caution.

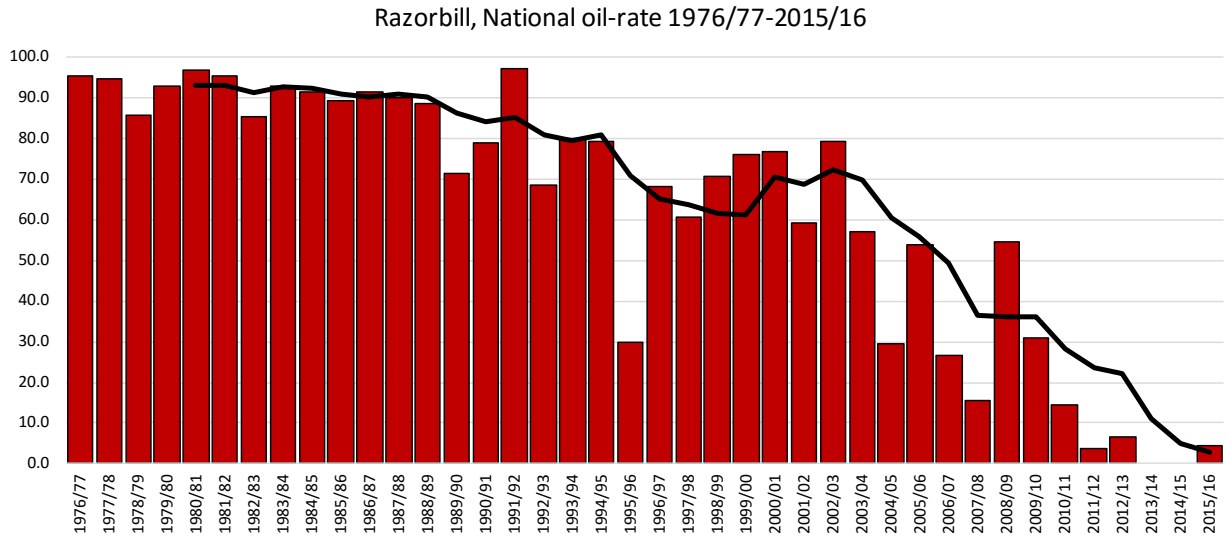


Fig. 5. Annual oil rates in Razorbills (n >25 complete carcasses) in The Netherlands and 5-year running (arithmetic) mean oil rates since the late 1970s. See Appendix 7 for the quality of values.

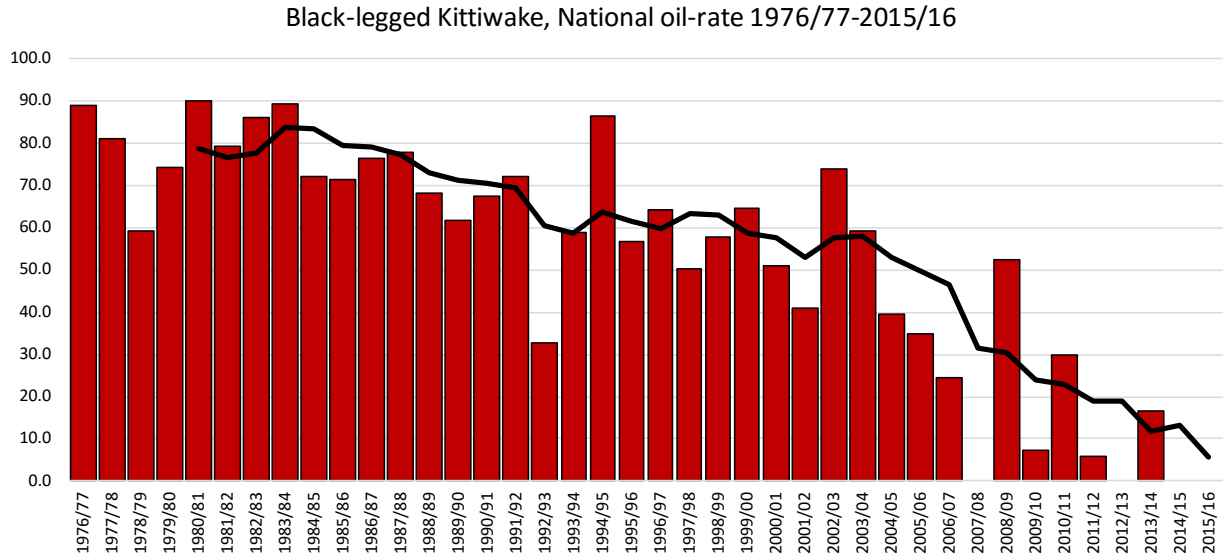


Fig. 6. Annual oil rates in Black-legged Kittiwakes (n >25 complete carcasses) in The Netherlands and 5-year running (arithmetic) mean oil rates since the late 1970s. See Appendix 8 for the quality of values. No reliable data for 2015/16 were collected (too few intact corpses were found).

Oil rates in nearshore seabirds - The long-term trends of the coastal species Common Eiders (**Fig. 7**) and Herring Gulls (**Fig. 9**) are even steeper declines. Oiled carcasses are currently rare, even along the North Sea coast, indicating a more pronounced decline in oil rates than in offshore seabirds. Remarkably, the oil rates of the more gregarious Common Scoters (**Fig. 8**) did not decline, until rather recently. The decline coincided with a marked decline in overall numbers washing ashore, and although seawatchers have indicated that Common Scoters today are scarce in comparison with the 1970s-90s (Camphuysen & Van Dijk 1983, Platteeuw *et al.* 1994, www.trektellen.nl), high concentrations of birds have occurred that did not produce higher numbers of (oiled or unoiled) carcasses.

