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Pesticides and PCBs (polychlorinated biphenyls) in Harbour porpoises of North Sea, Baltic Sea and Arctic waters

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In the frame work of the project "Investigations on small cetaceans as a basis for a monitoring programme", financed by the German Federal Ministry of Science and Technology, investigations on organochlorines in harbour porpoises (Phocoena phocoena) of North Sea, Baltic Sea and the west coast off Greenland were carried out .

Altogether 60 porpoises of different age and sex from these regions were sampled (blubber) and analysed for 51 individual chlorinated biphenyls (CBs) and CB groups, 6 chlorinated pesticides (HCB, α-HCH, γ-HCH, p,p'-DDT and the metabolites p,p'-DDE and p,p'-DDD). Chemical data (on a lipid weight basis) were obtained using single and multidimensional GC-ECD after extracting samples with n-hexane, clean-up with alumina and HPLC.

The sum CB concentrations (pmol/g lipid) of North Sea and Baltic Sea subadult specimens are comparable (48000 and 42000 respectively) whereas that of Greenland specimens is 10 times lower (3800). The median concentrations (pmol/g lipid) of HCB-, DDE-, DDD- and γ-HCH in porpoises are in the order of greenland < North Sea < Baltic Sea. The highest concentrations of a-HCH ie.151 pmol/g lipid is recorded in Greenland animals. DDT is measured only in these specimens.

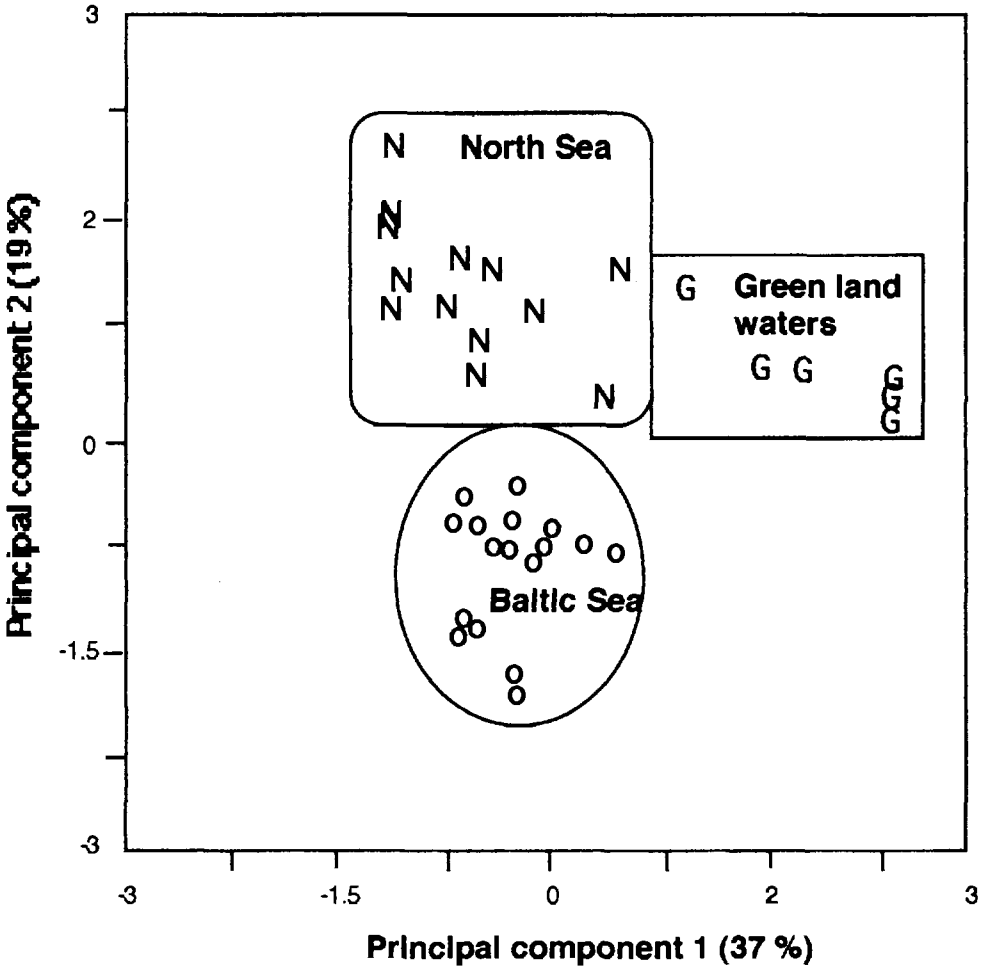
The concentration ratio between DDE and sum DDT (DDE+DDD+DDT) is a good indicator of environmental weathering of these compounds. Higher values indicate old input and lower values the fresh input of these compounds to the environment. High values of 0.79 and 0.75 are recorded for North Sea and Baltic Sea populations whereas the lowest value is measured in the Greenland population. Similar observation was made in Beluga whales between Canadian Arctic and St.Lawrence estuary (Muir et al.1990).

The distribution and environmental fate of these compounds in the Arctic zone is complex and depends on the ocean circulation, atmospheric transport, solubility properties and the local food web. It is proposed that long range transport of these compounds are possible through global distillation and ocean currents. For example, the occurrence of higest concentration of more water soluble α-HCH suggests global distillation. At the same time low DDE/sum DDT ratio indicate a fresh input of pesticides to these regions, possibly from Russian Arctic.

The composition of CBs in these regions are interesting as well. For example, the mol% values of tetra- and penta-Cl biphenyls such as CB-52, 44, 66/95, 91, 97 and 90/101 are higher in Greenland specimens (sum:17.4 mol%) than North Sea (sum:7.2) and Baltic Sea (sum:8.5). Some what higher values were recorded in Beluga (sum: ca.23, Muir et al. 1990) and Narwal (sum: ca. 25, Muir et al. 1992) from the Canadian Arctic. Global distillation could be one possibility. Studies in PCB compositions in solution and suspension in these regions from our laboratory (Schulz-Bull et al. 1998) suggest that particulate scavenging during ocean circulation could deplete the higher chlorinated CBs in the Arctic region, as well.

Factor analysis of these results yielded biplots suggessting distinct differences in the CB composition of these three populations. Thus environmental contaminants could possibly help genetic studies on population structure of harbour porpoises in these regions. Morphometric

analysis, enzyme studies and mitochondrial DNA sequencing studies suggest that the Baltic Sea and North Sea specimens are separate populations. Our study supports this view.



Principal component score plot of mol% contribution of CB congeners in the blubber of Harbour porpoises collected from North Sea (N), Baltic Sea (o) and the Greenland waters (G)

References:

Muir, D.C.G. etal., (1990) Organochlorine contaminants in belugas, Delphinapterus leucas, from Canadian waters. Can. Bull. Fish. Aquat. Sci. 224, 165-190.

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