THE *TRICOLOR* INCIDENT: FROM COLLISION TO ENVIRONMENTAL DISASTER

FRANCIS KERCKHOF, PATRICK ROOSE & JAN HAELTERS

Kerckhof F., P. Roose & J. Haelters 2004. The Tricolor incident: from collision to environmental disaster. Atlantic Seabirds 6(3/S.I.): 85-94. *The sinking of the Tricolor on 14 December 2002 and the subsequent related events had disastrous effects on the wintering seabirds in the southern North Sea. This article presents a chronological overview of the events leading to the wreck of seabirds in the first months of 2003 and summarises the actions performed by the administration responsible for marine environmental matters in Belgium, the Management Unit of the North Sea Mathematical Models (MUMM).*

Management Unit of the North Sea Mathematical Models, Royal Belgian Institute of Natural Sciences, 3de & 23ste Linieregimentsplein. B-8400 Oostende, Belgium

INTRODUCTION

On 14 December 2002, the car carrier *Tricolor* sank in the eastern Channel area after a collision with the container ship *Kariba*. During this incident, and because of subsequent related incidents involving other ships, hydrocarbons were released into the marine environment, especially from the end of December 2002 to the first months of 2003. Also during salvage operations, chronic pollution occurred in the vicinity of the shipwreck for most of 2003. After an incident on 22 January 2003, during salvage works, the consequences for seabirds became especially apparent. Although the amount of hydrocarbons released was relatively small in comparison with that released during incidents involving tankers such as the *Erika* and the *Prestige*, the consequences for the seabirds wintering off the coasts of northern France, Belgium and the Netherlands proved to be devastating. Many thousands of oiled seabirds washed ashore.

CHRONOLOGICAL DESCRIPTION OF THE INCIDENTS

14 December 2002 On 14 December 2002, around 02:15h UTC, the car carrier *Tricolor* collided with the container ship *Kariba* when both vessels were about to enter into the north-south shipping route through the English Channel. The *Tricolor* turned on its side, and sank in less than half an hour. The position of the shipwreck was 51°22.0'N, 002°12.7'E. This is in the middle of a very busy shipping route in French waters, at approximately 35 km north of Dunkirk, and

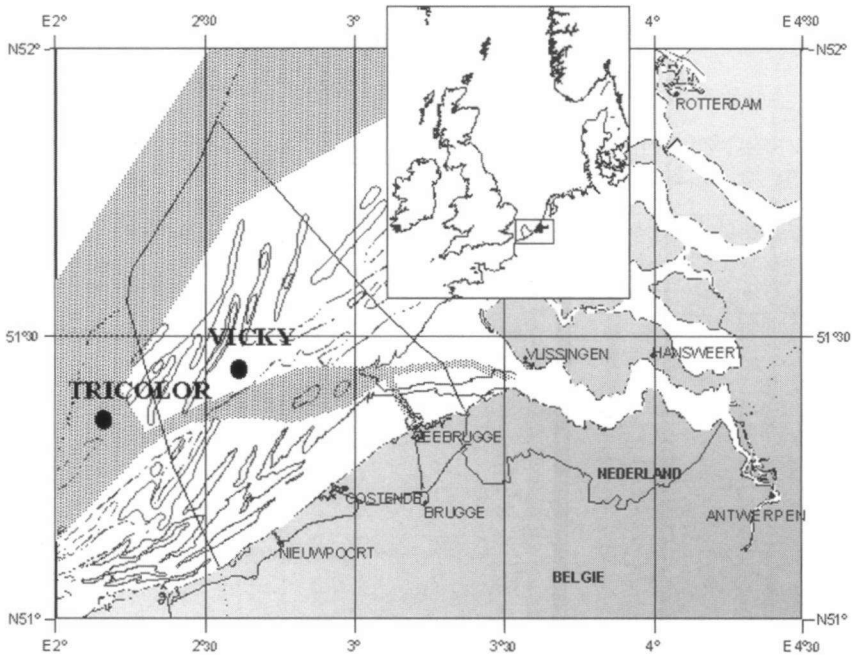


Figure 1. The position of the wreck of the Tricolor, *the Westhinder anchorage area where the* Vicky *remained anchored for nearly two weeks, and the limits of the Belgian marine areas.*

