

TRACE ELEMENTS IN ORGANS AND TISSUES OF DIFFERENT SPECIES OF CETACEANS FROM THE LIGURIAN SEA

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Abstract:

The concentrations of Hg (total and organic), Cd, Pb, Cu, Fe, Mn, Zn and Se were determined in the muscle, liver, kidney and heart of cetaceans belonging to 5 different species from the Ligurian sea. The levels of the different elements in the various organs are discussed and the measured values are compared with data from literature.

Keywords: cetacea, Ligurian sea, trace elements.

Introduction

Marine mammals can be considered among the best biological indicators of the health of the marine environment, due to their sensitivity to environmental variations, their position at the top of the trophic chain, and to the large number of studies on the levels of trace elements in cetaceans from different locations.

The distribution of Hg (total and organic), Cd, Pb, and the essential elements Cu, Fe, Mn, Zn and Se was studied in tissues and organs of five different species of cetaceans: 1 fin whale (*Balaenoptera physalus*), 1 Cuvier's beaked whale (*Ziphius cavirostris*), 2 Risso's dolphins (*Grampus griseus*), 1 bottlenose dolphin (*Tursiops truncatus*) and 2 striped dolphins (*Stenella coeruleoalba*), all stranded along the coast of the Ligurian Sea or found dead offshore during the period 1990-1999. These species are located at different levels of the trophic chain: *Balaenoptera physalus* is a mysticeton, feeding on krill; *Ziphius cavirostris* and *Grampus griseus* mainly feed on squids; *Tursiops truncatus* and *Stenella coeruleoalba* can feed mostly on fish and, to a lesser extent, squid.

Materials and Methods

The individuals were classified and measured: they were adult, except for *Tursiops truncatus* (suckling specimen), one of the two *Stenella coeruleoalba* and one of the two *Grampus griseus* (sub-adults). From each individual, muscle, liver, kidney and heart were collected; only muscle was available for *Balaenoptera physalus*. Moreover, the milk contained in the stomach of *Tursiops truncatus* was sampled and analysed.

Trace element concentrations in biological tissues were determined by atomic (emission and absorption) spectrometric methods: details on analytical methods and quality assurance control are described elsewhere (1).

Results and Discussion

In all of the individuals, liver was the organ containing maximum Hg concentrations (reaching more than 2000 µg g⁻¹), Pb and Se concentrations (higher than 1000 µg g⁻¹). Kidney contained lower Hg concentrations. In liver, increasing Hg concentrations correspond to a lower organic Hg percentage. A significant correlation between Hg and Se is observed in all of the analysed organs, except for heart. The essential elements Zn, Cu and Mn generally show concentrations within a restricted range of values in the different organs, with the lowest concentrations found in muscle.

The concentrations of the different elements in milk are comparable with the values measured in muscle, except for Fe, present in much lower amount, whereas Mn and Pb levels are somewhat higher. Hg is predominantly in the organic form (87% of the total).

A comparison between the different species sampled is made difficult by the biological variability (sex, age) of the specimens; however, the finding that high concentrations of Hg are found in *Grampus griseus*, also as a consequence of their specific dietary intake (2), are confirmed here.

Table I gives a summary of the results of the comparison between our data and data from literature: only Hg concentrations are reported for individuals having comparable size and age. Since age can affect the Hg concentration in dolphins (3), no comparison is made with literature data regarding *Tursiops truncatus*, since no data pertaining to suckling individuals were found.

Our specimens show Hg values comparable with other data for cetaceans from the Mediterranean sea, while they show much higher Hg content than in Atlantic specimens, thus confirming results of previous investigations (1,6).

Table I – Ranges of Hg concentrations taken from the literature and our values.

	N	Origin	Hg-tot (µg g ⁻¹ d.w.)	Hg-org (µg g ⁻¹ d.w.)
<i>Balaenoptera physalus</i>				
Sanpera <i>et al.</i> (4)	36	Spain-Iceland	0.46-0.71	0.36-0.61
Our data	1		2.64	2.57
<i>Ziphius cavirostris</i>				
Storelli <i>et al.</i> (5)	1	Southern Italy	36 (a)	26 (a)
Our data	1		34	20
<i>Grampus griseus</i>				
Frodello <i>et al.</i> (2)	1	Corsica	189	-
Storelli <i>et al.</i> (5)	2	Southern Italy	98-114 (a)	55-58 (a)
Our data (only adult)	1		139	24
<i>Stenella coeruleoalba</i>				
Holsbeek <i>et al.</i> (3)	1	France (Atlant.)	5	-
André <i>et al.</i> (6)	7	France (Atlant.)	6-44 (a)	-
	8	France (Medit.)	42-300 (a)	-
Augier <i>et al.</i> (7)	13	France (Medit.)	7-155	-
Frodello <i>et al.</i> (2)	1	Corsica	21	-
Cardellicchio <i>et al.</i> (8)	5	Southern Italy	30-53 (a)	-
Leonzio <i>et al.</i> (9)		N-W Italy	37-168	-
Our data (b)	8		65-260	14-45

(a) data converted from wet to dry weight;

(b) only adults, taken from the present work and from a previous work (1)

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