Analysis of PCDDs and PCDFs in Seal from the Baltic, Kattegat, and Skagerack

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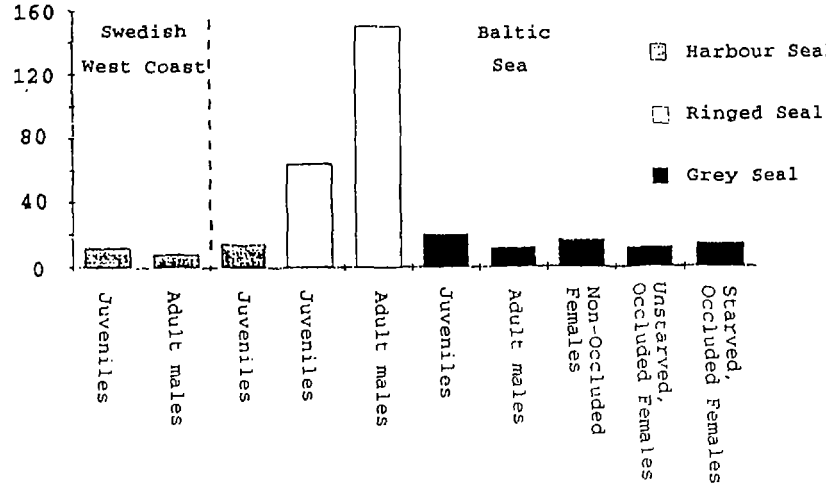
The Baltic Sea, surrounded by Scandinavia, Russia, the Baltic States, Poland, and Germany, has considerable inputs of environmental pollutants from industrialized activity dispersed throughout its watershed. The Baltic is also exposed to contaminants by means of atmospheric deposition from sources within as well as beyond its watershed. The Baltic seal populations, once vast, are now few due to extensive hunting practices. Less understood influences have been studied arising from environmental contaminants, for example as causative factors in a disease complex described as hyperadrenocorticism[1]. This condition, which is known to afflict both grey and ringed seal, with higher incidence in grey seal, is associated to reproductive impairment. As mammalian fish predators Baltic seals are valuable indicators of environmental contamination within the region since their migratory cycles are confined entirely within the Baltic. A number of readily detectable persistent organohalogen pollutants can be monitored at various trophic levels within the Baltic Sea. To date the analysis of DDT, DDE, PCDDs, PCDFs, and coplanar PCBs have attracted the majority of attention. Congener specific analysis of the PCDDs, PCDFs and planer PCBs have been of interest due to very high biological hazards associated with these substances. Though they do not comprise the greatest fraction of contaminants many congeners in these three classes have similar chemical and toxicological properties to the highly toxic 2,3,7,8-TCDD. Information regarding the occurrence of specific contaminant isomers is of value for addressing questions of point source, toxicological response, and sequestration. Some measurements showing the occurrence of PCDDs and PCDFs in seal from the Baltic have been previously reported[2,3,4]. In this poster recent data regarding the distribution and levels of 2,3,7,8-substituted PCDDs and PCDFs will be presented for ringed, grey, and harbour seals from the Baltic, Skagerak, and Kattegat. In particular, attention is directed toward age group, species, and spatial variation in both levels and patterns of PCDDs and PCDFs. All seal groups examined were collected during the 1980s.

In Figure 1 the levels of PCDDs and PCDFs are presented as TCDD toxic equivalents (TCDD-TEQ, pg/g wet weight) for juvenile seals representing various locals and species. Clearly no significant differences can be seen between harbour seals from

the Baltic and those representing the populations on the Swedish west coast. Neither are there dramatic differences between grey

