THREE COLOURS OF BLACK: SEABIRD STRANDINGS IN BELGIUM DURING THE *TRICOLOR* INCIDENT

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Stienen E.W.M., Haelters, J., Kerckhof, F & van Waeyenberge, J. 2004. Seabird strandings in Belgium during the *Tricolor* incident. Atlantic Seabirds 6(3/S.I.): 129-146. *After a small amount of oil had leaked into the southern North Sea as a results of the collision between the oil tanker* Vicky *and the sunken car carrier* Tricolor *on 1 January 2003, 249 oiled birds (98% Guillemot* Uria aalge *and Razorbill* Alca torda*) were received at the Bird Rehabilitation Centre at Ostend, Belgium. Following a second larger oil spill during the salvage works of the* Tricolor *a few weeks later, in total 9,177 birds stranded at the Belgian coast during the period 23 January to 15 February. This time, virtually all birds were heavily oiled and more than half of the birds were still alive on arrival in Ostend. More than 90% of the victims were Guillemot and Razorbill; other species that accounted for more than 1% of the stranded birds were Great Crested Grebe* Podiceps cristatus *and Common Scoter* Melanitta nigra*. The birds stranded in three waves. A first peak in numbers (> 1,000 victims per day) occurred at 26 January and consisted of high proportions of Guillemots that managed to reach the coast alive despite unfavourable wind conditions. In the following weeks, the daily numbers of stranded birds were closely related to the prevailing wind conditions. The second and third peak in the number of strandings coincided with two periods of strong onshore winds. Changes in the species composition and the location where the birds were found are thought to reflect the movements of the oil slick perpendicular and parallel to the coastline, respectively. The proportion of Razorbills among the auks found during the incident greatly differed from that at sea and the proportion of dead birds was much higher among Razorbills than Guillemots. These differences can not be explained from differences in wintering areas. It is suggested that the third peak in strandings was at least partly related to a wreck among auks that was unrelated to the oil polluation.*

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INTRODUCTION

On 14 December 2002, the car carrier *Tricolor* collided with the *Kariba* and sank at about 35 km north of Dunkerque (Fig. 1). This was the first in a series of (near-) incidents in which the *Tricolor* was involved (see Kerckhof *et al.* 2004

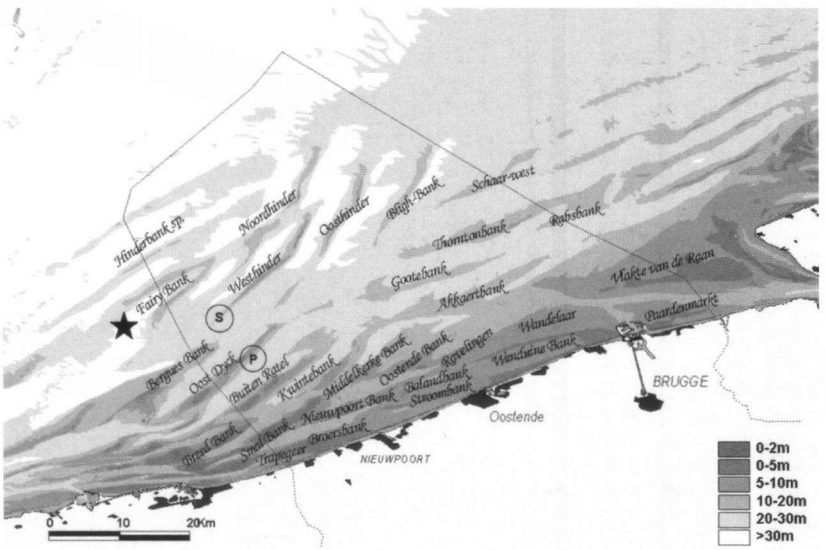


Figure 1. The Belgian marine waters and adjacent areas are characterised by various sand banks. Asteriks = position of the Tricolor, S = weather station, P = position where the oil slick was encountered on 24 January. The coastline was divided into three sections: west coast = French border to Middelkerke inclusive, mid coast = Raversijde to Wenduine inclusive, east coast = Blankenberge to Dutch border.

Figuur 1. De Belgische zeegebieden en de omringende wateren worden gekenmerkt door een aantal zandbanken op geringe afstand van de kust. Asteriks = positie van de Trciolor, S = meteorologisch station, P = de plaats waar op 24 januari de olievlek is waargenomen. The kustlijn is opgedeeld in drie secties: westkust = Franse grens tot en met Middelkerke, middenkust = Raversijde tot en met Wenduine, oostkust = Blankenberge tot de Nederlandse grens.

for a detailed chronological description of the incidents). A few days later, beached birds surveys were conducted along the Belgian beaches (16 December) as well as ship-based surveys in Belgian marine waters (16, 17 and 18 December). Obviously at that time no oil had leaked into the sea because both at sea and along the shoreline no conspicuous numbers of oiled birds were noted. The first oil was spilled on 1 January 2003 when the oil tanker *Vicky* came into collision with the wreck of the *Tricolor* and an unknown, but small amount of oil leaked into the sea. During beached bird surveys on 6-8 January, a total of 16 living oiled Guillemots *Uria aalge* as well as 23 (rather) fresh

Table 1. The number of victims received at the Bird Rehabilitation Centre in Ostend after the collision between the Vicky *and the* Tricolor *(*Vicky *1-22 Jan) and the numbers received at the ad hoc rehabilitation centre in Ostend after the major oil spill of the* Tricolor *(*Tricolor *23 Jan-15 Feb).*

