POSTNATAL TRANSFER OF POLYBROMINATED DIPHENYL ETHER, PBDE, IN JUVENILE LONG-FINNED PILOT WHALE (*Globicephala melas*) IN THE ATLANTIC - A FATAL LEGACY

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Introduction

Occurrence of PBDE in marine mammals and humans. The presence of PBDE in the environment was first discovered, in marine samples from Sweden, in 1981[1]. These first observations have been confirmed by several others [2,3,4]. Levels reported vary from 8 ng/g to 110,000 ng/g, depending on the individual, species or sampling site.

Recent publications of human levels of PBDE show relatively higher levels of the lower brominated congeners, and a typical human pattern of five major congeners seem to be present in human tissue[5,6]. In human tissue total levels of PBDE in the Swedish population are estimated to be in the range of 1-100 ng/g.

Lactational transfer of organohalogens. Main mammalian exposure for biomagnifying organohalogen compounds, and the one of most concern in addition to the fetal exposure, is the postnatal lactational transfer of these compounds from mother to off-spring. An increasing transfer of PBDE in marine mammals, as well as in humans, is alarming.

Human milk collected in the Stockholm region, in 1972 to 1997, showed continuously increasing levels of brominated diphenyl ethers in contrast to the decline seen for other organochlorinated compounds such as DDT, PCB and PCN[7].

In pilot whale. High levels of organochlorine contaminants have been reported in Atlantic pilot whale[8]. The PCB levels, between 1,000-48,000 ng/g lipid, are among the highest reported for biological samples. In a recent study the occurrence of 19 PBDEs in long-finned pilot whale was confirmed both by full scan (SCAN) and selective ion recording (SIR) mass spectrometry by Lindström, et al [9].

In 1995 Abraham et al.[10] reported on relatively high levels of organohalogens in blubber of pilot whale in the Faeroe Islands, and in breast milk from a mother with a high consumption of whale. In recent studies on PBDEs in human tissue we have found several of the 19 congeners reported in

pilot whale to be present also in the general Swedish population[11,12] . To investigate the lactational transfer of PBDE, in the marine mammalian pilot whale, we analysed PBDE in adult male and female as well as in juvenile whales from the Faeroe Islands.

Materials and Methods

Sampling at Vestmanna. The first sampling was on June 26th 1996 in Vestmanna, from a pod of a total of 192 whales. Samples were taken from 50 individuals randomly chosen. The whales were subdivided into four groups, according to sex and sexual maturity. The four sample groups thus represent immature females (n = 4, mean body length = 2,97 m, range 2,55 – 3,5 m) and males (n = 13, mean body length = 3,59 m, range 2,73 – 4,75 m), and mature females (n = 19, mean body length = 4,39 m, range 4,00 – 4,65 m) and males (n = 8, mean body length = 5,41 m, range 5,11 – 5,63 m). Four pooled fat samples of pilot whale from Vestmanna were analysed as described by Lindström[5] et al. Totally 19 individual PBDE congeners were determined.

Sampling at Sandavagur took place on August 26th 1997. Samples from totally 52 randomly chosen individuals were taken. The four sample groups, classified as above, consisted of 7 immature females, 19 immature males, 18 mature females and 8 mature males. Samples were cleaned up by SFE, as four pooled samples representing each sample category, and further analysed according to Lindström.

Sampling at Torshavn. The third sampling of long finned pilot whales was done in connection with the traditional drive kills in Torshavn, September 24th 1997. Individual blubber samples were taken from adult and juvenile males and females, as classified above. A material consisting of totally twelve individual samples, three of each category, was cleaned up by SFE and the 19 PBDEs determined as above.

Sampling at Leynar took place on December 2nd 1997. Individual blubber was taken from 9 young males, 10 young females, 3 adult males and 28 adult females. The samples were pooled into the four categories and analysed as described above.

Sampling at Hvalvik. The fifth, and latest, sampling was on November 25th 1998. The material consisted of 9 young males, 16 young females, 21 adult males and 7 adult females. Samples were pooled and analysed as above.

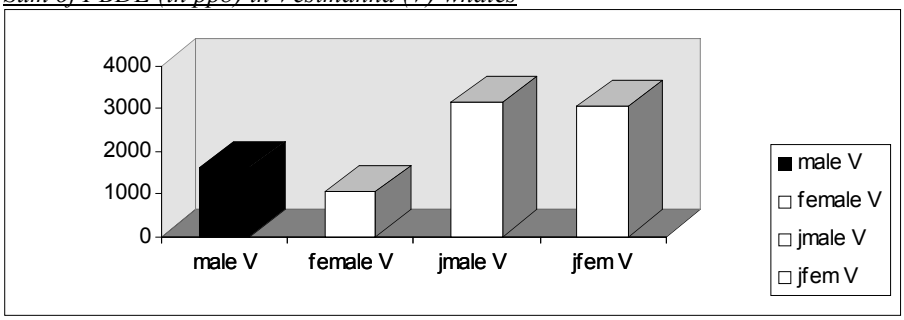
Results and Discussion

The sum of the levels of all 19 PBDE congeners were calculated for the four categories of whales at the five different sampling sites (Diagram 1). The levels are reported in ng/g whale fat and range from 126 ng/g, for an individual adult female caught at Torshavn, to 3160 ng/g, for a young male pool belonging to the Vestmanna pod.