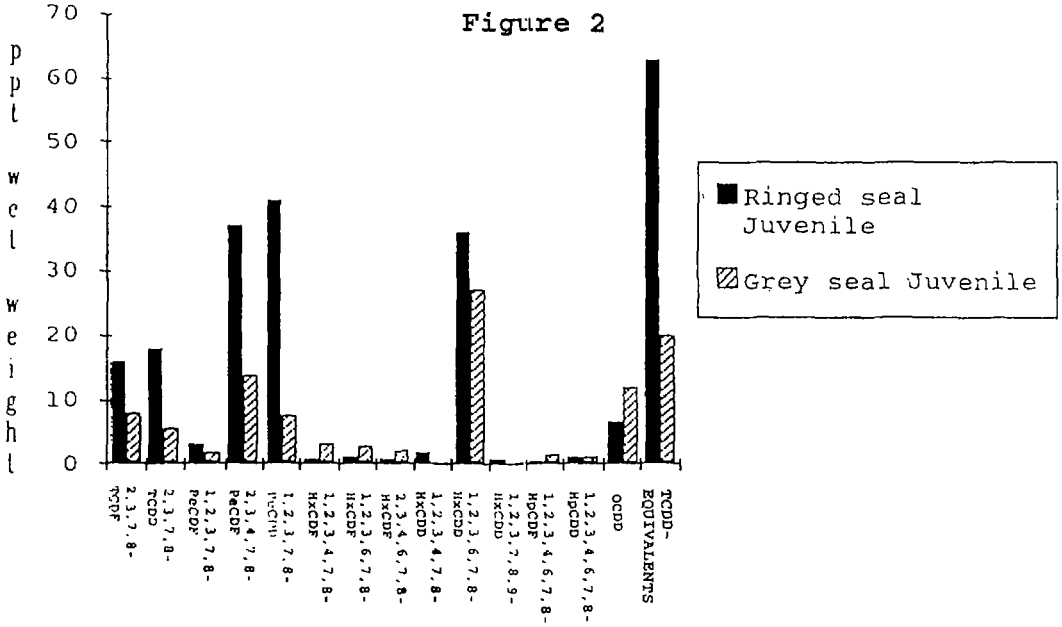
Figure 1

Concentration of PCDD/Fs in Seal Adipose
TCDD-TEQ (pg/g wet weight)



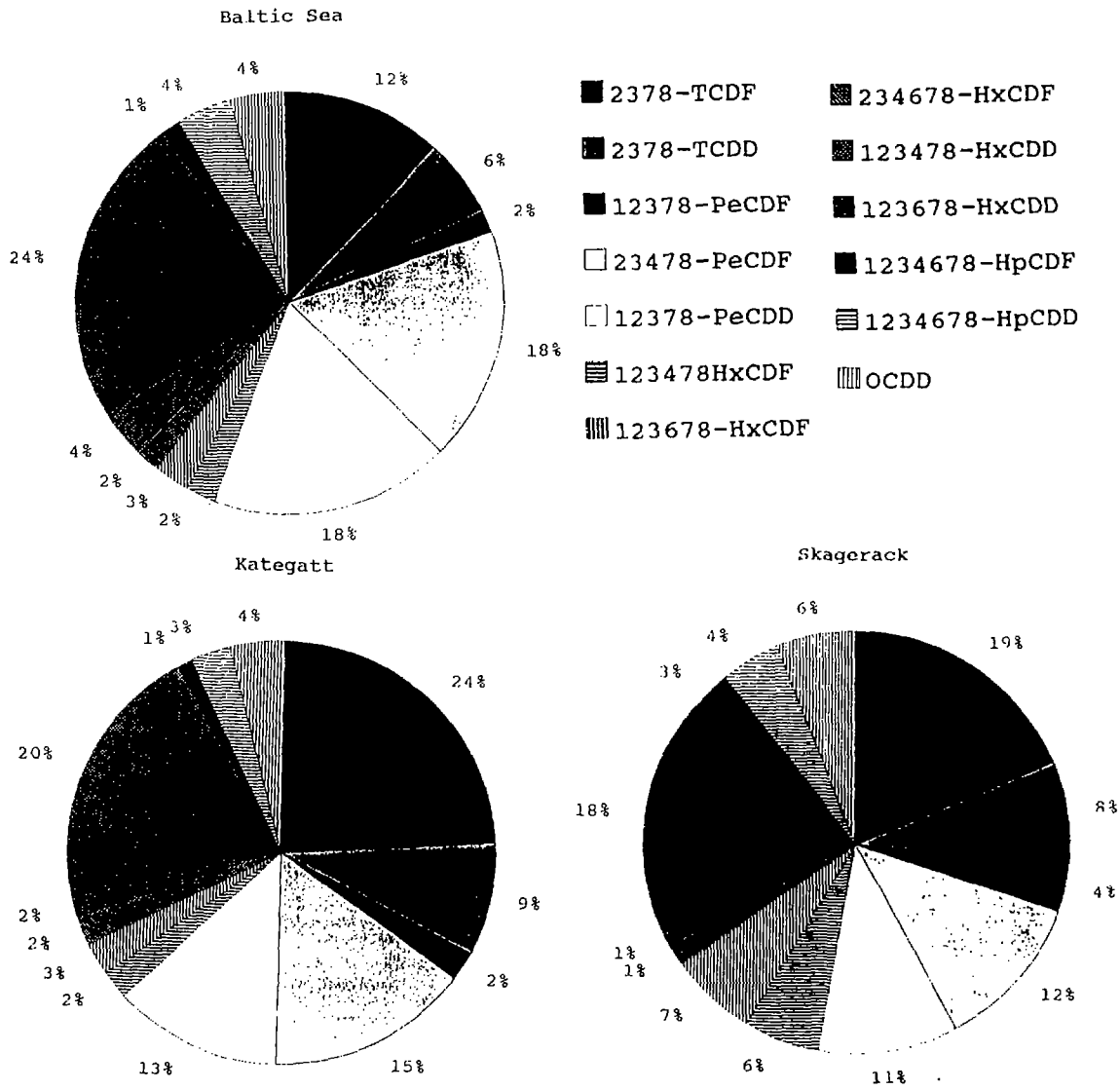
seal and harbour seal representing populations in the Baltic. Interestingly however, concentrations measured for ringed seals are higher than those for grey or ringed seals. A portion of

