Mystery spill of Polyisobutylene $(C_4H_8)_n$ off the Dutch coast affecting seabirds in March 2010

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Levels of chronic oil pollution in the marine environment are declining worldwide and certainly so in the southern North Sea (Anon. 1992, 1993; Camphuysen 1998, 2010). This is most likely the result of a combination of factors, including intensified and more effective aerial surveillance (remote sensing), legislation, human attitude, and enhanced possibilities to discharge unwanted substances in oil reception facilities in harbours. Beached bird surveys have documented this decline in considerable detail (Camphuysen 2010).

Accidental and small, but deliberate, illegal discharges do still happen. In recent years, cases of beach pollution and seabird mortality events have increasingly involved substances other than mineral oils (Verduin *et al*. 2010; Camphuysen & de Leeuw in press). Most of these substances remain unidentified since few countries have effective protocols in place to sample and analyse them when encountered, either at sea, on beached birds or on beaches. However, some incidents involve effects on wildlife that are so grim, or are on such a scale that they draw the attention of the public and the state authorities. A mass stranding of dead seabirds in March 2010 along the Dutch coast was one such mystery event in which action was undertaken, namely censuses of stranded birds, identification of the substance, and attempts to locate the source of the pollution at sea by the relevant authorities.

The first carcasses and live birds were reported on 14 March 2010. A sticky substance was reported and the presence of dead Red-throated Divers *Gavia stellata* and live Common Guillemots *Uria aalge* suggested a near-shore spill. Later strandings, however, involved auks (Alcidae) and Northern Fulmars *Fulmarus glacialis*, none of which were alive, suggesting that most birds came into contact with the substance at some distance from the coast. Most casualties were covered in a thick layer of glue-like material and must have been immobilised instantly. Several dozen carcasses were reported in total, littering sandy beaches between Camperduin on the mainland coast of Noord-Holland and the westernmost Wadden Sea islands of Texel and Vlieland. An old carcass of a Common Guillemot was also found on the East Friesian island of Mellum near Wilhelmshaven, Germany in late March. From the predominantly southerly winds during the incident, coupled with the fact that mostly offshore species were affected, we would expect that only a small proportion of the casualties had washed ashore. The physical condition of the severely contaminated birds found dead was excellent (large deposits of fat, muscular breast, good organ condition, full stomachs), indicating rapid death. Gas chromatography/Mass spectrometry analysis of the glue-like material at NIOZ revealed that it mainly consisted of a polymer with highly methylated monomer-units, most likely Polyisobutylene (PIB; $(C_4H_8)_n$). Its physical properties are consistent with the visual observations and chromatographic behaviour, and the identification was confirmed by Dr. Gerhard Dahlmann (Bundesamt für Seeschiffart und Hydrographie, Hamburg). An aerial inspection for surface pollutants in the Southern Bight by the coastguard on 20 March 2010, nearly a week after the incident was first reported, did not produce any results.

Camphuysen *et al*. (1999) reported on a mass stranding of seabirds in the North Sea in December 1998, when an estimated 1,100 birds washed ashore in Zeeland (SW Netherlands), mainland Noord-Holland and Texel. Common Guillemots, Northern Fulmars and Common Scoters *Melanitta nigra* were the most numerous birds affected and all were covered in a glue-like substance, soon identified as PIB. As in 2010, the substance was sticky, transparent and odourless. However, in 1998, volunteers cleaning the birds in rehabilitation centres reported serious discomfort (irritation of the respiratory tract) and dizziness. Even worse, the soft parts of the birds found dead (the horny layers of the bill, the eyes, throat, and foot webs) appeared to dissolve within days, although the carcasses remained intact since they were covered in feathers. No birds were taken to rehabilitation centres in 2010, but in contrast to 1998, the soft parts of carcasses did not dissolve, even after a week. PIB itself is not a corrosive substance, and an explanation for the observed effects on soft parts in the 1998 stranding could be the use of some unidentified cleaning agent, particular additives used with PIB, or possibly an acid or base was present which would easily dissolve in water (and which was therefore not found in organic analysis).

Polyisobutylene or butyl rubber is a colourless to light yellow synthetic rubber, which is generally both odourless and tasteless. It is impermeable to air, and is therefore used in many applications requiring an airtight rubber seal. Polyisobutylene is also used in making adhesives, agricultural chemicals, fibre optic compounds, cling film, electrical fluids, lubricants (engine oil), paper and pulp, personal care products, pigment concentrates, for rubber and polymer modification, for protecting and sealing certain equipment for use in areas where chemical weapons are present, as a gasoline/diesel fuel additive, and even in chewing gum. A substance like PIB cannot be recognised from visual inspection only and chemical analyses of samples are required. For wildlife rehabilitators and beached bird surveyors,

Figure 1. Common Guillemots *Uria aalge* contaminated with polyisobutylene ready for *post mortem* analysis (left image), and an adult Common Guillemot, oiled on the breast, but also covered all over with polyisobutylene (right image); thick deposits of subcutaneous fat suggest death was rapid after contamination. Both photographs Texel, 22 March 2010. © *Kees Camphuysen*.

the clear advice would be: don't touch or touch only with proper personal protection, understanding that as long as the chemical identity of a substance is unknown, a toxic cocktail may be involved, potentially inducing serious health risks.

This case study illustrates the risks that seabirds face in the North Sea, even when mineral oil pollution is declining. Under MARPOL Annex II, PIB is listed under category Z of noxious liquid substances in bulk: *substances presenting a minor hazard to either marine resources or human health and therefore justify less stringent restrictions on the quality and quantity of the discharge into the marine environment*. One may wonder if this ranking is justified given the observed and immediate impact of PIB on marine wildlife in the 1998 and 2010 incidents.

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Leach's Storm-petrels *Oceanodroma leucorhoa* nesting at a new site in Shetland

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Abstract

In August 2010, six small islands in northern Shetland were prospectively surveyed for breeding colonies of Leach's Storm-petrels *Oceanodroma leucorhoa* using vocalisation playback methods. Four adult birds, two with a nest, were located on 10 August in burrows at a new site for the species in the UK: Gloup Holm, off north Yell. Under license, three birds were temporarily extracted and examined; all had brood patches entirely bare of feathering and highly vascularised. Eggs and chicks were not located but burrows were all too deep to check conclusively. Future surveys of Gloup Holm and other small islands in the north of Shetland, carried out in June, may locate further adults, eggs and chicks.

Introduction

In Britain and Ireland, the vast majority of breeding Leach's Storm-petrels *Oceanodroma leucorhoa* nest on islands and sea stacks in the Western Isles, Scotland, in particular on St Kilda, the Flannan Isles and North Rona, where a total of c. 48,000 pairs were found between 1999 and 2001