Tabel 1. Het aantal slachtoffers dat werd binnengebracht in Vogelopvangcentrum te Oostende na de aanvaring tussen de Vicky *en de* Tricolor *(*Vicky *1-22 januari) en het aantal slachtoffers dat werd binnengebracht nadat een grotere olievlek was vrijgekomen tijdens de bergingswerkzaamheden aan de* Tricolor *(*Tricolor *23 januari-15 februari).*

Species	Vicky 1-22 Jan	Tricolor 23 Jan-15 Feb	Total
Guillemot *Uria aalge*	231	5875	6106
Razorbill *Alca torda*	12	2094	2106
Guillemot/Razorbill	0	411	411
Great Crested Grebe *Podiceps cristatus*	3	310	313
Common Scoter *Melanitta nigra*	0	125	125
Red-throated Diver *Gavia stellata*	0	63	63
Little Auk *Alle alle*	0	61	61
Kittiwake *Rissa tridactyla*	0	61	61
Larus spp.	0	35	35
Gannet *Morus bassanus*	1	33	34
Other	2	36	38
Atlantic Puffin *Fratercula arctica*	0	27	27
Kittiwake *Rissa tridactyla*	0	24	24
Velvet Scoter *Melanitta fusca*	0	22	22
Total	249	9177	9426

corpses of auks were found on 51.6 km Belgian beach. Although the densities of dead auks were similar to those in the 1990s (in both cases 1.2 auks km^{-1}), the oil rate of the corpses (78% of the corpses was oiled) was somewhat higher than oil rates in the 1990s (Seys *et al.* 2002b). From 1-22 January, 249 oiled seabirds were brought to the Bird Rehabilitation Centre in Ostend, of which respectively 92.8% and 4.8% were Guillemots and Razorbills *Alca torda* (Table 1).

A second larger oil spill occurred during the salvage operation of the *Tricolor* on 22 January. Again a relatively small quantity of oil was spilled (at most 170 tons), but this time it had disastrous effects on the seabirds wintering

in the southern North Sea. We report here on the marine bird population at risk, the presumed movement of the oil patch as well as the number and species composition of birds collected along the Belgian coastline in the period following this oil spill. A detailed species list is given by Kerckhof *et al.* (2004).

METHODS

Study area The Belgian shoreline is only 66 km long. It mainly consists of easily accessible sandy beaches and more than half is built up with boulevards and buildings. The Belgian marine waters are shallow and dominated by strong currents, a high turbidity and four groups of linear sand ridges that extend beyond the French and Dutch border (Fig. 1). The sandbanks contribute to strong variations in water depth and sediment composition. Carter *et al.* (1992) designated the southern North Sea to be highly vulnerable to surface pollutants. The area is one of the most heavily navigated areas in the world (Maes *et al.* 2000) and hosts important numbers of seabirds (Offringa *et al.* 1996, Seys *et al.* 2001, Stienen & Kuijken 2003). A dense network of important shipping routes makes it very susceptible for ship collisions and oil pollution. It is one of the most polluted areas in the North Sea (Skov *et al.* 1996, Camphuysen 2004). It is for these reasons that oil pollution in the Belgian marine waters is regularly monitored from the air (Jacques et. al. 1991, Di Marcantonio 1999). Belgium has a long history in beached bird surveys (first census in 1962) and an extensive dataset on this is kept at the Institute of Nature Conservation. Recent publications describe patterns and trends in the numbers of beached birds and the proportions that are oiled, and give a more extensive description of the study area (Seys *et al.* 2002a, b).

For this study the Belgian shoreline was subdivided into three sections being the French border to Middelkerke inclusive, Raversijde to Wenduine inclusive and Blankenberge to the Dutch border (Fig 1). For convenience these section are called west coast, mid coast and east coast, respectively.

From 23 January to 15 February 2003, dead and living birds were retrieved from the Belgian shoreline by volunteers, civil servants and co-workers of Belgian rehabilitation centres and brought to an ad hoc rehabilitation centre at Ostend. Here birds were identified and counted. Virtually all birds were oiled and most were heavily oiled. In total 411 birds were only identified as "Razormots" because unpacking them from the thick layer of oil would have been too time consuming. During the first three days (23-25 January), the counting of birds was not yet organised and consequently daily numbers are not known. However, the casualties (living and dead) found during this period were kept at the rehabilitation centre and were counted altogether in the early morning of 26 January.