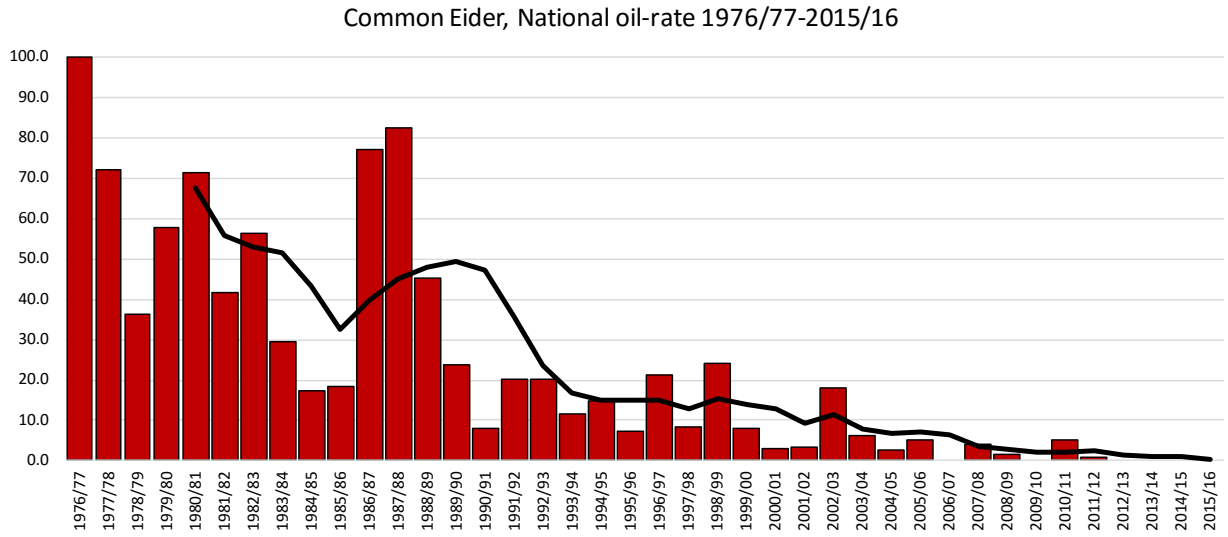


Fig. 7. Annual oil rates in Common Eiders (n >25 complete carcasses) in The Netherlands and 5-year running (arithmetic) mean oil rates since the late 1970s. See Appendix 11 for the quality of values.

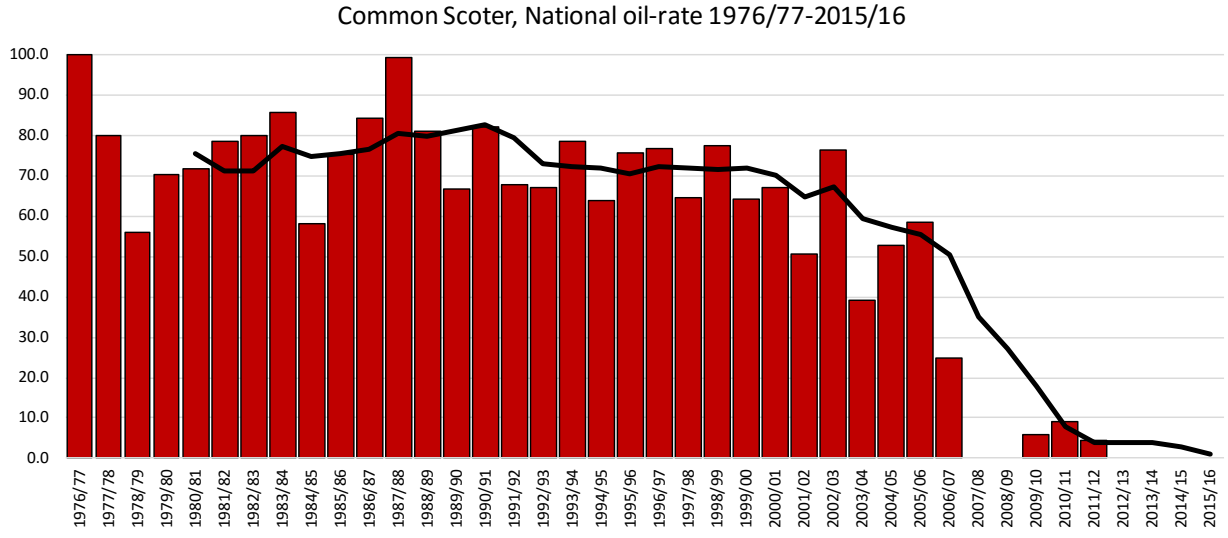


Fig. 8. Annual oil rates in Common Scoters (n >25 complete carcasses) in The Netherlands and 5-year running (arithmetic) mean oil rates since the late 1970s. See Appendix 10 for the quality of values.

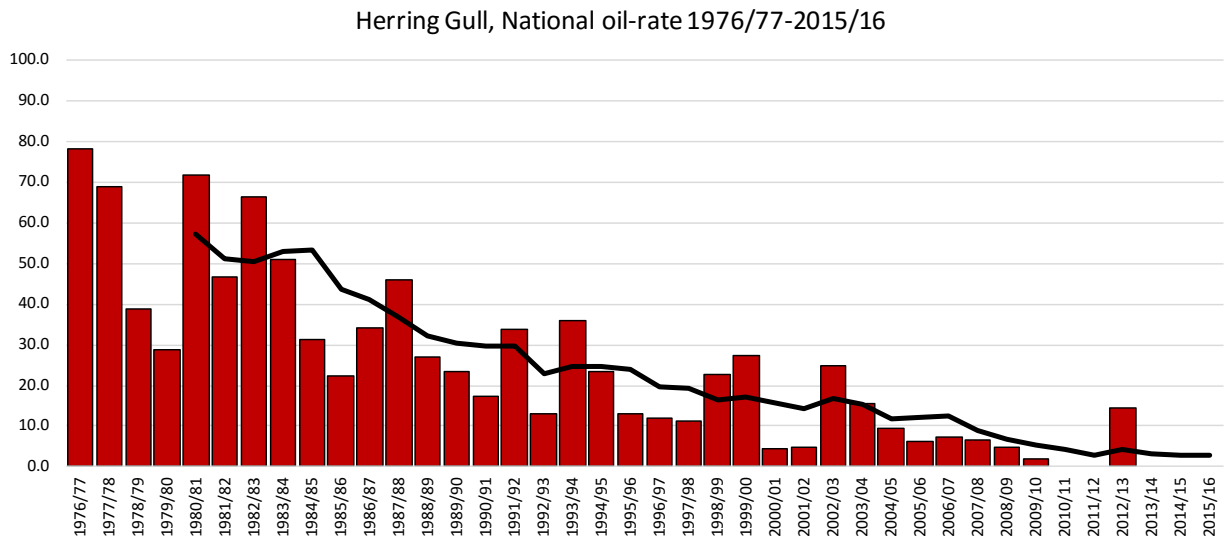
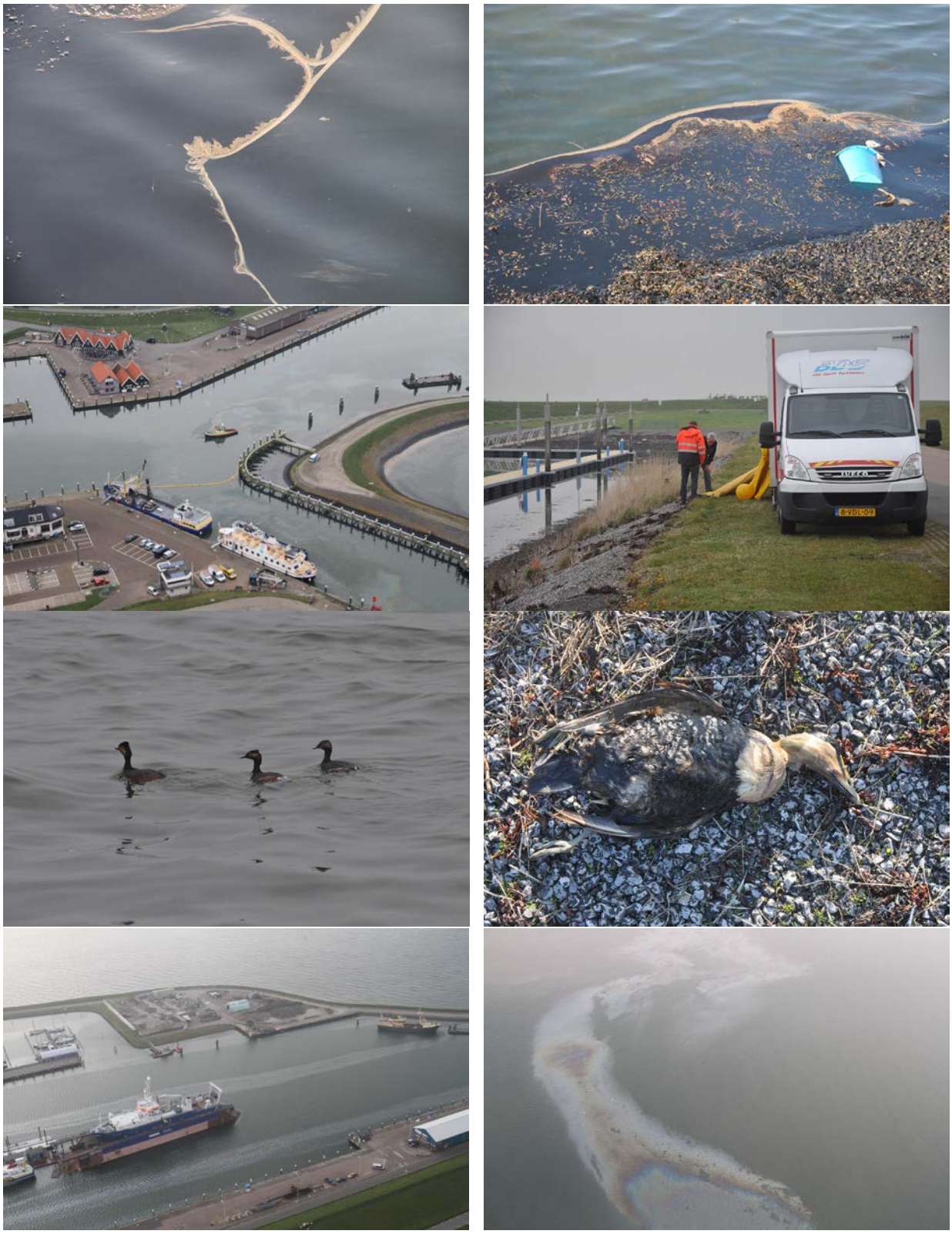


