

Causes of death of harbor porpoises (*Phocoena phocoena*) stranded on the on the continental coastline of the southern North Sea (Belgium, France, and Dutch coasts) between 1990 and 2007

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Abstract

The Marine Animals Research & Intervention Network investigated the causes of death of marine mammals stranded on the continental coastline of the southern North Sea (Belgium and France, and selected cases of the Dutch coast). Since the end of the 1990s, a significant rise of harbour porpoise (*Phocoena phocoena*) strandings occurred in the area, annual stranding average being less than 50 porpoises between 1990 and 1998, and more than 260 between 1999 and 2007. The aim of the study is to present the main lesions and causes of death of 615 porpoises found dead and necropsied, and to find a potential explanation for that dramatic rise. Most frequent observations included net marks on the skin, sub-cutaneous and muscular bruises, emaciation, pulmonary and gastric parasitism, acute pneumonia, and pulmonary congestion and edema. Two causes

of death were significant: by-catch in fishing nets and infectious diseases. By-catch was mainly observed in March and April while infectious diseases, mainly responsible for acute pneumonia secondary to parasites infestation, occurred throughout the year. Based on the necropsy, between 1990 and 1998, 20% of stranded porpoises were by-caught and 40% between 1999 and 2007. Only 60% of by-caught animals were healthy, others having evidence of emaciation, pneumonia and parasitosis. There are two possible reasons to explain the recent rise of stranding in the southern North Sea, one could be associated with the increase of capture in fishing net, the other seems to be linked with the southward shift of the population within the North Sea.

Introduction

The aims of the multidisciplinary research group MARIN (Marine Animals Research and Intervention Network) are to identify the causes of death and monitor the health status of marine mammals stranded along the coasts of Belgium and Northern France, and occasionally on the coast of the Netherlands.

Harbour porpoises (*Phocoena phocoena*) are the most common cetaceans in the North Sea. During the 20th century, the porpoise population has severely declined along the coasts of the southern North Sea but since the of the 1990s, a significant rise of harbour porpoise strandings occurred in the area. Indeed, the annual stranding average was less than 50 porpoises between 1990 and 1998, and more than 260 between 1999 and 2007 (figure 1).

The most frequent causes of death of porpoises in the North Sea are accidental by-catch in fishing gear, acute bronchopneumonia (Baker and Martin, 1992; Jauniaux *et al.*, 2002; Kuiken *et al.*, 1994; Kirkwood *et al.*, 1997; Siebert *et al.*, 1999, 2001) and severe parasitosis.

The aims of this study were to describe the main lesions and causes of death of 619 harbour porpoises stranded along the Belgian, Northern France and Dutch coastlines between 1990 and 2007, and to find a potential explanation for that dramatic rise.

Material and methods

From 1990 to 2007, 2706 harbour porpoises stranded on the Belgian, Northern French and Dutch coastlines. Among them, 619 were selected for necropsy and sampled by a standard procedure (Jauniaux *et al.*, 2002). For every porpoise, a conservation code was determined from 1 (very fresh) to 5 (remains, skeleton). Based on the conservation

code, the necropsy and sampling were adapted.

After external examination, the abdominal and thoracic cavities were opened and the skull was sown longitudinally to expose the brain. The lesions and the cause of death were identified. Three age categories based on body length were recognized: neonatal (≤ 90 cm), immature (91-130 cm) and mature (>130 cm) (Lockyer, 1995). Samples were collected for histopathology, for microbiology, for serology (*Brucella sp.* and morbillivirus infection) and for parasitology.

Results and discussion

The distribution of strandings was very irregular with less than 50 porpoises per year between 1990 and 1998 and more than 260 annually between 1999 and 2007 (Figure 1). The majority of strandings occurred during winter and early spring. One possible reason to explain this rise of stranding in the southern North Sea could be linked with the southward shift of the population within the North Sea (http://biology.st-and.ac.uk/scans2/documents/issue9_Dec06.pdf.)

The most common findings were severe emaciation: weight loss, reduced blubber layer thickness and dorsal muscle atrophy; acute bronchopneumonia: pulmonary consolidation with haemorrhagic or purulent fluid oozing from the parenchyma; severe multisystemic parasitosis in airways and blood vessels: nematodes *Torynurus convolutus* and *Pseudalius inflexus*, in gastric cavities: nematode *Anisakis simplex* and trematode *Pholeter gastrophilus*, of liver: trematode *Campula oblonga* and of middle ear: *Stenurus minor*. Evidence of capture in fishing net was regularly observed: net marks on skin, flipper amputations, subcutaneous or muscular bruises, extensive pulmonary congestion and oedema with abundant white, often blood-tinged froth within airways.

Based on gross lesions, two causes of death were significant: by-catch in fishing nets (20 to 40%) and infectious diseases (40-49%). By-catch was mainly observed in March and April while infectious diseases associated with emaciation, mainly responsible for acute pneumonia secondary to parasites infestation, occurred throughout the year.