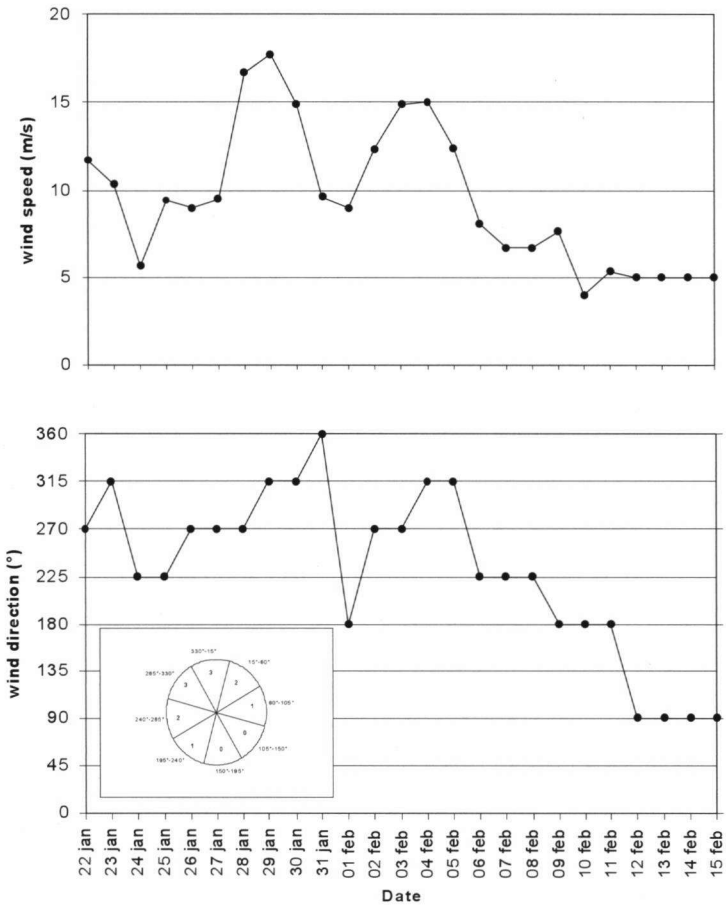


Figure 2. The average daily wind speed (upper graph) and the rounded mode of wind direction (lower graph) measured at the offshore meetstation Westhinder during the period 22 January – 15 February 2003. The inset in the lower graph shows the weighing factor (0-3) for each sector of 45° used to calculate the wind factor (see methods for further details). The inset shows the Belgian coastline that runs approximately from 240° to 60°.

Figuur 2. De gemiddelde windsnelheid (boven) en de modus van de windrichting (onder) gemeten op het offshore meetstation Westhinder tijdens de periode 22 januari – 15 februari 2003. De inzet toont de wegingsfactor (0-3) per sector van 45° die is gebruikt om de windfactor te berekenen (zie tekst voor details). In de inzet is de Belgische kustlijn te zien die loopt van 240°-60°.

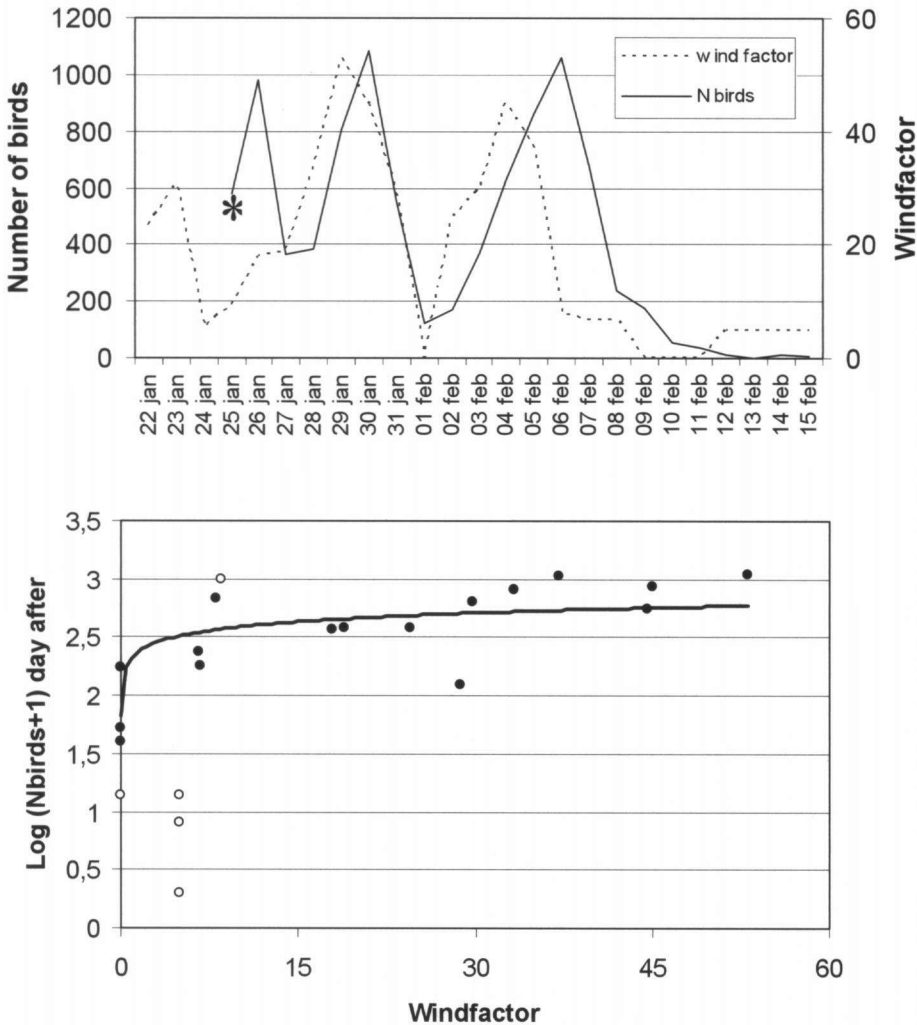


Figure 3. See opposite page for legend.
Figuur 3, Zie tegenoverliggende pagina voor bijschrift.

*Opposite page: Figure 3. During the period 27 January –11 February, but not before, fluctuations in the daily number of birds stranded along the Belgian coast largely resulted from differences in wind condition (upper graph). The lower graph shows that there was a strong positive relationship between the wind factor and the number of victims counted one day later (*log *[Nbirds + 1] = 0,111 ** ln *[wind factor] +2.333,* R^2 *= 0.64,* n *= 16). Circles represent omitted data from the period 23–26 January when almost exclusively living birds came ashore and data after 11 February when numbers were too low for a proper analysis. Birds brought in during the period 23-25 January were counted altogether afterwards and plotted here at 25 January (*).*