Figure 2



the ringed seal diet includes benthic crustaceans, whereas both harbour and grey seal feed almost exclusively on fish. Crustaceans have earlier been reported to contain appreciable concentrations of PCDDs, a factor which may perhaps explain the higher concentrations found in ringed seal. The patterns of 2,3,7,8-substituted PCDDs and PCDFs (pptr wet weight) detected in ringed and grey seal are presented in Figure 2. A difference is revealed which further indicates apparent differences in contaminant sources for the two species. A comparison of the patterns of 2,3,7,8-substituted PCDDs and PCDFs measured in harbour seals from the Skagerak, Kattegat and Baltic is presented in Figure 3, given as isomer percentages of the total PCDD/F by weight.

Figure 3



It becomes apparent that 2,3,7,8-TeCDF comprises a higher relative proportion in the Kattegat, an observation which at present cannot be explained. It is seen for all three species however that 1,2,3,6,7,8-HxCDD is always among the most dominant of isomers present, a general observation made earlier for marine mammalian samples from North America[5]. The levels of PCDDs and PCDFs reported here are not unusually high when compared to other biological or marine samples. Baltic seals have considerably higher levels of organochlorines such as DDTs and PCBs than do seals from the Swedish west coast[6] but no such differences in PCDD or PCDF levels are observed in this study. It is noteworthy that the levels of DDTs and PCBs, as well as PCDDs and PCDFs are higher in fish from the Baltic by comparison.

Based on previous data the concentrations of DDT and PCB in seal adipose appear to be one to two orders of magnitude greater in seal than in the extractable fat tissue from fish. By contrast the PCDD and PCDF levels found in seal adipose are of the same magnitude as that found in fish adipose. The results would indicate a fast metabolism of PCDDs and PCDFs in seals. This interpretation is supported by an unpublished examination of seal faeces for PCDDs and PCDFs. Irrespective of the high intake of PCDDs and PCDFs through ingestion of large quantities of contaminated fish, analysis of faeces samples indicate virtually undetectable levels.

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