Fig. 9. Annual oil rates in Herring Gulls (n >25 complete carcasses) in The Netherlands and 5-year running (arithmetic) mean oil rates since the late 1970s. See Appendix 11 for the quality of values.

Recent trends and long-term projection - The long-term trends are declines in oil rates in all species. For Common Guillemots, the recent trend based on logit transformed oil rates over the most recent winters (2001/02 - 2015/16), for the Dutch North Sea coast as a whole, was significant ($P < 0.001$; $a = 0.71$, $b = -0.10$, $r^2 = 0.54$, rms= 0.18, se $b = 0.03$, $t = -3.93$, $n = 15$), leading to a projection of only 5% oiled birds (logit -1.28) for 2020, which is in accordance with the most recent targets.

Oil incidents – On Thursday 31 March 2016, an accidental oil spill occurred within the harbour of Oudeschild on Texel. Poor local management resulted in a considerable spill that reached the western Wadden Sea. Oil slicks were observed between the North Sea (Marsdiep entrance) and the northeastern coast of Texel (De Schorren), where a very important staging area of Black-necked Grebes *Podiceps nigricollis* is situated. It was only on Monday 4 April 2016 that the beached bird survey programme was alerted, not by a phonecall from Rijkswaterstaat (as planned for oil incidents in The Netherlands), but as a result of a heavy diesel smell that had reached our office in ‘t Horntje on Texel. Once contact became established, Rijkswaterstaat (Willem Riesenkamp and G. Hemelrijk) in close contact with NIOZ/NSO (CJ Camphuysen), tried to minimize potential damage in the most sensitive part of the western Wadden Sea: off the Schorren/IJzeren Kaap. Field observations on the ground (CJC) and aerial and boat surveys (RWS) were organized to try and forego that the grebe area would become affected. Light sheens reached the grebe area (photo’s below), and the RWS vessel tried to break the sheen to stimulate natural dispersal of the oil. Despite a fairly heavy contamination of the harbor area itself (photo’s below), and apart from some heavily oiled Common Eiders that died (photo’s below), seabird mortality was minimal and the oil disappeared from the Wadden Sea in just over a week.



Images of the Oudeschild oilspill, March-April 2016 (1-2,4-6 CJC, 3, 7-8 RWS). 1-2 pollution within the marina, 3-4 containment of the oil within the harbour, after the oil was spilled into the Wadden Sea, 5 Black-necked Grebes in a light oil sheen near IJzeren Kaap, 6 completely oiled Common Eider, and 7-8 aerial photos of Oudeschild harbour and oil sheens at sea.

Discussion and conclusion

Beached bird surveys are an essential part of both the Oiled-Guillemot EcoQO as well as for the plastic particle monitoring conducted by using Northern Fulmar carcasses around the North Sea (Van Franeker & SNS Fulmar Study Group 2013 and numerous other reports). Seabird densities in recent winters tended to be low so that volunteers refrained from searching systematically. More opportunistic reports from www.waarneming.nl including clear photographic material, after screening for double counts and identification errors, were used to enhance the sample size of stranded Common Guillemots. Fox predation, beach-clean-up operations by NGOs and the more and more frequent 'sand suppletions' are issues that hinder regular beached bird surveys in various ways.

In winter 2015/16, fairly large numbers of seabirds washed ashore, facilitating both projects. The oil rates were very low this season, signalling a further improvement in marine ecosystems for as far as chronic oil pollution is concerned (Fig. 1). The 5-year running (arithmetic) mean oil rate in Common Guillemots for North Sea coasts in OSPAR areas 8 and 9 combined arrived at 23.5% (Fig. 2). The latest results (last decade), but particularly this most recent season, suggest an acceleration of the decline in oil rates in the southern Bight. Following the most recent data, (2001/2-present), a projection for 2020 would arrive at a national oil rate for Common Guillemots of c. 5% (logit -1.28)! The Dutch data collected for OSPAR regions 8 and 9 must be seen as contributions to the data set. An international co-ordinator, or OSPAR itself, will have to combine Dutch, Belgian and German data for these areas in order to arrive at OSPAR area specific oil rates for Common Guillemots in the southeastern North Sea. There is no doubt that similar trends will be revealed as presented in the current document for the Dutch area as a whole.