*Tegenoverliggende pagina: Figuur 3. In de eerste dagen (23–26 januari) was er geen duidelijk verband tussen de weersomstandigheden en het dagelijkse aantal vogels dat in het vogelopvangcentrum te Oostende werd binnengebracht, maar daarna zijn de schommelingen in de aantallen grotendeels te verklaren uit verschillen in windrichting en –snelheid, hier weergegeven als windfactor (figuur boven). De onderste figuur laat zien dat er een sterk positief verband is tussen de windfactor en het aantal slachtoffers dat één dag later werd geteld (*log *[aantal vogels + 1] = 0,111 ** ln *[windfactor] +2.333,* R^2 *= 0.64,* n *= 16). De open cirkels hebben betrekking op niet gebruikte gegevens uit de periode 23–26 januari toen vrijwel uitsluitend levende vogels aanspoelden en strandingen na 11 februari die vanwege het geringe aantal slachtoffers die niet werden gebruikt voor de analyse. Vogels die in de periode 23-25 januari werden binnengebracht, zijn allemaal tegelijk geteld en ingetekend op 25 januari (*).*

Weather conditions Wind speed (in $m.s^{-1}$) and direction (in degrees) were measured at sea every 10 minutes by the "Administratie Waterwegen en Kust" at the Westhinder station (51° 24' N, 2° 26' E) using international standards (Fig. 2). The wind direction was subdivided into eight categories of 45°, so that we could distinguish between offshore and onshore wind (Fig. 2). The daily mode of the wind direction was calculated and valued in a way that onshore winds were more important than offshore winds for beaching (Fig. 2). The daily wind factor was obtained by multiplying the average daily wind speed with this value.

Surveys at sea Ship-based surveys in Belgian marine waters have been carried out using standardised methods for counting seabirds at sea (Tasker *et al.* 1984, Komdeur *et al.* 1992). To calculate seabird densities, the numbers were corrected for birds missed at greater perpendicular distance. For transect counts that covered more than 1 km, seabird densities ($N.km^{-2}$) were calculated. Seabird densities were averaged for each rectangle of 1' x 1' (cf. Fig. 6). In this study we present averaged values for the period 1992-2003 as well as separate data from the winter 2002/03 (i.e. December-February).

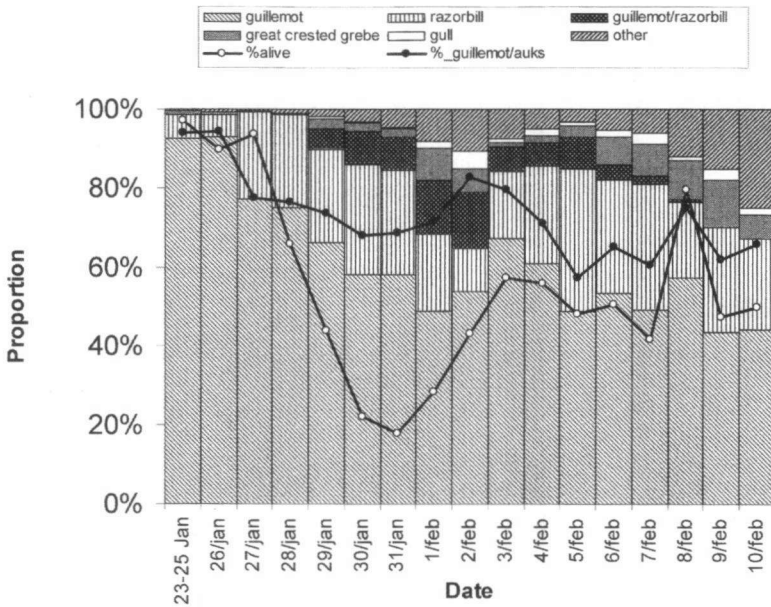


Figure 4. The variation in species composition of the birds stranded along the Belgian coast (bars) from 23 January – 10 February (after 10 February, sample sizes were too low to calculate proportions). The sample size is given in figure 2. The drawn lines represent the proportion of birds that were still alive when brought into the rehabilitation centre (white dots) and the proportion Guillemots among the Guillemots and Razorbills (black dots).

Figuur 4. Dagelijkse verschillen in de soortsamenstelling van de slachtoffers die langs de Belgische kust werden gevonden (balken) van 23 januari tot 11 februari (na 10 februari waren de aantallen te laag voor analyse). Het aantal vogels is weergegeven in figuur 2. De getrokken lijnen tonen het aandeel vogels dat nog in leven was bij binnenkomst in het vogelopvangcentrum (witte stippen) en het aandeel Zeekoeten in de groep Zeekoeten + Alken (zwarte stippen).

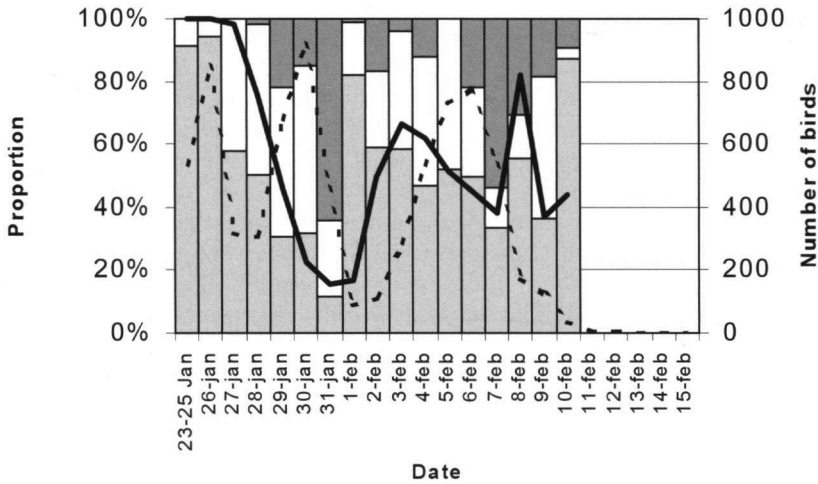


Figure 5. The relative number of Guillemots and Razorbills that beached at different sections of the Belgian coast (see Fig. 1 for divisions). The few auks found just over the French border and at sea were excluded from the analysis. After 10 February, sample sizes were too low (< 10 birds) to calculate proportions. The drawn line shows the number of birds processed and is plotted against the right axis.

