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RESEARCHES ON THE MORTALITY FACTORS OF CETACEANS ON THE COASTS OF FRANCE

R. Duguay, Museum National D'Histoire Naturelle, Centre D'Etude des Mammifères Marins, 28 Rue Albert, 1700 La Rochelle, France.

An important part of the research programme carried out, since 1972, by the Centre d'Etude des Mammifères Marins, is dedicated to the study of cetaceans stranded on the coast of France. Each time that circumstances permit, an autopsy is carried out on stranded animals, completed by sampling for heavy metal and pesticide levels and histopathological examination of selected tissues. But there are numerous difficulties in this work, related, essentially, to the poor state of the stranded cetaceans and to the difficulties of transporting Delphinids or the necessity to work on large cetaceans in situ.

In spite of the restricted number of cases for which we have yet obtained complete data, it seemed to us interesting to attempt an analysis of strandings and to research their causes, to try to open some general lines of thought on the mortality factors of cetaceans found on the coast of France.

Geographical distribution and seasonal variation

The geographical distribution of strandings whose location is known — a total of 788 for 20 species — reveals a difference between our three principal coastal sectors: 45,6% on the Atlantic, 36% on the Mediterranean and 18,4% on the Channel. But it appears, moreover, that the frequency of strandings is very variable within the sectors: Var on the Mediterranean, Charente-Maritime and Gironde on the Atlantic are the three 'départements' where the observations are most numerous.

Though these data cannot be statistically interpreted, one can take into account the factors which could favour strandings. The study of monthly incidence shows, for the Channel, that the maximum occurs at the beginning of autumn, notably for *Hyperoodon ampullatus* (the Bottlenosed whale). This suggests a correlation between strandings and passage migrations. On the Atlantic and the Mediterranean, by contrast, the majority of observations are in winter and, in certain sectors (Charente-Maritime and Var), we have been able to demonstrate a clear correlation between high winds and strandings. So there exists a positive meteorological factor whose mode of action is difficult to define; it causes, at one and the same time, a movement towards the coast of cetaceans dead at sea, but equally a severe environmental disturbance able to bring about the death of certain animals with low resistance (the ill, the aged or the young).

Biological factors (species, age, sex)

The percentage of each of the twenty species found on our coasts gives a general idea of their frequency in local waters, but only signifies that one species strands more frequently than another of equal population size. In reality, each one of them is exposed to a different type of mortality according to its way of life.

It is certain, for example, that species not adapted to low water are very vulnerable when they find themselves in the shallows; this is the case with *Hyperoodon ampullatus* in the Channel. In contrast, coastal cetaceans — *Phocoena phocoena* (the common porpoise) and *Tursiops truncatus* (the bottlenosed dolphin) — are not rarely entangled in nets. Certain gregarious animals, notably *Globicephala melaena* (pilot whale), are almost condemned to death when isolated. Finally, in the case of species straying far from their normal area of distribution, it may be considered that they are also condemned: this was the case for a *Delphinapterus leucas* (Beluga whale) on the Atlantic coast in 1948.

Age seems to play an important role in determining mortality. Although our data are insufficient for precise estimation of age classes, we have been able to ascertain that a large proportion of the stranded animals were immature and that a smaller proportion were aged individuals, whilst adults were rare. By contrast, we have found no significant difference between the number of males and females stranded.

Pathological factors

1. *Infections*

The display of pathological factors is made difficult by the relatively small number of autopsies and histopathological examinations which we have carried out. Of

known infectious diseases, the only one identified is erysipelas (*Erysipelothrix rhusiopathiae*), observed in a *Globicephala melaena*. From our researches we may suppose that this disease is rarer in wild cetaceans than in captive specimens.

One case of necrotic osteitis, in the dorsal and lumbar vertebrae, has been observed in a *Delphinus delphis* (common dolphin), but the aetiology was undetermined. The same applies to a subacute generalized adenitis, with large lymphoid follicles in the lymph nodes in another *D. delphis*.

The presence of localised infection in the posterior abdomen has been seen several times: in a *G. melaena* female with metritis and ovarian abscesses and in several *D. delphis* with peri-genital abscessation, particularly in the blubber, in association with encysted parasites.

On several occasions we have found a gingivo-dental infection with complete erosion of the palate. In many old animals (*Grampus griseus*, *Delphinus delphis*, and *Stenella coeruleoalba*) it is a question of whether this disease caused severe pain or even prevented feeding.