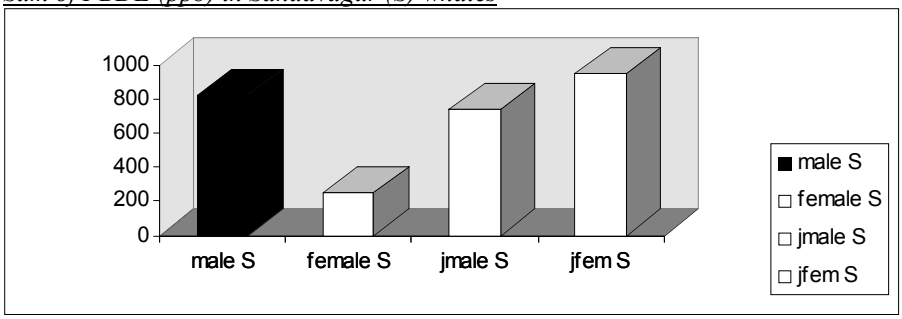
Considerations. Total levels of PBDEs in the pooled pilot whale samples are somewhat higher than PBDE levels previously reported in seals. The PBDE levels presented here are among the highest measured in mammalian samples so far. High levels of PBDE in the juvenile whales can be explained by a considerable lactational transfer of these compounds from the females to the off-spring. As can be seen from the diagrams adult females have significantly lower levels than their off-spring, and also lower than males from the same 'grind'.

Diagram 1. Levels of the sum of totally 19 PBDEs, in ng/g lipid, in adult male and female and in juvenile male (jmale) and female (jfem) Pilot Whale (*Globicephala melas*). Pooled samples from five different samplings in 1996-1998 in the Faeroe Islands.

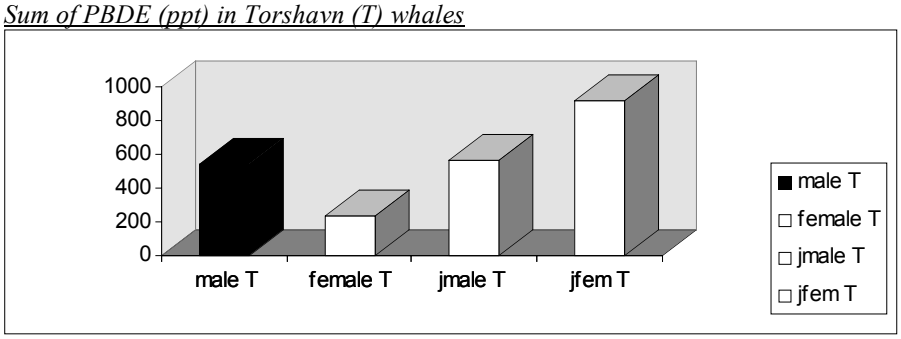
Sum of PBDE (in ppb) in Vestmanna (V) whales



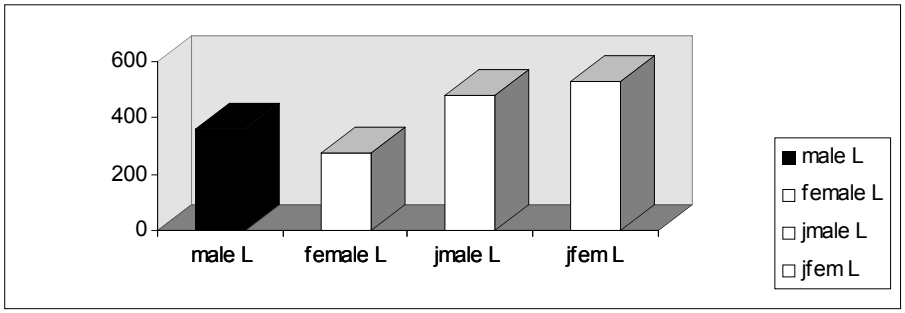
Sum of PBDE (ppb) in Sandavagur (S) whales



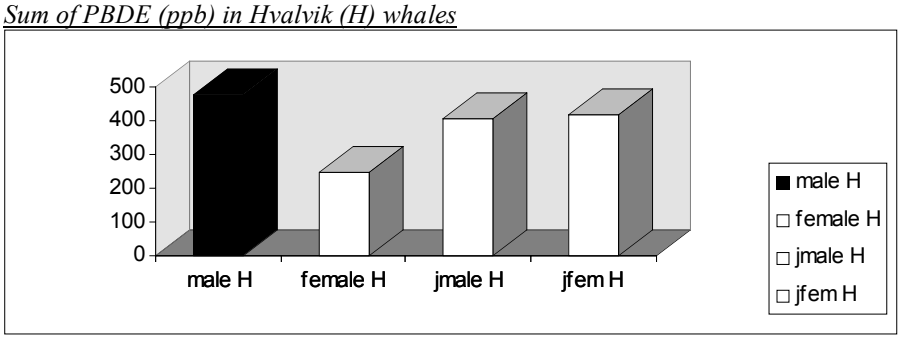
Sum of PBDE (ppt) in Torshavn (T) whales



Sum of PBDE (ppb) in Leynar(L) whales



Sum of PBDE (ppb) in Hvalvik (H) whales



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