Figuur 5. Het aantal Zeekoeten en Alken dat verhoudingsgewijs aanspoelde op verschillende segmenten van de Belgische kust (zie Fig. 1 voor de onderverdeling). De weinige alkachtigen die net over de Franse grens of op zee werden gevonden, zijn niet gebruikt voor de analyse. Na 10 februari waren de aantallen te laag (< 10 vogels) voor analyse. De getrokken lijn (rechter as) geeft het aantal vogels dat is gebruikt voor de berekening.

RESULTS

From 23 January to 15 February 2003, 9,177 birds of 32 species were brought into the rehabilitation centre (Table 1). During this period three peaks can be distinguished when more then 1,000 birds day^{-1} stranded at the Belgian coast (Fig. 3). A first massive stranding occurred on 26 January and concerned almost exclusively Guillemots (92.5%) and Razorbills (6.1%). A remarkably high

proportion of the birds found on this day (89.8%) were still alive on arrival at the rehabilitation centre (Fig. 4). A second peak in strandings took place from 29 to 31 January. Again the victims were mainly auks (94.2%), but by then the proportion of living birds had dropped to 28.4% and the proportion of Guillemots had dropped to 64.0%. After a few days with relatively low numbers of stranded birds, numbers increased again from 3 February onwards to a third peak on 6 February. During this peak relatively high proportions (14.1%) of species other than Guillemot and Razorbill were found (mainly Great Crested Grebes *Podiceps cristatus* and gulls) and the proportion of living birds amounted to 50.6%.

Except during the period 23 to 26 January, daily numbers of stranded birds were strongly related to the prevailing wind conditions 1 to 2 days earlier (Fig. 3). The second and third peaks in strandings both followed a period with strong onshore winds. During the first 4 days following the oil spill, the prevailing wind direction was offshore. Still high numbers of birds came ashore, but these were mainly live ones, reaching the coast on their own account.

During the first few days following the oil spill, the prevailing northwesterly winds pushed the oil over the Belgian border and slowly towards land. In the morning of 24 January we encountered a large oil patch at about 22 km from the coastline near the sandbanks Buiten Ratel and Oostdyck (Fig. 1). The oil slick stretched for several km in northwestward direction. Moderate west to southwest winds during the period 25 to 27 January, allowed for a further spreading of the oil over the Flemish Banks and the northern parts of the coastal banks. The areas first hit by the oil normally hold high densities of wintering auks (compare Fig. 6). Ship-based surveys taken in December 2002 and January 2003 suggested no strong deviations from this pattern. From 23-28 January, proportionately high numbers of auks (> 98% of all stranded birds) beached at the Belgian coast. At first birds stranded mainly at the Belgian west coast, but the oil appears to have drifted in easterly direction because soon also along the Belgian mid coast relatively high numbers of victims were found (Fig. 5). Strong north-northwest winds on 28 to 30 January, blew the oil further towards the coast and the oil hit the coastal region around the mid and east coast. This resulted in an increasing proportion of more inshore species like Great Crested Grebes (Fig. 4) and a decreasing proportion of birds found along the west coast (Fig. 5). During the next few days, the oil slick was subject to more easterly moderate winds (31 January to 2 February) that finally turned into an offshore direction. As a result, increased numbers of victims were found along the west coast on 1 February (Fig. 5), whereas the proportion of auks increased during the following few days (2 to 5 February; Fig. 4). From 3 to 7 February, strong northwesterly winds blew the oil patch onshore at the east coast. The relative numbers gradually increased along the east coast, while the

Table 2. The species composition (in %) of victims found along the Belgian coast during the Tricolor *incident compared with the at sea composition in Belgian marine waters in the winter 2002/03 (BCS_02/03) and the averaged at sea composition from the winters 1992-2002 (BCS_winter, published by Stienen et al. 2002). BCS_swimming = composition of predominantly swimming species in Belgian marine waters in an average winter. * = a relatively large group of Wigeons* Anas penelope *was counted in December 2002.*

Tabel 2. Het soortenspectrum van zeevogels (in %) gevonden tijdens de ramp met de Tricolor *in vergelijking tot de samenstelling in Belgisch mariene wateren tijdens de winter 2002/03 (BCS_02/03) en die in een gemiddelde winter (BCS_winter = gemiddelde waarden van scheepstellingen uitgevoerd in de periode 1992-2002 zoals gepubliceerd door Stienen et al. 2002). BCS_swimming = samenstelling van de zwemmende soorten in het Belgische zeegebied tijdens een gemiddelde winter. * = een relatief grote groep Smienten* Anas penelope *werd geteld in december 2002.*

	Tricolor	BCS_02/03	BCS_winter	BCS_swimming
Guillemot/Auk	91,3	33	35,3	71,1
Great Crested Grebe	3,4	5,7	3,8	7,7
Gavia spp.	0,7	1,9	2,2	4,4
Scoter	1,6	0,5	8,3	16,7
Kittiwake	0,7	10,2	10,4	
Larus spp.	0,4	33,4	36,9	
Gannet	0,3	7,2	1,7	
Fulmar	0,3	1,1	1,2	
other	1,3	7,1*	0,1	

relative number of Great Crested Grebe as well as other non-auks increased again after 5 February.