2. Organic lesions

We have only exceptionally found characteristic lesions in different organs. Besides a tumour of neoplastic appearance, in the kidneys we have only observed glomerular alterations with some signs of sclerosis, of undetermined origin.

The digestive tract seems quite rarely affected: we have only noted an intestinal thrombosis in a *Ziphius cavirostris* (Cuvier's beaked whale), and an obstruction with peritoneal adhesions in a *Tursiops truncatus*. On the other hand, the presence of zones of ischaemia in the intestine is common: it is due to vascular defects characteristic of the pre-agonal period. Damage to lung tissue has been found in many cases, in different species. Most often there is apparent alveolar congestion, more or less localised but we have observed two cases of pneumonia. Two other cases involved acute pulmonary oedema from cardiac insufficiency, one of them in an old *Grampus griseus* (Risso's dolphin). One should point out, in this connection, that the majority of cases of pulmonary damage are connected with cardiac insufficiency and more rarely with infectious disease.

3. Miscellaneous lesions

Skeletal examination quite often reveals the existence of healed fractures: most often these are of the ribs, more rarely of the rami of the mandible. In old animals one often finds vertebral ankylosis, occasionally causing fusion of the cervical vertebrae. In a single case we found a fatal fracture: it occurred in a *Stenella coeruleoalba* (blue-white dolphin) with a fractured rib, splinters of which had pierced the pleura and caused a gas gangrene of the thoracic wall.

It is quite difficult to determine if serious wounds, of which one often finds traces, have caused the death of the animal or if they have occurred on a dying or dead animal. In the case of shark or killer whale bites, seen on several occasions, it seems that they have been made on animals already dead, taking into account their location on the dorsal and ventral regions, between the level of the dorsal fin and the tail.

4. Parasitism

Cetaceans are almost always carriers of parasites, but it is difficult to know within what limits this constitutes a mortality factor.

Parasitism by a cestode (*Phyllobotrium delphini*) is as a rule general in *D. delphis* and *S. coeruleoalba*. Quite often it gives rise to abscess formation in the peri-genital

blubber or in the abdominal cavity which, in that case, may lead to a generalised infection.

The most important lesions which we have seen have been caused by a nematode (*Crassicauda sp.*): they affected the lining of the skull causing very important osteolytic lesions (Robineau, 1975). Although the animal (*T. truncatus*) had been captured alive, it seemed certain that its life would have been short.

5. *Echolocation problems*

In cetaceans, the echolocation system is certainly the most fragile. Also one may admit that derangement of its function — from various causes — sets up a fatal disturbance for the cetacean which ends up by stranding itself. This phenomenon is particularly clear at the time of mass strandings, almost always of *G. melaena* on our coasts.

6. *Intoxications*

Cetaceans suffer, like all marine organisms, the effect of pollutants, especially heavy metals and pesticides.

As regards mercury, we have reported (Thibaud and Duguy, 1973) that the maximum concentrations are generally observed in the liver (up to 905 ppm), that accumulation increases with age and that the intoxications are much more marked in the Mediterranean than in the Atlantic or the Channel. Our study, in progress, perhaps may define the importance of this mortality factor. It is the same for the pesticides whose mode of action — probably on fertility — is yet to be defined.

Pollution by hydrocarbons can, in much lesser measure, cause intoxication: we have only twice noted the presence of hydrocarbons in the alimentary tract of *T. truncatus*. Certain other local pollutants have been reported as mortality factors: this is the case with the 'red sediments' in the Mediterranean which act synergistically with other sources of pollution (Viale 1976).

7. *The action of man*

The influence of man, as a mortality factor, is far from being negligible on the coasts of France.

A part of this is involuntary — as in the case of accidental capture of cetaceans in nets set close to the shore or, much more rarely, in trawls. It happens, also, that collisions occur between boats and cetaceans, notably with *Balaenoptera physalus* (fin whale) in the Mediterranean. However, it is impossible to know whether the animals were naturally asleep or abnormally sluggish connected with some pathological state.

But there exists, unfortunately, a form of action which directly causes deaths of cetaceans: either by harpooning practised by certain groups or by rifle fire — notably in the Mediterranean — and in spite of existing regulations for protection. We have also seen the death of a *Stenella coeruleoalba* due to a shock wave caused by experimental military explosions.

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