Figuur 1. De positie van het wrak van de Tricolor, *het Westhinder-ankergebied, waar de* Vicky *bijna twee weken voor anker lag, en de begrenzing van de Belgische maritieme wateren.*

near the border of the Exclusive Economic Zones (EEZ) of Belgium and the United Kingdom. (Fig. 1). The *Kariba* steamed back to port, severely damaged. The Norwegian-registered *Tricolor*, built in 1987, traded for the shipping company Wallenius Wilhelmsen lines A.S. The ship was sailing from Zeebrugge to Southampton, carrying, amongst other cargo, almost 3,000 new luxury cars. She had almost 2000 tons of hydrocarbons on board, most of them being heavy fuel. The *Tricolor* was 190 m long and 32m wide, and had a gross tonnage of 49,792 GT. She sank in waters 30 m deep. The *Kariba*, carrying the flag of the Bahamas, was on her way from Antwerp to western Africa, via Le Havre. The crew of the *Kariba* rescued three of the *Tricolor*'s crew members; the remaining 21 crew members found refuge on board the Belgian URS tug *Boxer*. The *Tricolor* was eventually declared a total loss. On 24 December, the

French authorities ordered the wreck to be removed, as it was perceived to represent a danger to shipping and the environment.

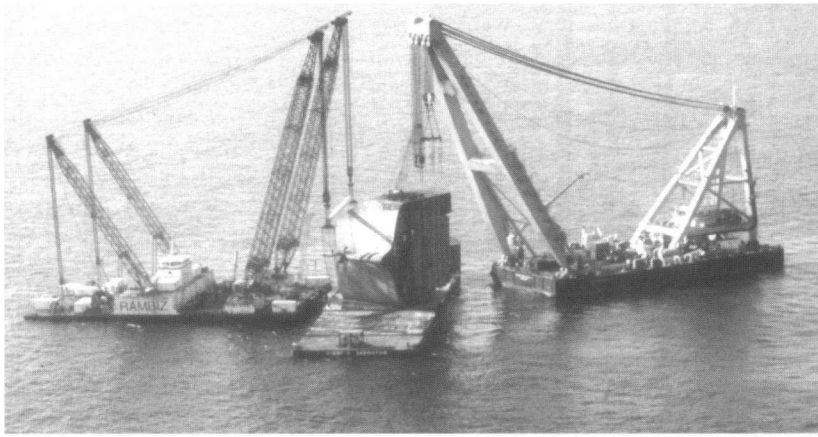
16 December 2002 The German coaster *Nicola* ran into the wreck of the *Tricolor*. As the *Nicola* was empty at the time of the collision, she suffered only minor damage. However, the wreck of the *Tricolor* probably suffered further damage.

1 January 2003 The Turkish tanker *Vicky* (244 m long, 43,500 GT), with a cargo of 70,000 tons of gasoline, and more than 2,000 tons of heavy fuel on board, ran into the wreck of the *Tricolor* at full speed. The incident was inexplicable, given the safety measures around the wreck and the warnings for sailors. This collision not only caused much damage to the *Vicky* herself, but also to the wreck of the *Tricolor*. After the collision, the *Vicky* sailed on towards the Westhinder anchorage area, 14 miles off the Belgian coast (at 51°25.4'N, 002°34.9'E; Fig. 1). She leaked hydrocarbons from the ruptured tanks at the bow. The *Vicky* was partly emptied, and left the anchorage area only on 12 January. Between 2 and 8 January, more than 200 oiled birds were taken to the permanent rehabilitation centre at Oostende. Most probably these birds were fouled with oil originating from the *Vicky*.