The species composition of the victims found along the beach greatly differed from the composition of the population at risk (Table 2). Compared to the situation at sea proportionally fewer gulls and more auks were found during the *Tricolor* incident. Although hundreds of gulls were seen with oiled plumage along the Belgian shoreline, only few were found dead. Generally, the stained gulls were much less heavily oiled than the auks and could not be caught by hand. During the following breeding season, many oiled gulls (both Herring *Larus argentatus* and Lesser Black-backed Gulls *L. fuscus*) were seen breeding in the colony at Zeebrugge (Belgium), but nothing is known about their reproductive success. The species composition of birds found during the *Tricolor* spill resembles more the average composition of swimming seabirds wintering in Belgian marine waters (Table 2). Only the proportions of beached Common Scoters *Melanitta nigra*, Great Crested Grebes and Red-throated

Divers *Gavia stellata* were lower than expected from the surveys performed at sea. Ship-based surveys (Table 2) and aerial surveys of seaducks confirm that the number of scoters was relatively low during the winter 2002/03 (1049 individuals were counted from the air on 13 January 2003). On the other hand ship-based surveys suggest that relatively high numbers of Great Crested Grebes were present in the area at that time (Table 2). This is, however, not reflected in the number of stranded grebes.

DISCUSSION

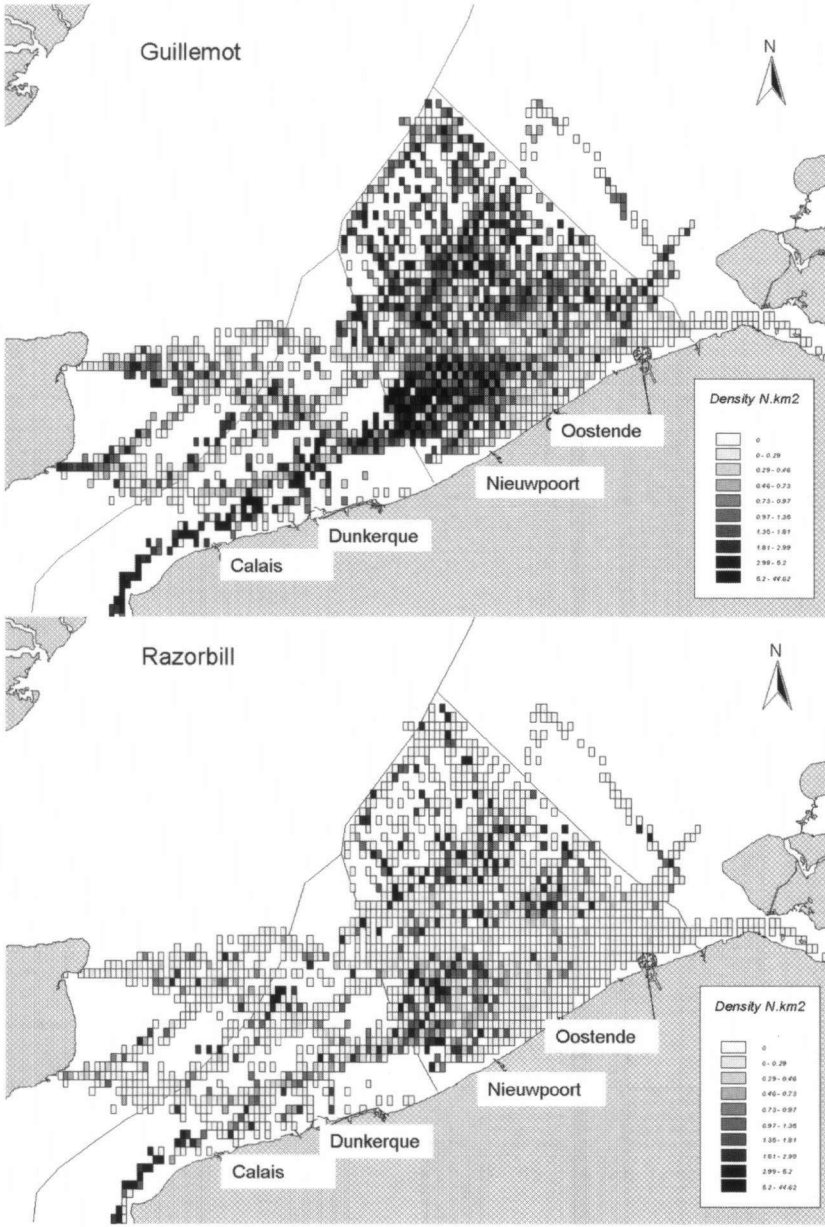
Typically, the *Tricolor* oil spill mainly affected birds that spend most time swimming on the water, whereas the more aerial gulls were less affected. Also during other major incidents, swimming birds were more sensitive to the oil pollution than gulls (e.g. Hope Jones *et al.* 1970, Harrison 1993, Piatt *et al.* 1990, Carter et. al. 1992). Many gulls spend the night on land making them even less sensitive to oil pollution. It was fortunate that relatively few scoters were present in the area this winter. During some winters, the Belgian marine waters hold more than 10, 000 Common Scoters, but numbers fluctuate heavily (Van Waeyenberge *et al.* 2001). It remains unclear why the numbers of stranded grebes and divers were relatively low, while ship-based surveys suggest proportionately higher numbers at sea at that moment. Behavioural differences as well as differences in the distribution of species might play a role in this.

