

LEVELS IN BIOTIC COMPARTMENTS

CONTAMINATION OF PERSISTENT ORGANOCHLORINES IN SMALL CETACEANS STRANDED ALONG BRAZILIAN COASTAL WATERS

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Introduction

The worldwide contamination by persistent organochlorines (OCs) such as PCBs and DDTs has posed a great concern on their endocrine disrupting effects to humans and wildlife. Because of the chemically stable and lipophilic nature of these OCs, their high contamination and extensive bioaccumulation/ biomagnification have been noted in aquatic mammals, the top predators of the ecosystem. Supporting with the massive usage of chemicals in a number of developed countries, notable OC pollution in the northern hemisphere became obvious. Although OCs levels in the southern hemisphere have been considered to be low, little information is available for elucidating its contamination status. There are limited studies addressing the difference in OCs pollution between the two hemispheres using offshore species including minke whale (*Balaenoptera acutorostrata*) [1] and albatrosses [2]. However, few studies have been conducted regarding the local OCs pollution of terrestrial and coastal species in the southern hemisphere.

The present study is aimed at understanding the recent contamination of OCs in small cetaceans stranded along Brazilian coastal waters during 1997 and 1999. The two newly identified microcontaminants, *tris* (4-chlorophenyl) methane [TCPMe] and *tris* (4-chlorophenyl) methanol [TCPMOH], were also examined to understand their global distribution, transport and behaviors.

Materials and Methods

Samples

Twenty-six tucuxi (*Sotalia guianensis*) and 26 franciscana (*Pontoporia blainvillei*) were found stranded on the coasts of São Paulo and Paraná states in Brazil during 1997 and 1999. Both are endemic odontoceti species inhabiting the Atlantic coast of South America. Blubber samples were excised from dead animals and wrapped in aluminum foil, and kept in a deep freezer at -20°C until analysis.

Chemical analysis

PCBs and other organochlorines (DDTs, HCHs, CHLs, HCB, heptachlor epoxide, dieldrin, TCPMe and TCPMOH) were analyzed following the method reported by Tanabe *et al.* [3] and Watanabe *et al.* [4] with slightly modification. Briefly, approximately 2-3 g of blubber sample was extracted in a Soxhlet apparatus with a mixture of diethyl ether and hexane. An aliquot of extract was added to a gel permeation chromatography column for lipid removal. The GPC fraction containing organochlorines was concentrated and passed through an activated Florisil column for fractionation. Quantification of

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Table 1. Mean and range concentrations of organochlorine compounds in small cetaceans stranded along Brazilian coastal waters

Species	n	Age	Lipid (%)	Concentrations (ng/g on lipid wt.)								
				PCBs	DDTs	CHLs	HCB	HCHs	TCPMOH	TCPMe	HP epox.*	Dieldrin
Tucuxi	26	8.1 (0-29)	72 (5.4-84)	17000 (1300-65000)	29000 (1000-150000)	290 (15-990)	33 (2.1-350)	19 (2.3-69)	84 (8.0-300)	56 (7.4-250)	50 (1.6-180)	79 (0.59-240)
Franciscana	26	3.4 (0-16)	85 (72-99)	2500 (320-12000)	3600 (580-35000)	46 (4.7-110)	11 (1.4-20)	3.6 (1.1-4.0)	22 (6.0-120)	9.5 (1.8-72)	6.6 (2.4-13)	24 (0.58-61)

* heptachlor epoxide

PCBs and organochlorine pesticides was performed using a GC (Hewlett Packard 6890 series) equipped with an ECD. Identification and quantification of TCPMe and TCPMOH were performed using a GC-MS (HP6890 and HP5973) in selective ion monitoring mode.

Resultats and Discussion

OC contaminants were detected in all the samples of tucuxi and franciscana collected from Brazilian coastal waters. DDTs and PCBs were the predominant contaminants with 150 µg/g lipid wt. and 65 µg/g lipid wt. at the maximum concentrations in the blubber sample from tucuxi, and 35 µg/g lipid wt. and 12 µg/g lipid wt. in franciscana, respectively (Table 1). On the other hand, CHLs, H