While chronic oil pollution has been a most serious problem for decades in the North Sea and off the Dutch coast (Mörzer Bruyns & Brouwer 1959, Camphuysen 1989, 1995, 2010, Camphuysen & Vollaard 2015), actual oil incidents (i.e. spillages with a known cause or source) have been fairly scarce. The most serious incident occurred in 1969 (Swennen & Spaans 1970), killing tens of thousands of nearshore wintering seaduck, and other serious incidents included the Borcea in 1988 (Camphuysen *et al.* 1988) and the Tricolor in 2002 (Camphuysen 2003, Camphuysen & Leopold 2005). The occurrence of oil within the Wadden Sea, as a highly sensitive and internationally important bird area, has always been of great concern. Also, the co-operation between NSO and Rijkswaterstaat has always been strong, when issues with oil in nearshore waters were to be discussed. It came therefore as a surprise that a more serious spill did not lead to immediate co-operation between RWS and NIOZ/NSO (nearly a week delay occurred), and that oil could slip out of a harbour and into the Wadden Sea. The lack of co-operation was caused by an inadequate immediate response by local harbour authorities and fisheries organisations, where the risks were underestimated and economic short-term benefits (the fleet had to leave the harbour) was outweighed against a potential ecological drama. Once the contact between RWS and NIOZ/NSO (and Ecomare Texel) became established, the co-operation was fruitful and effective.

The most dangerous oil sheens were carefully monitored and the beaches were searched for casualties. Advice was provided to prevent oiling of the grebe ground at all costs, but further action was not required thanks to a rapid evaporation and natural dispersal of the oil.

This annual report completed the 40th season of beached bird surveys since the working group Nederlands Stookolieslachtoffergroep (NSO) became established in 1977 (Camphuysen 1977).

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Appendix 1 Observer effort

Kilometers surveyed in beached bird surveys in The Netherlands, winter 1976/77-2015/16.

	OSPAR 8	OSPAR 9	OSPAR 10	Totals
1976/77	204	40		244
1977/78	356	45	7	408
1978/79	473	103	3	579
1979/80	595	124	3	721
1980/81	1493	330	302	2125
1981/82	1177	264	528	1968
1982/83	1846	532	749	3126
1983/84	1342	541	566	2448
1984/85	1133	304	424	1861
1985/86	1023	253	470	1746
1986/87	708	251	444	1403
1987/88	835	494	509	1839
1988/89	951	287	433	1671
1989/90	1063	153	291	1506
1990/91	1191	92	123	1406
1991/92	807	136	266	1208
1992/93	678	128	376	1182
1993/94	523	123	482	1128
1994/95	335	106	481	923
1995/96	482	145	328	956
1996/97	382	99	353	833
1997/98	378	167	408	953
1998/99	772	325	698	1795
1999/00	647	428	905	1979
2000/01	450	590	690	1730
2001/02	497	536	935	1969
2002/03	805	464	600	1869
2003/04	370	424	516	1310
2004/05	285	439	772	1496
2005/06	253	412	583	1248
2006/07	301	293	515	1109
2007/08	232	209	494	934
2008/09	239	321	361	921
2009/10	225	321	230	776
2010/11	277	268	141	685
2011/12	302	312	414	1027
2012/13	219	91	153	463
2013/14	255	170	130	555
2014/15	238	112	131	481
2015/16	112	185	232	528

Appendix 2 Species found, winter 2015/16

Euring	Nederlandse naam	Scientific name	English name	*n*
0	Geen vogels gevonden	No birds found dead	No birds found dead	34
20	Roodkeelduiker	*Gavia stellata*	Red-throated Diver	2
59	ongedeterm. duiker	*Gavia spec.*	unidentified diver	1
90	Fuut	*Podiceps cristatus*	Great Crested Grebe	2
220	Noordse Stormvogel	*Fulmarus glacialis*	Northern Fulmar	16
462	Vale Pijlstormvogel	*Puffinus puffinus mauretanicus*	Balearic Shearwater	1
640	Roodsnavelkeerkringvogel	*Phaethon aethereus*	Red-billed Tropicbird	1
710	Jan van Gent	*Sula bassana*	Northern Gannet	25
720	Aalscholver	*Phalacrocorax carbo*	Great Cormorant	5
800	Kuifaalscholver	*Phalacrocorax aristotelis*	European Shag	1
950	Roerdomp	*Botaurus stellaris*	Great Bittern	1
1220	Blauwe Reiger	*Ardea cinerea*	Grey Heron	1
1590	Kolgans	*Anser albifrons*	Greater White-fronted Goose	3
1610	Grauwe Gans	*Anser anser*	Greylag Goose	4
1639	ongedeterm. grijze gans	*Anser spec.*	unidentified goose	1
1670	Brandgans	*Branta leucopsis*	Barnacle Goose	4
1680	Rotgans	*Branta bernicla*	Brent Goose	10
1730	Bergeend	*Tadorna tadorna*	Common Shelduck	31
1790	Smient	*Anas penelope*	Eurasian Wigeon	1
1840	Wintertaling	*Anas crecca*	EurasianTeal	1
1860	Wilde Eend	*Anas platyrhynchos*	Mallard	2
1940	Slobeend	*Anas clypeata*	Northern Shoveler	1
1959	ongedeterm. zwemeend	*Anas spec.*	dabbling duck	1
2060	Eidereend	*Somateria mollissima*	Common Eider	111
2130	Zwarte Zeeëend	*Melanitta nigra*	Black Scoter	8
2180	Brilduiker	*Bucephala clangula*	Common Goldeneye	3
2210	Middelste Zaagbek	*Mergus serrator*	Red-breasted Merganser	1
2269	ongedeterm. eend	*unidentified duck*	unidentified duck	1
2870	Buizerd	*Buteo buteo*	Common Buzzard	1
4500	Scholekster	*Haematopus ostralegus*	Eurasian Oystercatcher	18
4960	Kanoetstrandloper	*Calidris canutus*	Red Knot	2
4970	Drieteenstrandloper	*Calidris alba*	Sanderling	2
5120	Bonte Strandloper	*Calidris alpina*	Dunlin	1
5290	Houtsnip	*Scolopax rusticola*	Eurasian Woodcock	17
5340	Rosse Grutto	*Limosa lapponica*	Bar-tailed Godwit	1
5410	Wulp	*Numenius arquata*	Eurasian Curlew	6
5460	Tureluur	*Tringa totanus*	Common Redshank	2
5610	Steenloper	*Arenaria interpres*	Ruddy Turnstone	2
5699	ongedeterm. jager	*Stercorarius spec.*	skua	1
5780	Dwergmeeuw	*Hydrocoloeus minutus*	Little Gull	1
5820	Kokmeeuw	*Chroicocephalus ridibundus*	Black-headed Gull	11
5900	Stormmeeuw	*Larus canus*	Mew Gull	34
5910	Kleine Mantelmeeuw	*Larus fuscus*	Lesser Black-backed Gull	5
5920	Zilvermeeuw	*Larus argentatus*	Herring Gull	76
6000	Grote Mantelmeeuw	*Larus marinus*	Great Black-backed Gull	23
6020	Drieteenmeeuw	*Rissa tridactyla*	Black-legged Kittiwake	57
6110	Grote Stern	*Sterna sandvicensis*	Sandwich Tern	2
6150	Visdief	*Sterna hirundo*	Common Tern	1
6340	Zeekoet	*Uria aalge*	Common Guillemot	181
6360	Alk	*Alca torda*	Razorbill	36