Around 26 January 2003, peak numbers of seabirds stranded along the southwest coast of Belgium in spite of unfavourable wind conditions for beaching. This mismatch between wind and the number of stranded birds, in combination with the fact that the first victims were almost exclusively living birds strongly implies that many auks actively swam to the shoreline after being hit by the oil. At first, we found low numbers of Razorbills and high proportions of Guillemots among the victims. Only after the first peak, the relative numbers of Razorbill increased while at the same time the proportion of dead birds sharply increased (Fig. 4). In total 5,875 Guillemots were brought into the rehabilitation centre of which 36.5% were dead, whereas 62.5% of the 2,094 Razorbills were dead on arrival at Ostend. A possible explanation for this difference might be that Razorbills winter further offshore than Guillemots, making it less likely for them to reach the shore alive. In fact, other inshore species show similarly "low" proportions of dead birds as Guillemots (the proportion of dead birds among the received Great Crested Grebe, Red-throated Diver and Common Scoter was respectively 13.2%, 36.5% and 48.8%). In contrast, 70.5% of the more offshore living Kittiwakes had died on the arrival at rehabilitation centre. Ship-based surveys performed in the southern North Sea during the past 11 years, show that the core areas of both Razorbills and

Guillemots are found directly above shallow sandbanks (Fig. 6). There are no obvious differences in the distribution of the two species, except for the Vlakte van de Raan that holds relatively low numbers of Razorbills. Surveys performed during the winter 2002/03 suggest a normal distribution pattern during this winter, except that the Vlakte Raan held rather low numbers of both species. Thus the relatively high numbers of dead Razorbills compared to that of Guillemots were probably not caused by a difference in the distribution between the two species. An explanation can, however, be found when examining the proportion of dead birds in relation to the finding date (Fig. 7). Both in Razorbill and Guillemot high proportions of living birds were found until 28 January, followed by a strong decrease until 1 February. During the first week of February, however, the two species greatly differed in the relative number of dead birds. In particular the period 4 to 7 February appears to be of interest. At that time high numbers of Razorbills (754 in total) stranded at the Belgian beach while the proportion of Guillemots was low (compare Fig. 4). At sea, Razorbills on average constitute only 13.3% of the auks in the study area (ship-based surveys during the period 1992-2002), while in the *Tricolor* strandings it amounted on average 26.3% and reached a maximum of 42.6% on 5 February. At sea a similar increase in the proportion of Razorbills was noted. Razorbills amounted to 4.3% and 2.9% of the auks at sea in December 2002 and January 2003, respectively. During the February surveys this proportion had increased to 17.6%. This increase seems not sufficient to explain the strong increase in the proportion of Razorbills found in the stranded birds.

From 4-7 February 2003, relatively high numbers of Little Auks *Alle alle* and Atlantic Puffins *Fratercula arctica* washed ashore the Belgian coast. Dissection of 33 Little Auks and 8 Atlantic Puffins revealed that the birds were severely emaciated and that the oil contamination had occurred post-mortem. The exceptionally high numbers and the post-mortem data strongly indicate that the birds were not killed by the oil, but starved to death because of food-shortage. Camphuysen (2003) describes a similar wreck at the same time among Atlantic Puffins and Little Auks in The Netherlands. Although found during the *Tricolor* incident the birds were emaciated and unoiled. Camphuysen (2003) suggests a mass displacement of weakened auks to the southern North Sea as a result of food shortage in the more northern parts of the North Sea. The timing of this wreck perfectly matches the third peak in seabird strandings along the Belgian coast, suggesting that it not only involved Atlantic Puffins and Little Auks, but also Razorbills.

Although other explanations (e.g. damage to the food stocks by the oil) can not be excluded, it thus seems likely that the third peak in strandings is at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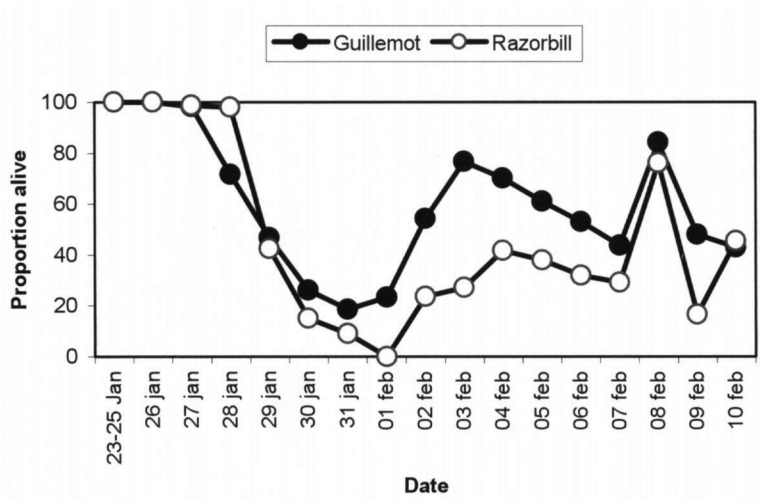

Figure 7. The daily proportion of Guillemot and Razorbill that were received alive at the rehabilitation centre in Ostend during the Tricolor incident.

Figuur 7. Het dagelijkse percentage Zeekoeten en Alken dat levend werd binnengebracht in het vogelopvangcentrum te Oostende tijdens het incident.

least partly caused by a starvation of auks that was unrelated to the *Tricolor* incident. This implies that the number of casualties from the *Tricolor* incident reported here as being oil victims might be somewhat exaggerated. On the other hand it is obvious that many *Tricolor* victims were not counted because they were left on the beaches, thrown away in dustbins or removed from the beach together with a thick layer of oil. Some oiled birds might never have reached the coastline because they sank to the bottom of the sea or drifted elsewhere. Beached Bird Surveys in the United Kingdom indicate that at least some birds drifted/swam in unexpected directions. In the south-east part of the UK,

Opposite page: Figure 6. The distribution of Guillemot (upper map) and Razorbill (lower map) in the southern North Sea during winter (period December-February) based on surveys at sea during the period 1992-2003.