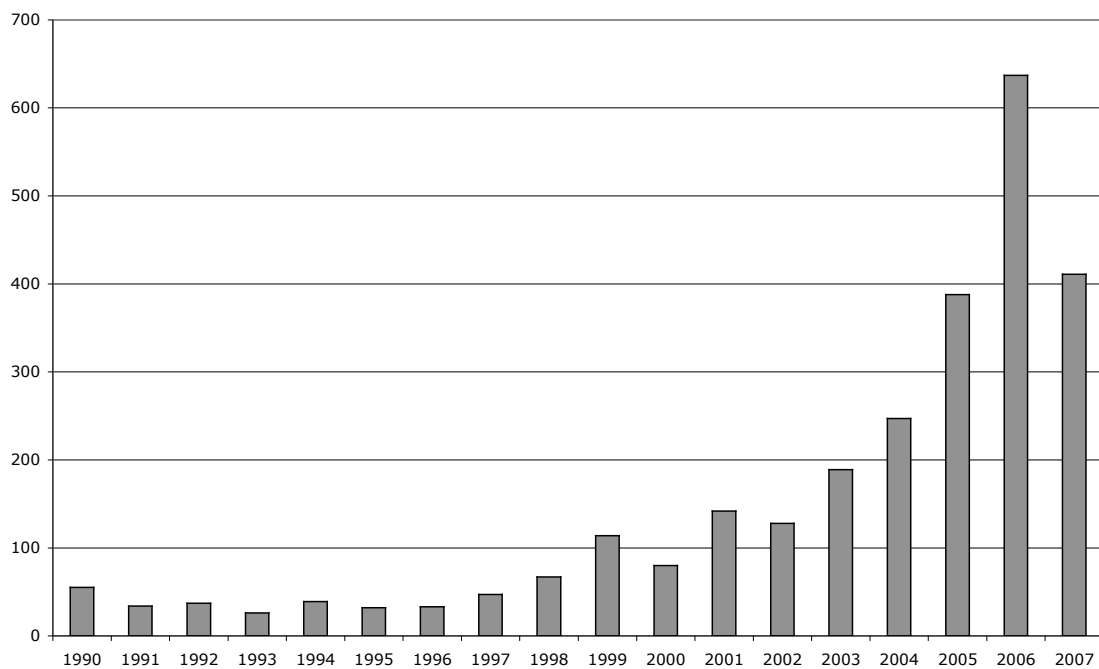
Between 1990 and 1998, 20% of stranded porpoises were by-caught and 40% between 1999 and 2007. For neighbouring countries, the average percentage of capture was 34% on the British coasts (1990 to 1996, Jepson *et al.*, 2000), 50% on the German coasts (1991 to 1993, Benke *et al.*, 1998). A previous study reported 10 - 20 % for the Dutch coast from 1990 to 1994 (Addink and Smeenk, 1999). By the necropsy, it is not possible

to determine the category of the fishing net involved in the capture but most of porpoises with evidence of capture were very fresh and recreational fishing activity (beach net,...) is strongly suspected to be one of the responsible, at least for Belgian coastline. In addition, Haelters *et al.* (2006) demonstrated that some of porpoises (in less good conservation code) stranded on the Belgian coastline drifted from the northern France waters. The increase of capture could be explained by the extended presence of porpoises along the coast in winter when fishing activities occurred also. As there is no specific lesion of net capture, the prevalence of by-catch, if based only on the necropsy of stranded porpoises would be largely underestimated in the southern North Sea. According to Siebert *et al.* (2001) by-catches probably have a significant impact on the population dynamics of North Sea porpoises. Only 60% of by-caught animals were healthy, others having evidence of emaciation, pneumonia, slight to severe parasitosis and empty gastro-intestinal tract.

Infectious diseases with severe emaciation, severe parasitism and bronchopneumonia were common findings (1990-1998: 49%; 1999-2007: 40%) and similar to those described in porpoises from other regions of the North Sea (Baker and Martin, 1992; Kirkwood *et al.*, 1997; Siebert *et al.*, 1999, 2001). Bronchopneumonia was frequently associated with parasitosis or emaciation, or both. These are chronic, debilitating processes which might predispose to fatal bronchopneumonia, lung parasitism, leading to secondary bacterial infection and bronchopneumonia (Jauniaux *et al.*, 2002). After entanglement in fishing nets, this combination has been identified as the most frequent cause of porpoises death in British (Baker and Martin, 1992; Jepson *et al.*, 2000), Dutch (García Hartmann, 1997) and German waters (Benke *et al.*, 1998; Siebert *et al.*, 1999, 2001). In the present study, 40-49% porpoises had severe bronchopneumonia responsible for death of the animal, which is similar to the 46% reported in German waters but higher than the 10 to 12% reported in British waters. Infectious diseases may be related to high tissue concentration of organochlorines (Jepson *et al.*, 1999) or mercury (Siebert *et al.*, 1999), frequently reported in porpoises from other parts of the North Sea. Nevertheless, such an association was not always confirmed (Kuiken *et al.*, 1994).

No case of *Brucella* nor morbillivirus virus infection was reported.

Figure 1: Annual distribution of harbour porpoises stranding along the Belgian, northern French and Dutch coastline between 1990 and 2007.



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