Euring	Nederlandse naam	Scientific name	English name	*n*
6470	Kleine Alk	*Alle alle*	Little Auk	1
6540	Papegaaiduiker	*Fratercula arctica*	Atlantic Puffin	5
6655	Postduif	*Columba 'domestica'*	domestic pigeon	2
6700	Houtduif	*Columba palumbus*	Common Wood Pigeon	1
9920	Boerenzwaluw	*Hirundo rustica*	Barn Swallow	1
11870	Merel	*Turdus merula*	Common Blackbird	4
11980	Kramsvogel	*Turdus pilaris*	Fieldfare	5
12010	Koperwiek	*Turdus iliacus*	Redwing	2
13150	Vuurgoudhaantje	*Regulus ignicapilla*	Firecrest	1
15600	Kauw	*Corvus monedula*	Eurasian Jackdaw	1
15820	Spreeuw	*Sturnus vulgaris*	Common Starling	3
19999	ongedeterm. zangvogel	*unidentified passerine*	unidentified passerine	1
23510	Bruinvis	*Phocoena phocoena*	Harbour Porpoise	3
24320	Grijze Zeehond	*Halichoerus grypus*	Grey Seal	1
30002	Konijn	*Oryctolagus cuniculus*	Rabbit	1
30003	Haas	*Lepus capensis*	Brown Hare	5

Appendix 3 Common Guillemot *Uria aalge*

Oil rates (%)[1] of Common Guillemots in The Netherlands, winter 1976/77-2015/16. The National survey combines all surveys along the North Sea coast (Dutch contributions to OSPAR 8 and 9).

	Subregion 8		Subregion 9		subregion 10			National (8+9)		Five yr
	%	*n*=	%	*n*=	%	*n*=		%	*n*=	mean %
1976/77	97.4	38	(100.0)	8			1976/77	97.8	46	
1977/78	96.3	82	(100.0)	23			1977/78	97.1	105	
1978/79	83.9	93	91.3	46			1978/79	86.3	139	
1979/80	94.1	118	85.9	64	(66.7)	3	1979/80	91.2	182	
1980/81	90.4	3078	96.0	448	91.8	233	1980/81	91.1	3526	92.7
1981/82	86.9	678	95.6	204	92.2	115	1981/82	88.9	882	90.9
1982/83	87.7	2515	95.6	1454	91.9	434	1982/83	90.6	3969	89.6
1983/84	87.6	1649	95.2	660	77.9	163	1983/84	89.7	2309	90.3
1984/85	77.3	863	89.6	480	87.2	47	1984/85	81.7	1343	88.4
1985/86	78.5	808	90.4	387	81.5	162	1985/86	82.3	1195	86.6
1986/87	89.7	107	96.1	51	(88.2)	17	1986/87	91.8	158	87.2
1987/88	96.1	1184	92.8	292	79.1	86	1987/88	95.5	1476	88.2
1988/89	73.5	1249	85.2	290	49.6	133	1988/89	75.7	1539	85.4
1989/90	79.9	1296	77.0	161	73.5	83	1989/90	79.6	1457	85.0
1990/91	84.2	1892	85.6	146	42.9	35	1990/91	84.3	2038	85.4
1991/92	88.9	524	92.2	269	(100.0)	6	1991/92	90.0	793	85.0
1992/93	43.4	821	28.7	150	46.3	136	1992/93	41.1	971	74.1
1993/94	61.0	562	58.1	186	53.3	107	1993/94	60.3	748	71.1
1994/95	69.4	248	77.8	135	71.1	83	1994/95	72.3	383	69.6
1995/96	58.6	111	62.3	61	(57.1)	7	1995/96	59.9	172	64.7
1996/97	84.4	147	76.4	72	(66.7)	6	1996/97	81.7	219	63.1
1997/98	71.6	306	66.2	154	(61.9)	21	1997/98	69.8	460	68.8
1998/99	54.1	1302	54.9	678	25.5	419	1998/99	54.3	1980	67.6
1999/00	79.0	691	77.2	320	61.2	152	1999/00	78.4	1011	68.8
2000/01	50.9	114	66.2	213	44.0	50	2000/01	60.9	327	69.0
2001/02	63.4	347	55.7	325	51.1	139	2001/02	59.7	672	64.6
2002/03	96.0	2011	58.9	314	46.8	77	2002/03	91.0	2325	68.9
2003/04	83.8	142	70.4	223	46.8	62	2003/04	75.6	365	73.1
2004/05	63.3	278	40.9	320	42.7	103	2004/05	51.3	598	67.7
2005/06	55.3	85	56.8	132	47.9	71	2005/06	56.2	217	66.8
2006/07	33.0	382	25.5	157	16.5	79	2006/07	30.8	539	61.0
2007/08	50.0	18	50.0	44	(35.0)	20	2007/08	50.0	62	52.8
2008/09	86.4	22	77.1	70	(66.7)	9	2008/09	79.3	92	53.5
2009/10	56.5	23	50.0	30	(70.0)	10	2009/10	52.8	53	53.8
2010/11	(55.6)	9	(40.0)	25		0	2010/11	44.1	34	51.4
2011/12	29.9	107	34.7	101	6.7	30	2011/12	32.2	208	51.7
2012/13	3.6	28	18.5	27	(33.3)	3	2012/13	10.9	55	43.9
2013/14	(0.0)	16	53.5	43	(12.5)	16	2013/14	39.0	59	35.8
2014/15	(55.6)	18	10.5	19		0	2014/15	32.4	37	31.7
2015/16	(10.5)	19	1.7	121	4.0	25	2015/16	2.9	140	23.5

[1]) Oil rates are given in parentheses if based on a sample size was <25 intact individual corpses

Appendix 4 Razorbill *Alca torda*

Oil rates (%)[1] of Razorbills in The Netherlands, winter 1976/77-2015/16. The National survey combines all surveys along the North Sea coast (Dutch contributions to OSPAR 8 and 9).