22 January 2003 During operations aimed at emptying the fuel tanks of the *Tricolor*, in which the tug *Alphonse Letzer* participated, two valves on one of the fuel tanks of the *Tricolor* broke loose. Probably up to 170 tons of heavy fuel escaped rapidly into the sea. Clean-up operations at sea proved impossible during the following days because of poor weather.

22 January to mid-February During pollution control flights by the Management Unit of the North Sea Mathematical Models (MUMM), limited but chronic leakage of oil was observed from the wreck of the *Tricolor*. Probably more than 170 tons of oil were released into the sea from 22 January onwards, as it became clear by mid February that the wreck had suffered important structural damage, and that several of the fuel tanks were ruptured. According to a press release of the *Préfecture Maritime de la Manche et de la Mer du Nord*, most of the oil had been pumped out of the wreck by 17 February, but up to 60 tons of oil might still have been present in the wreck.

In contrast with the situation during the first weeks of January, strong onshore winds prevailed between the last week of January and the first weeks of February. This resulted in very high numbers of oiled seabirds on beaches in France, Belgium and the Netherlands (Haelters *et. al.* 2003; Stienen *et al.* 2004, this issue).



The giant sheerlegs (floating cranes) Asian Hercules *II and* Rambiz *have lifted the first section of the* Tricolor *and placed it on the floating pontoon* Giant 4. De drijvende kranen *Asian Hercules II* en *Rambiz* hebben het eerste deel van de *Tricolor* opgetild en op de drijvende Giant 4 geplaatst *(photo MUMM).*

22 July 2003 – September 2004 The salvage operation of the giant wreck of the *Tricolor* was one of the largest ever attempted. A Dutch-Belgian consortium *Combinatie Berging Tricolor* (CBT) started cutting-up the wreck into nine sections, using a special steel-cutting wire system operated from two working platforms (see picture). A similar technique was used before during the salvage of the wreck of the Russian submarine *Koersk*. The sections of the *Tricolor* were lifted out of the water with two sheer-leg cranes, and put onto a barge for transportation to Zeebrugge, where they were scrapped together with their content.

The cutting and dismantling of the wreck began on 22 July and continued through the summer of 2003. The eighth and final cut was completed on 17 October. On 12 November 2003, unfavourable weather conditions necessitated postponement of the removal of the remaining sections. By then, five sections of the wreck had been lifted and transported to Zeebrugge. Severe, gale force winds rendered the removal of the four remaining sections too dangerous. These sections, weakened due to the cutting operations and the poor weather conditions, had collapsed. It was possible to remove them only by using a floating crane equipped with a large grab. This was done during summer 2004. The whole operation, including the removal of all scrap from the seafloor was completed in October 2004.

Oil pollution during the summer of 2003 During the salvage operations, the wreck still contained quantities of oil. The owners of the *Tricolor* estimated that 490 tons of heavy fuel had not been recovered during pumping operations. Analyses of the oil that was recovered from the wreck revealed that it had formed an emulsion with 30-50 % water.

During cutting and lifting actions, a significant quantity of heavy fuel was released from the wreck on 6 and 7 September. During the following weeks, this oil polluted large parts of Belgian and French waters and coastline. During aerial surveys conducted by MUMM, estimates of the quantity of emulsified oil observed at sea ranged from 200-800 tonnes. This was apparently the last major release of oil from the wreck. Given the low numbers of vulnerable birds in this region during this time of the year, the oil released during this incident probably did not cause a high number of casualties amongst birds.

ACTIONS PERFORMED BY MUMM/RBINS DURING THE *TRICOLOR* INCIDENT

The Management Unit of the North Sea Mathematical Models (MUMM) is a department of the Royal Belgian Institute of Natural Sciences (RBINS), a federal scientific institute. MUMM, as the administration responsible for marine environmental matters in Belgium, had the task of continuously assessing the environmental impact of this incident. The resources available to MUMM include a dedicated aircraft, mathematical models, a laboratory, and an intervention network for dealing with stranded animals, in which a large number of institutes and organisations participate.