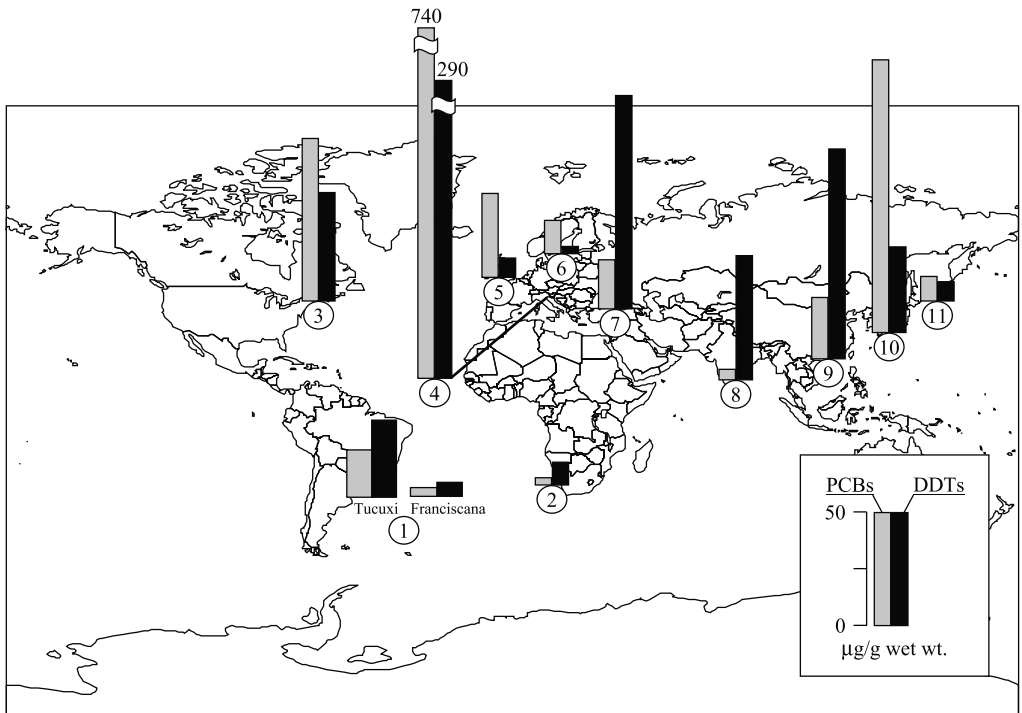


Figure 1. PCBs and DDTs residues in the blubber of small cetaceans (mature male) from various regions. 1) this study, 2) dusky dolphin [6], 3) beluga [7], 4) bottlenose dolphin [8], 5) harbour porpoise [9], 6) harbour porpoise [10], 7) harbour porpoise [11], 8) humpback dolphin [12], 9) finless porpoise [13], 10) finless porpoise [14], 11) harbour porpoise [11].

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HCHs, TCPMe, TCPMOH, heptachlor epoxide and dieldrin were detected in two to three orders of magnitude lower than PCBs and DDTs. Elevated concentrations of PCBs and DDTs suggest serious pollution by persistent OCs in southern Brazilian coast. TCPMe and TCPMOH were detected in most of the samples analyzed, ranging from 1.8 - 250 ng/g lipid wt. and 6.0 - 300 ng/g lipid wt., respectively, indicating widespread contamination by these compounds in the Brazilian coastal ecosystem. To our knowledge, this is the first comprehensive study showing the accumulation of TCPMe with TCPMOH in animals from the southern hemisphere.

OCs residues found in this study were compared with those reported in coastal odontoceti species from other parts of the world. Contrary to our expectation, contaminations by PCBs and DDTs in Brazilian species were comparable to those in animals from most locations except high-industrialized areas including the Mediterranean Sea, Atlantic coast of USA and Japanese coastal waters (Figure 1). This result implies that there are highly polluted areas in the southern hemisphere related to industrialization as well as the northern developed countries. On the other hand, contamination levels of CHLs, HCB, HCHs, dieldrin and heptachlor epoxide were generally lower than other species from the northern hemisphere, suggesting less contamination by these OCs in Brazilian coastal waters. TCPMe and TCPMOH residue levels in Brazilian cetaceans were almost comparable to those in some species from the northern hemisphere, implying the expansion of the contamination by these compounds in the southern hemisphere.

Contamination of OCs in the southern hemisphere has been considered to be lesser than the northern hemisphere in relation to the total OCs amount used. Actually, studies examining minke whale and albatross showed clear differences in OCs residue levels between the northern and southern hemispheres [1, 2]. However, the present study revealed the existence of highly polluted area by certain OC contaminants in the southern hemisphere, such as Brazilian coastal regions, comparable to the northern industrialized areas. High OC contamination in mussels from the coastal waters of Brazil and Argentina [5] may partly support the specific accumulation of OCs in Brazilian cetaceans. Furthermore, Guruge *et al.* [2] reported relatively high OC concentrations in royal albatrosses (*Diomedea epomophora*) that mainly inhabit Australian/New Zealand waters. Temporal trends of OCs residues in minke whale from both hemispheres suggested that OC levels were declining in the northern hemisphere, but were almost constant or slightly increasing in the southern hemisphere [1]. Considering all these facts, further research should be conducted to elucidate the contamination status in urbanized and industrialized areas in the southern hemisphere.

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