	Subregion 8		Subregion 9		subregion 10			National (8+9)		Five yr
	%	*n*=	%	*n*=	%	*n*=		%	*n*=	mean %
1976/77	(94.4)	18	(100.0)	4			1976/77	95.5	22	
1977/78	92.6	27	(100.0)	9			1977/78	94.4	36	
1978/79	84.0	25	(88.2)	17			1978/79	85.7	42	
1979/80	96.8	31	(80.0)	10	n.d.		1979/80	92.7	41	
1980/81	96.2	498	0.0	77	88.5	26	1980/81	96.7	575	93.0
1981/82	95.0	80	96.7	30	(100.0	19	1981/82	95.5	110	93.0
1982/83	85.0	1327	86.2	318	85.8	141	1982/83	85.2	1645	91.2
1983/84	93.0	560	92.1	38	96.8	31	1983/84	93.0	598	92.6
1984/85	90.1	71	93.3	45	(100.0	2	1984/85	91.4	116	92.3
1985/86	87.8	131	93.5	46	(100.0	4	1985/86	89.3	177	90.9
1986/87	(88.2)	17	(0.0)	6	n.d.		1986/87	91.3	23	90.0
1987/88	94.4	180	78.3	69	(85.0	20	1987/88	90.0	249	91.0
1988/89	88.1	159	90.7	43	(81.8	11	1988/89	88.6	202	90.1
1989/90	72.2	699	62.3	69	48.0	25	1989/90	71.4	768	86.1
1990/91	79.4	175	77.1	35	(100.0	2	1990/91	79.0	210	84.1
1991/92	97.6	42	96.3	27	(100.0)	1	1991/92	97.1	69	85.2
1992/93	72.9	59	(37.5)	8	(33.3	6	1992/93	68.7	67	81.0
1993/94	83.7	49	(68.8)	16	(0.0	2	1993/94	80.0	65	79.2
1994/95	77.4	53	81.8	33	(73.3	15	1994/95	79.1	86	80.8
1995/96	29.5	122	30.4	46	(25.0)	4	1995/96	29.8	168	70.9
1996/97	(62.5)	24	(76.5)	17	(33.3)	3	1996/97	68.3	41	65.2
1997/98	60.5	81	60.6	33	(100.0)	2	1997/98	60.5	114	63.5
1998/99	74.4	86	65.6	64	(55.6	18	1998/99	70.7	150	61.7
1999/00	76.9	273	73.9	92	(53.8	13	1999/00	76.2	365	61.1
2000/01	(70.0)	10	80.0	20	(50.0	2	2000/01	76.7	30	70.5
2001/02	59.0	78	59.5	42	(33.3	18	2001/02	59.2	120	68.6
2002/03	87.8	846	38.2	178	(26.1	23	2002/03	79.2	1024	72.4
2003/04	50.0	62	65.4	52	(66.7	6	2003/04	57.0	114	69.6
2004/05	34.8	135	23.5	119	(13.0	23	2004/05	29.5	254	60.3
2005/06	(50.0)	24	55.8	52	91.4	35	2005/06	53.9	76	55.8
2006/07	29.9	154	16.0	50	(22.2	18	2006/07	26.5	204	49.2
2007/08	(16.7)	6	(14.3)	7	(0.0)	4	2007/08	15.4	13	36.5
2008/09	(60.0)	5	(50.0)	6	n.d.		2008/09	54.5	11	36.0
2009/10	(40.0)	10	(0.0)	3	(100.0)	1	2009/10	30.8	13	36.2
2010/11	(0.0)	4	(33.3)	3		0	2010/11	14.3	7	28.3
2011/12	2.4	210	5.4	147	0.0	36	2011/12	3.6	357	23.7
2012/13	(0.0)	10	(20.0)	5	(0.0)	1	2012/13	6.7	15	22.0
2013/14	(0.0)	10	(0.0)	7	(0.0)	2	2013/14	0.0	17	11.1
2014/15	n.d.	0	(0.0)	7		1	2014/15	0.0	7	4.9
2015/16	(0.0)	2	(5.0)	20	(0.0)	5	2015/16	4.5	22	3.0

[1]) Oil rates are given in parentheses if based on a sample size was <25 intact individual corpses

Appendix 5 Black-legged Kittiwakes *Rissa tridactyla*

Oil rates (%)[1] of Black-legged Kittiwakes in The Netherlands, winter 1976/77-2015/16. The National survey combines all surveys along the North Sea coast (Dutch contributions to OSPAR 8 and 9).

	Subregion 8		Subregion 9		subregion 10			National (8+9)		
	%	*n*=	%	*n*=	%	*n*=		%	*n*=	Five yr mean %
1976/77	(85.0)	20	(100.0)	7			1976/77	88.9	27	
1977/78	83.5	103	(50.0)	8			1977/78	81.1	111	
1978/79	53.7	54	(100.0)	7			1978/79	59.0	61	
1979/80	73.7	114	76.7	30	n.d.		1979/80	74.3	144	
1980/81	89.7	1395	92.3	209	84.2	184	1980/81	90.1	1604	78.7
1981/82	79.0	162	79.2	53	90.8	65	1981/82	79.1	215	76.7
1982/83	86.4	1102	83.2	214	82.1	262	1982/83	85.9	1316	77.7
1983/84	89.7	1905	81.3	123	82.5	143	1983/84	89.2	2028	83.7
1984/85	69.6	184	79.4	68	(84.6)	13	1984/85	72.2	252	83.3
1985/86	70.5	295	75.6	45	75.0	32	1985/86	71.2	340	79.5
1986/87	(76.3)	93	(77.8)	9	(20.0)	5	1986/87	76.5	102	79.0
1987/88	78.9	142	73.0	37	57.1	35	1987/88	77.7	179	77.3
1988/89	68.8	109	(65.2)	23	(41.2)	17	1988/89	68.2	132	73.1
1989/90	60.7	135	(68.8)	16	(37.5)	16	1989/90	61.6	151	71.0
1990/91	67.2	134	(71.4)	14	(75.0)	4	1990/91	67.6	148	70.3
1991/92	69.0	58	(85.7)	14	(50.0)	2	1991/92	72.2	72	69.4
1992/93	32.8	183	32.1	28	38.9	36	1992/93	32.7	211	60.5
1993/94	54.5	44	64.7	34	(50.0)	16	1993/94	59.0	78	58.6
1994/95	81.4	43	(100.0)	16	(66.7)	15	1994/95	86.4	59	63.6
1995/96	(50.0)	20	(100.0)	3	(0.0)	2	1995/96	56.5	23	61.4
1996/97	63.6	33	(66.7)	6	n.d.	0	1996/97	64.1	39	59.7
1997/98	43.1	116	71.8	39	(37.5)	16	1997/98	50.3	155	63.3
1998/99	52.9	136	65.8	79	(46.2	39	1998/99	57.7	215	63.0
1999/00	63.6	140	65.6	93	(46.5	43	1999/00	64.4	233	58.6
2000/01	(50.0)	30	(52.4)	21	(25.0)	4	2000/01	51.0	51	57.5
2001/02	49.6	115	27.6	76	34.0	47	2001/02	40.8	191	52.8
2002/03	86.4	110	36.1	36	(68.8)	16	2002/03	74.0	146	57.6
2003/04	69.2	39	46.9	32	(20.0)	10	2003/04	59.2	71	57.9
2004/05	36.6	71	46.7	30	13.2	38	2004/05	39.6	101	52.9
2005/06	(38.5)	13	(28.6)	7	(0.0)	5	2005/06	35.0	20	49.7
2006/07	(13.6)	22	(36.8)	19	(9.1)	11	2006/07	24.4	41	46.4
2007/08	(0.0)	4	(0.0)	12	(11.8)	17	2007/08	0.0	16	31.6
2008/09	(60.0)	5	(50.0)	16	0.0	1	2008/09	52.4	21	30.3
2009/10	(12.5)	8	(0.0)	6	n.d.	0	2009/10	7.1	14	23.8
2010/11	(20.0)	5	(40.0)	5	n.d.	0	2010/11	30.0	10	22.8
2011/12	3.9	153	11.5	52	0.0	28	2011/12	5.9	205	19.1
2012/13	(0.0)	20	(0.0)	9	(0.0)	3	2012/13	0.0	29	19.1
2013/14	(0.0)	1	(20.0)	5	n.d.	0	2013/14	16.7	6	11.9
2014/15	n.d.	0	(n.d.)	0	n.d.	0	2014/15		0	13.1
2015/16	(0.0)	1	(0.0)	15	(0.0)	4	2015/16	0.0	16	5.6

[1]) Oil rates are given in parentheses if based on a sample size was <25 intact individual corpses

Appendix 6 Common Eiders *Somateria mollissima*

Oil rates (%)[1] of Common Eiders in The Netherlands, winter 1976/77-2015/16. The National survey combines all surveys along the North Sea coast (Dutch contributions to OSPAR 8 and 9).