MUMM operates, in co-operation with the Belgian army, a twin engined Britten Norman Islander equipped for tracking and recording oil pollution. This aircraft is also used as a guide for ships controlling pollution on the sea surface. During the *Tricolor* incident, frequent pollution control flights were carried out over Belgian waters and over the wreck site in French waters. Observations of oil pollution were reported to relevant authorities (Coastguard, Flemish Community, coastal Province, French authorities) on a regular basis, and were fed into the mathematical models run by MUMM.

Mathematical models describing the movement, spread, and physical and chemical development of pollutants, particularly hydrocarbons, were used to determine the potential impact of pollution, and to provide support for decisions to be taken in pollution control operations. In order to run, the model requires the input of the spill co-ordinates, the volume of the spill, the nature of the oil, water current data, and meteorological conditions. One of the models used is the so-called MU-slick model (MUMM 2004). This model is particularly useful

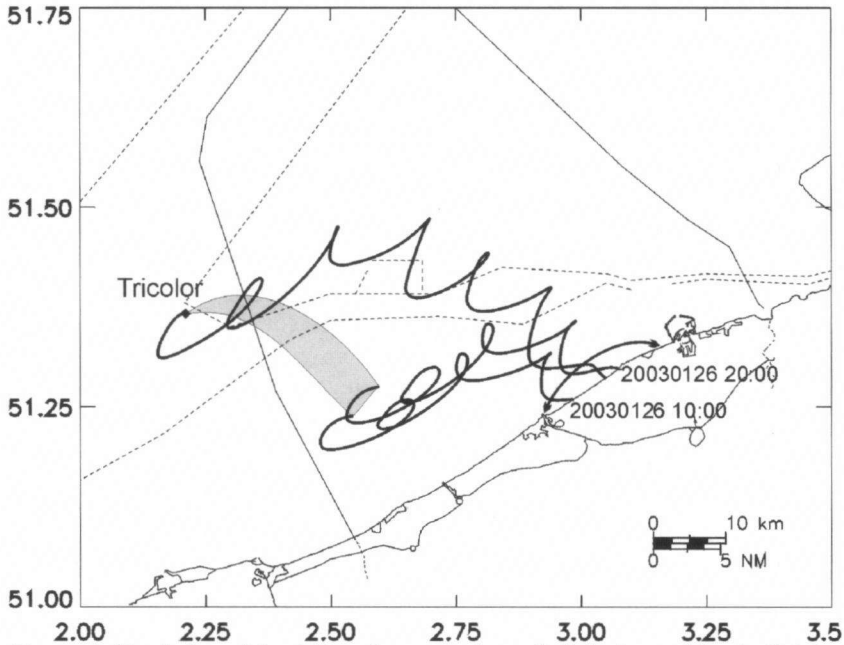


Figure 2: Simulation of the drift and spread of an oil slick observed by the Belgian surveillance aircraft on 24 January 2003 (grey zone). On 24 January the model predicted that oil would wash ashore from 26 January onwards, between Oostende and Zeebrugge. The end of the simulation was 28 January 2003. Such simulations were repeated every few hours with the input of the most recent meteorological predictions (source S. Scory, MUMM).

Figuur 2. Simulatie van de verspreiding en groter worden van een olievlek die 24 januari 2003 door een Belgisch surveillance-vliegtuig werd waargenomen (grijs). Op 24 januari voorspelde het model dat de olie vanaf 26 januari tussen Oostende en Zeebrugge zou aanspoelen. De simulatie eindigde op 28 januari 2003. Deze simulatie werden om de paar uur herhaald met input van de meest recente meteorologische verwachtingen (bron S. Scory, MUMM).

when there is a risk of oil pollution on the shore. Figure 2 shows a simulation of the drift and spreading of an oil slick as an example.