Tegenoverliggende pagina: Figuur 6. De verspreiding van Zeekoet (figuur boven) en Alk (figuur onder) in de zuidelijke Noordzee tijdens de winter (december-januari) gebaseerd op scheepstellingen in de periode 1992-2003.

hundreds of oiled auks were found during the surveys in February 2003. This resulted in the highest oiling rates in that area since 1991 (Schmitt 2003). In literature, the number of birds that die but never come ashore greatly varies, from 0-100% (review in Seys *et al.* 2001). It is therefore not advisable to apply a correction for birds that were not recovered during the *Tricolor* incident in order to calculate the true number of victims. Drift experiments, including some performed in the southern North Sea, show that for a dead bird the probability to wash ashore depends for an important part on the wind (e.g. Hope Jones *et al.* 1970, Bibby & Lloyd 1977, Stowe 1982, Keijl & Camphuysen 1992 and review in Seys et. al. 2001). Also this study shows a strong relationship between wind direction and velocity on the one hand and the number of beached birds on the other. In fact during the *Tricolor* incident many factors were favourable for a high probability of recovery (wind conditions, distance to the shore as well as the effort put in searching the beaches).

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DRIE KLEUREN ZWART: DE STRANDING VAN ZEEVOGELS LANGS DE BELGISCHE KUST TIJDENS DE RAMP MET DE *TRICOLOR*

In eerste instantie leek de aanvaring tussen het containerschip de Kariba en het autoschip de *Tricolor* op 14 december 2002 geen negatieve gevolgen te hebben voor de zeevogels in de zuidelijke Noordzee. Pas bij de aanvaring tussen de olietanker de *Vicky* en het wrak van de *Tricolor* (1 januari 2003) lekte er voor het eerst een onbekende, maar kleine hoeveelheid olie in zee. Als gevolg hiervan werden in de eerste weken van januari in totaal 249 met olie besmeurde vogels in het vogelopvangcentrum te Oostende binnengebracht (Tabel 1). Dit was nog maar een eerste voorproef van wat ons te wachten stond. Op 23 februari kwam tijdens de bergingswerkzaamheden van het wrak van de *Tricolor* maximaal 170 ton olie in zee terecht die vele duizenden zeevogels fataal werd. In de periode 23 januari tot 15 februari spoelden in totaal 9177 vogels behorende tot 32 soorten aan op de Belgische kust (Tabel 1). Vrijwel alle vogels waren sterk besmeurd met olie en iets minder dan de helft van de vogels (45,7%) was al dood toen ze werd binnengebracht in het ad hoc

opgerichte vogelopvangcentrum te Oostende. Zeekoeten *Uria aalge* (64,0% van alle slachtoffers) en Alken *Alca torda* (22,8%) waren het zwaarst getroffen, gevolgd door niet-geïdentificeerde Zeekoeten/Alken (4,5%), Futen *Podiceps cristatus* (3,4%) en Zwarte Zee-eenden *Melanitta nigra* (1,4%). Andere soorten maakten minder dan 1% uit van de slachtoffers. De soortensamenstelling van de aangespoelde vogels verschilde sterk van de samenstelling die op zee waargenomen wordt. Normaal worden er in de zuidelijke Noordzee verhoudingsgewijs meer meeuwen waargenomen (Tabel 2). Die brengen echter relatief veel tijd door in de lucht en overnachten vaak op land, wat hun minder gevoelig maakt voor olie op zee. Overigens werden tijdens het incident langs de Belgische kust, maar ook tijdens het daaropvolgende broedseizoen in de kolonie te Zeebrugge veel meeuwen gezien met olievlekken op hun verenkleed. Ook werden er om onbekende redenen minder Futen en Roodkeelduikers *Gavia stellata* gevonden dan was verwacht op basis van de aantallen op zee.

Er waren drie piekdagen waarop ongeveer 1000 vogels werden binnengebracht (Fig. 3). Tijdens een eerste piek 4 dagen na het incident werden voornamelijk Zeekoeten (92,5%) gevonden. Die waren grotendeels nog in leven (89,8%) toen ze werden binnengebracht (Fig. 4). Blijkbaar waren de vogels ondanks ongunstige windomstandigheden massaal naar de kust toe gezwommen. Na die eerste piek was het aantal vogels dat per dag op de Belgische kust aanspoelde sterk gecorreleerd met de heersende windsnelheid en –richting (Fig. 3). De twee volgende pieken (op 30 januari en 6 februari) volgden op periodes van harde aanlandige wind. De twee tussenliggende periodes met relatief lage aantallen slachtoffers vielen dan weer samen met aflandige wind.

Er wordt gesuggereerd dat veranderingen in de soortensamenstelling van de olieslachtoffers verband hielden met de bewegingen van de olievlek. Hoe dichter de olievlek bij de kust kwam des te meer kustgebonden vogels zoals Futen er werden binnengebracht (Fig. 4). Beweging van de olievlek evenwijdig aan de kust werden gereflecteerd door de plaats langs de Belgische kust waar de vogels aanspoelden (Fig. 5).

Tijdens de ramp met de *Tricolor* werden veel meer Alken binnengebracht (26,3% van de groep Zeekoet + Alk), dan dat er verhoudingsgewijs op zee aanwezig zijn (13,1%). Bovendien was een relatief groot gedeelte van de Alken al dood bij binnenkomst in het vogelopvangcentrum (62,5% tegen 36,5% bij Zeekoet). Deze verschillen kunnen niet verklaard worden door verschillende overwinteringsgebieden (Fig. 6). Het vermoeden bestaat dat er afgezien van de *Tricolor* slachtoffers ook Alken (en ook Kleine Alken en Papegaaiduikers) zijn aangespoeld die door verhongering om het leven zijn gekomen. Hoewel voor dat laatste geen bewijzen zijn, duidt een soortgelijke massale sterfte door verhongering onder alkachtigen in meer noordelijke gebieden op voedseltekorten in delen van de Noordzee.

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