	Subregion 8		Subregion 9		subregion 10			National (8+9)		Five yr
	%	*n*=	%	*n*=	%	*n*=		%	*n*=	mean %
1976/77	n.d.	0	(100.0)	6			1976/77	100.0	6	
1977/78	(71.4)	14	(75.0)	4			1977/78	72.2	18	
1978/79	(53.3)	15	27.6	29			1978/79	36.4	44	
1979/80	(71.4)	7	54.8	31	(25.0)	4	1979/80	57.9	38	
1980/81	(76.2)	21	69.6	56	39.3	61	1980/81	71.4	77	67.6
1981/82	(36.4)	22	44.0	50	37.0	119	1981/82	41.7	72	55.9
1982/83	47.1	34	58.2	170	41.3	392	1982/83	56.4	204	52.7
1983/84	57.7	52	17.2	122	17.7	379	1983/84	29.3	174	51.3
1984/85	22.9	96	15.7	287	14.3	509	1984/85	17.5	383	43.3
1985/86	(50.0)	8	15.9	107	5.7	211	1985/86	18.3	115	32.6
1986/87	62.9	35	78.6	355	75.3	174	1986/87	77.2	390	39.7
1987/88	99.5	555	52.8	322	17.3	237	1987/88	82.3	877	44.9
1988/89	41.2	51	46.1	217	10.9	523	1988/89	45.1	268	48.1
1989/90	(87.5)	8	16.2	68	17.7	209	1989/90	23.7	76	49.3
1990/91	11.0	429	2.0	204	2.0	200	1990/91	8.1	633	47.3
1991/92	36.8	261	7.6	340	13.5	155	1991/92	20.3	601	35.9
1992/93	34.1	123	9.1	154	2.3	343	1992/93	20.2	277	23.5
1993/94	28.6	28	3.4	58	14.4	111	1993/94	11.6	86	16.8
1994/95	29.3	41	6.1	66	8.1	533	1994/95	15.0	107	15.0
1995/96	4.6	108	9.0	178	4.1	121	1995/96	7.3	286	14.9
1996/97	9.7	31	25.9	81	4.4	206	1996/97	21.4	112	15.1
1997/98	21.4	28	3.8	78	9.5	105	1997/98	8.5	106	12.8
1998/99	(6.3)	16	29.1	55	11.6	173	1998/99	23.9	71	15.2
1999/00	20.4	456	4.7	1631	3.4	4987	1999/00	8.1	2087	13.9
2000/01	7.5	93	1.9	377	0.2	965	2000/01	3.0	470	13.0
2001/02	1.5	323	4.1	614	1.6	2724	2001/02	3.2	937	9.4
2002/03	73.7	57	4.3	232	1.1	474	2002/03	18.0	289	11.3
2003/04	(20.0)	10	4.2	71	1.4	209	2003/04	6.2	81	7.7
2004/05	(0.0)	14	2.9	170	1.7	480	2004/05	2.7	184	6.6
2005/06	(16.7)	12	4.0	101	1.9	268	2005/06	5.3	113	7.1
2006/07	(0.0)	4	0.0	38	1.5	130	2006/07	0.0	42	6.4
2007/08	n.d.	0	(4.2)	24	0.0	59	2007/08	4.2	24	3.7
2008/09	(0.0)	1	1.5	67	0.0	82	2008/09	1.5	68	2.7
2009/10	n.d.	0	0.0	51	2.8	71	2009/10	0.0	51	2.2
2010/11	(0.0)	3	(5.9)	17	(0.0)	13	2010/11	5.0	20	2.1
2011/12	(0.0)	6	0.9	112	0.0	61	2011/12	0.8	118	2.3
2012/13	n.d.	0	(0.0)	5	(0.0)	5	2012/13	0.0	5	1.5
2013/14	n.d.	0	(0.0)	9	(0.0)	6	2013/14	0.0	9	1.2
2014/15	n.d.	0	(0.0)	5	(0.0)	12	2014/15	0.0	5	1.2
2015/16	n.d.	0	(0.0)	7	(0.0)	14	2015/16	0.0	7	0.2

[1]) Oil rates are given in parentheses if based on a sample size was <25 intact individual corpses

Appendix 7 Common Scoters *Melanitta nigra*

Oil rates (%)[1] of Common Scoters in The Netherlands, winter 1976/77-2015/16. The National survey combines all surveys along the North Sea coast (Dutch contributions to OSPAR 8 and 9).