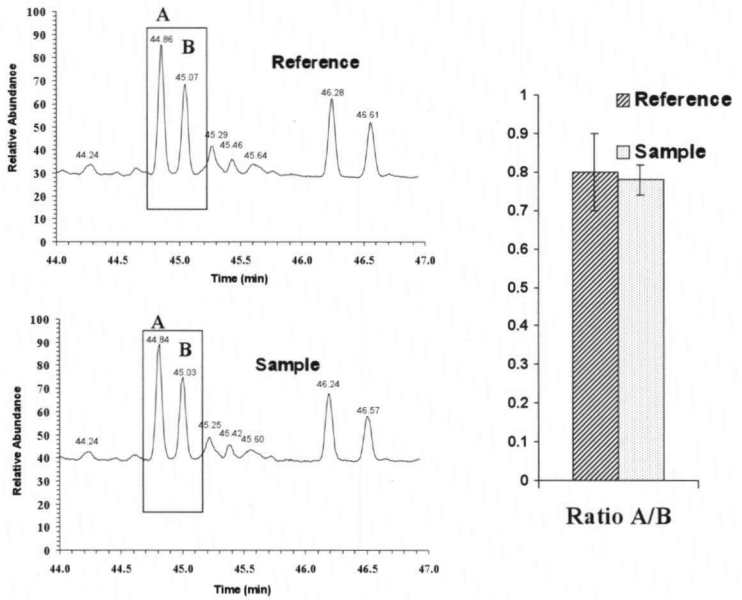


Figure 3. Comparison between the hopane pattern of a sample and a reference oil, including the illustration of the calculation and comparison of diagnostic ratios.

Figuur 3. Vergelijking van het hopaanpatroon van een monster en een referentie, inclusief een beeld van de berekening en vergelijking van diagnostische verhoudingen.

Intervention network for dealing with scientific research on stranded animals Since 1992, MUMM has co-ordinated scientific research on stranded marine mammals and seabirds. This includes regular counts of stranded seabirds, carried out by the Institute of Nature Conservation (Seys 2001). Given that the number of stranded seabirds during the last week of January and the first weeks of February 2003 reached such high numbers, MUMM requested the coastal communities to transport not only live birds, but also dead birds to the ad-hoc rehabilitation centre at Oostende. There, all dead birds were identified and counted by personnel of MUMM, the Institute of Nature Conservation and volunteers of the Bird Rehabilitation Centre at Oostende (VOC). Live birds were counted, identified and cared for by hundreds of helpers and volunteers of the VOC. Detailed results of these counts appear in Haelters *et al.* (2003), and are also discussed in Stienen *et al.* (2004, this issue). A report on the extensive rescue operation was published by the VOC (Velter 2003).

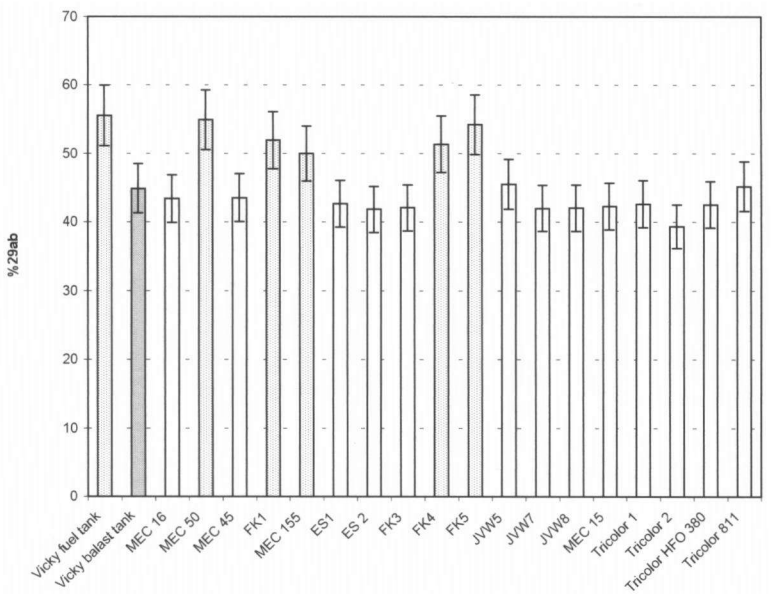


*Figure 4. Comparison of the percentage of biomarker 29ab in oil samples collected during the incident and reference samples (*Vicky*: light and dark grey,* Tricolor*: white). Error margins represent the 95% CI of the calculated value.*

*Figuur 4. Vergelijking van het percentage van de biomarker 29ab in oliemonsters die verzameld zijn tijdens het incident met referenties (*Vicky*: lichtgrijs en donkergrijs,* Tricolor*: wit). Foutenmarges geven de 95%-betrouwbaarheidsinterval van de berekende waarde aan.*

Laboratory analyses Oil is a complex chemical mixture. Several of its constituents can be used for identification purposes: polyaromatic hydrocarbons (PAHs) and the so-called biomarkers. Biomarkers, such as hopanes, are molecules of biological origin that are characteristic of the region where the oil was formed. Oils from different oil fields therefore have a different PAH and/or biomarker pattern. Moreover, these particular chemicals are resistant to degradation, rendering the patterns constant over time. During the incident, MUMM, together with other authorities such as the Coastguard, the Flemish Community and local authorities, took samples of the oil on beaches, on birds, at sea, and from the wreck itself. The French authorities provided reference samples of oil from the bunkers of the *Tricolor*, and also reference samples of

oil from the *Vicky* and the *Prestige*. These samples were taken to MUMM's laboratory in Oostende for comparative analysis.

At the MUMM laboratory, a selected number of oil samples were analysed, and the relative abundance of PAHs and biomarkers in each of them was calculated (Fig. 3). The ratios between two oil components shown in the box in Fig. 3 (known as the diagnostic ratios for marker compounds) are statistically compared with those for an unknown sample and a reference sample. An unknown sample was considered to be different from the reference sample if the value for the selected diagnostic ratio (DR) was outside the 95% confidence intervals (CI) of the DR for the reference sample. Figure 4 shows the comparison of the DRs for biomarker 29ab, calculated for the reference samples and the unknowns. From the graph, samples originating from the *Vicky* (light grey) can easily be identified. On the other hand, no distinction could be made between a sample containing oil from the ballast water tank of the *Vicky* (dark grey) and samples from the *Tricolor* (white). This clearly illustrates the possibilities and the pitfalls of oil fingerprinting during an incident such as this one.

CONCLUSIONS

Dealing with a disaster such as the Tricolor inherently requires the deployment of a great deal of manpower and resources. Although the treatment and rehabilitation of oiled wildlife was of major importance, many other problems had to be tackled as well. This could only be achieved by close co-operation between all involved parties. In many ways, the co-operation between the various official bodies, NGOs and the numerous volunteers was remarkable and highly stimulating. Meanwhile, during multidisciplinary research, data were collected on all aspects of the incident. The research yielded valuable data needed for the assessment of the potential ecological consequences. The results will also allow authorities to be better prepared for future disasters. Finally, the scientific results play an important role in raising public awareness.

HET TRICOLOR INCIDENT: VAN AANVARING TOT MILIEURAMP

Het zinken van de Tricolor op 12 december 2002 en de daaropvolgende incidenten hebben een zware milieuramp veroorzaakt met verstrekkende gevolgen voor de zeevogels die overwinteren in Het Kanaal. In dit artikel wordt een chronologisch overzicht gegeven van de gebeurtenissen die voorafgingen aan de stranding van olieslachtoffers op de Franse, Belgische en Nederlandse kust gedurende de eerste maanden van 2003. Daarnaast wordt een overzicht gegeven van de activiteiten van één van de verantwoordelijke autoriteiten in België tijdens het Tricolor incident, namelijk de Beheerseenheid van het Mathematisch Model van de Noordzee (BMM, Koninklijk Belgisch Instituut voor Natuurwetenschappen).

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The multipurpose offshore salvage and diving support vessel Union beaver *is specially equipped to clean up oil from the sea.* Het multifunctionele offshore bergingsvaartuig *Union beaver* is speciaal uitgerust om olie van het zeeoppervlak op te ruimen (*photo MUMM).*