	Subregion 8		Subregion 9		subregion 10			National (8+9)		Five yr
	%	*n*=	%	*n*=	%	*n*=		%	*n*=	mean %
1976/77	(0.0)	8	n.d.	0			1976/77	100.0	8	
1977/78	(75.0)	8	(100.0)	2			1977/78	80.0	10	
1978/79	54.8	221	60.7	56			1978/79	56.0	277	
1979/80	76.3	38	(33.3)	6	n.d.	0	1979/80	70.5	44	
1980/81	63.9	36	(83.3)	24	87.8	41	1980/81	71.7	60	75.6
1981/82	83.5	121	71.6	88	81.5	65	1981/82	78.5	209	71.3
1982/83	79.5	122	80.9	89	76.9	52	1982/83	80.1	211	71.3
1983/84	86.4	103	82.9	35	59.4	32	1983/84	85.5	138	77.2
1984/85	57.6	118	59.1	88	56.0	25	1984/85	58.3	206	74.8
1985/86	79.1	187	60.0	45	53.5	43	1985/86	75.4	232	75.6
1986/87	85.2	108	82.2	45	75.9	29	1986/87	84.3	153	76.7
1987/88	99.6	1523	93.8	64	43.8	32	1987/88	99.4	1587	80.6
1988/89	75.8	66	(100.0	18	(31.3)	16	1988/89	81.0	84	79.7
1989/90	(77.8)	9	(33.3)	3	(42.9)	7	1989/90	66.7	12	81.3
1990/91	82.7	127	80.4	46	(23.5)	17	1990/91	82.1	173	82.7
1991/92	85.3	68	32.4	34	(87.5)	8	1991/92	67.6	102	79.3
1992/93	81.6	49	63.3	199	32.3	62	1992/93	66.9	248	72.9
1993/94	84.6	65	(33.3)	9	40.5	37	1993/94	78.4	74	72.3
1994/95	96.4	55	24.4	45	73.0	137	1994/95	64.0	100	71.8
1995/96	78.2	101	66.7	27	(43.8)	16	1995/96	75.8	128	70.5
1996/97	87.0	54	57.1	28	(47.1)	17	1996/97	76.8	82	72.4
1997/98	94.4	18	(23.1)	13	(83.3)	6	1997/98	64.5	31	71.9
1998/99	95.9	122	42.2	64	78.2	78	1998/99	77.4	186	71.7
1999/00	86.7	30	47.5	40	52.8	53	1999/00	64.3	70	71.8
2000/01	(50.0)	4	68.4	57	(33.3)	18	2000/01	67.2	61	70.1
2001/02	60.9	46	42.1	57	39.3	89	2001/02	50.5	103	64.8
2002/03	93.5	62	57.9	57	56.0	25	2002/03	76.5	119	67.2
2003/04	(57.1)	7	(31.3)	16	(57.1)	14	2003/04	39.1	23	59.5
2004/05	(82.6)	23	(0.0)	13	(25.0)	16	2004/05	52.8	36	57.2
2005/06	(66.7)	12	(50.0)	12	(38.5)	13	2005/06	58.3	24	55.4
2006/07	n.d.	0	(25.0)	4	(22.2)	9	2006/07	25.0	4	50.3
2007/08	n.d.	0	(0.0)	4	(25.0)	16	2007/08	0.0	4	35.0
2008/09	n.d.	0	(0.0)	10	n.d.	0	2008/09	0.0	10	27.2
2009/10	n.d.	0	(5.9)	17	(16.7)	6	2009/10	5.9	17	17.8
2010/11	(0.0)	3	(12.5)	8	(0.0)	1	2010/11	9.1	11	8.0
2011/12	(0.0)	13	(11.1)	9	(0.0)	6	2011/12	4.5	22	3.9
2012/13	n.d.	0	(0.0)	5	(0.0)	3	2012/13	0.0	5	3.9
2013/14	(0.0)	6	n.d.	0	(0.0)	3	2013/14	0.0	6	3.9
2014/15	(0.0)	3	(0.0)	3	(0.0)	2	2014/15	0.0	6	2.7
2015/16	n.d.	0	(0.0)	2	n.d.	0	2015/16	0.0	2	0.9

[1]) Oil rates are given in parentheses if based on a sample size was <25 intact individual corpses

Appendix 8 Herring Gull *Larus argentatus*

Oil rates (%)[1] of Herring Gulls in The Netherlands, winter 1976/77-2015/16. The National survey combines all surveys along the North Sea coast (Dutch contributions to OSPAR 8 and 9).

	Subregion 8		Subregion 9		subregion 10			National (8+9)		Five yr
	%	*n*=	%	*n*=	%	*n*=		%	*n*=	mean %
1976/77	76.7	43	(100.0)	3			1976/77	78.3	46	
1977/78	68.8	64	(71.4)	7			1977/78	69.0	71	
1978/79	38.9	211	(36.8)	19			1978/79	38.7	230	
1979/80	32.0	122	18.4	38	(0.0)	4	1979/80	28.8	160	
1980/81	73.9	353	63.6	88	25.0	40	1980/81	71.9	441	57.3
1981/82	52.9	261	27.4	84	13.2	121	1981/82	46.7	345	51.0
1982/83	67.4	282	62.3	61	20.1	134	1982/83	66.5	343	50.5
1983/84	51.0	451	51.2	41	12.3	162	1983/84	51.0	492	53.0
1984/85	32.5	228	27.7	83	17.4	144	1984/85	31.2	311	53.4
1985/86	26.1	188	14.7	95	11.7	120	1985/86	22.3	283	43.5
1986/87	42.7	124	21.0	81	10.5	76	1986/87	34.1	205	41.0
1987/88	48.6	109	39.6	48	6.7	119	1987/88	45.9	157	36.9
1988/89	28.8	184	21.1	57	5.1	137	1988/89	27.0	241	32.1
1989/90	23.2	220	(26.1)	23	11.8	51	1989/90	23.5	243	30.5
1990/91	16.2	173	(60.0)	5	(0.0)	9	1990/91	17.4	178	29.6
1991/92	30.4	112	52.4	21	(0.0)	4	1991/92	33.8	133	29.5
1992/93	13.0	108	12.9	31	11.0	73	1992/93	12.9	139	22.9
1993/94	30.4	92	(63.2)	19	0.0	24	1993/94	36.0	111	24.7
1994/95	33.3	72	9.8	51	6.8	73	1994/95	23.6	123	24.8
1995/96	9.6	83	19.5	41	0.0	54	1995/96	12.9	124	23.9
1996/97	10.4	67	15.6	32	0.0	29	1996/97	12.1	99	19.5
1997/98	8.6	81	20.0	25	(5.0)	20	1997/98	11.3	106	19.2
1998/99	20.0	105	33.3	27	16.7	42	1998/99	22.7	132	16.5
1999/00	20.7	87	40.9	44	9.1	44	1999/00	27.5	131	17.3
2000/01	5.0	40	4.3	47	0.0	99	2000/01	4.6	87	15.6
2001/02	2.7	74	9.4	32	3.6	166	2001/02	4.7	106	14.2
2002/03	41.2	51	6.7	45	0.7	135	2002/03	25.0	96	16.9
2003/04	(16.7)	24	14.3	28	0.0	74	2003/04	15.4	52	15.4
2004/05	13.2	38	3.8	26	2.2	91	2004/05	9.4	64	11.8
2005/06	(7.1)	14	(5.3)	19	3.4	116	2005/06	6.1	33	12.1
2006/07	(9.1)	11	(5.9)	17	0.0	63	2006/07	7.1	28	12.6
2007/08	(0.0)	6	(11.1)	9	0.0	47	2007/08	6.7	15	8.9
2008/09	(0.0)	15	7.4	27	1.6	62	2008/09	4.8	42	6.8
2009/10	(0.0)	7	2.3	44	0.0	40	2009/10	2.0	51	5.3
2010/11	(0.0)	11	(0.0)	18	0.0	39	2010/11	0.0	29	4.1
2011/12	0.0	26	0.0	30	0.0	37	2011/12	0.0	56	2.7
2012/13	(28.6)	7	(0.0)	7	(0.0)	8	2012/13	14.3	14	4.2
2013/14	(0.0)	3	(0.0)	14	(12.5)	8	2013/14	0.0	17	3.2
2014/15	(0.0)	5	(0.0)	6	0.0)	14	2014/15	0.0	11	2.9
2015/16	(0.0)	2	(0.0)	21	0.0	25	2015/16	0.0	23	2.9

[1]) Oil rates are given in parentheses if based on a sample size was <25 intact individual corpses