

POLYBROMINATED DIPHENYL ETHERS IN THE BLUBBER OF HARBOUR PORPOISES (*Phocoena phocoena* L.) STRANDED ON THE COASTS OF ENGLAND AND WALES

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Introduction

An earlier study of the distribution of polybrominated diphenyl ethers (PBDEs) downstream of potential sources in the UK showed particularly high concentrations of these contaminants to occur in sediments from the Rivers Skerne and Tees, downstream of a manufacturing site¹. High concentrations of PBDEs (particularly bromodiphenyl ether (BDE) congener BDE47; 2,2',4,4'-tetrabromodiphenyl ether) were also found in some fish, and particularly in livers of dab and flounder from Tees Bay in NE England. Marine mammals consuming fish are therefore exposed to PBDEs in their diet, and have the potential for further accumulation of these lipophilic contaminants. In order to establish the current levels of contamination, we have undertaken the analysis of PBDEs in blubber samples from a range of marine mammal species. The samples were derived from the UK national marine mammal strandings programme funded by the UK government and operated by the National History Museum and the Institute of Zoology. Animals which strand in a fresh condition or are bycaught are taken for post-mortem study in order to establish cause of death, degree of parasitism, etc, and contaminant analyses are conducted in selected animals with the aim of exploring possible links between contaminant burdens and death due to infectious disease^{2,3}. Hitherto, this has involved the analysis of a range of trace elements, organochlorine pesticides and chlorobiphenyls, but more recently the analysis of butyltins^{4,5} and BDE congeners in these samples. In this paper we report initial data for BDE congeners in 39 common (harbour) porpoises stranded or bycaught around England and Wales during 1997-98.

Methods and Materials

The analytical methodology employed was essentially that used during the earlier survey for specific BDE congeners, but expanded to cover the wider range of congeners for which standards are now available. In brief, the method involved Soxhlet extraction for 4 hours with *n*-hexane, clean-up using alumina and fractionation on silica, and analysis by GC-NICIMS on an HP5973 quadrupole instrument. In all, 13 congeners were determined (BDEs 28, 47, 66, 71, 75, 77, 85, 99, 100, 119, 138, 153, 190.) The samples will also be screened for BDE209 at a later date and using a somewhat different methodology, as this congener is thermally sensitive and can degrade during analysis under the conditions used for the analysis of the other congeners. BDE209 has been frequently reported to be present in sediment samples, including some in the UK, although it usually seems to be either undetectable or present only at very low concentrations in biota^{1,6}. The locations at which the porpoises were stranded or bycaught are shown in Figure 1.

Results and Discussion

The concentrations of BDE congeners in each of the samples of porpoise blubber are given in Table 1, with details of sex, length, and location of stranding. Figure 2a shows a chromatogram of a mixed congener standard with the congener identity indicated, and Figure 2b shows an example of a chromatogram of porpoise blubber under the same conditions. The highest concentrations were found in a male porpoise (body length 111 cm; age not yet available) stranded at Tynemouth in NE England. The concentrations of BDE47 and Σ BDE in the blubber of this porpoise (SW1997/87) were 6,100 and 6,900 μgkg^{-1} wet weight (6,800 and 7,700 μgkg^{-1} on a lipid weight basis), respectively. Not all congeners could be detected in all samples, but BDE47 was found in all porpoises analysed, the lowest concentration being found in an adult female porpoise (SW1997/94) stranded at Pembrey in Wales, 198 μgkg^{-1} wet weight (228 μgkg^{-1} lipid weight). Concentrations of both BDE47 and Σ BDE in a foetus were approximately two-thirds of the concentrations seen in the mother (SW1997/93; Table 1).

Alongside concurrent studies in other species including pelagic cetacean species feeding in deep offshore waters⁷, these data highlight the widespread distribution of BDEs and their accumulation via marine foodchains. It is difficult to assess the significance of the PBDE concentrations reported in this study as the mechanisms of the toxicity of individual congeners in marine mammals is poorly understood at the present time. Further studies are needed in order to elucidate the potential impact of these compounds on marine mammals if their use and discharge continues.

Acknowledgements

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References

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POLYBROMINATED FLAME RETARDANTS - POSTERS

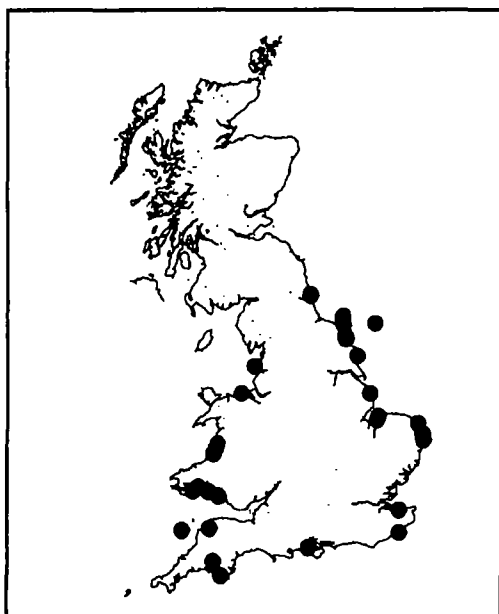


Figure 1. Map showing the locations at which porpoises were stranded or bycaught

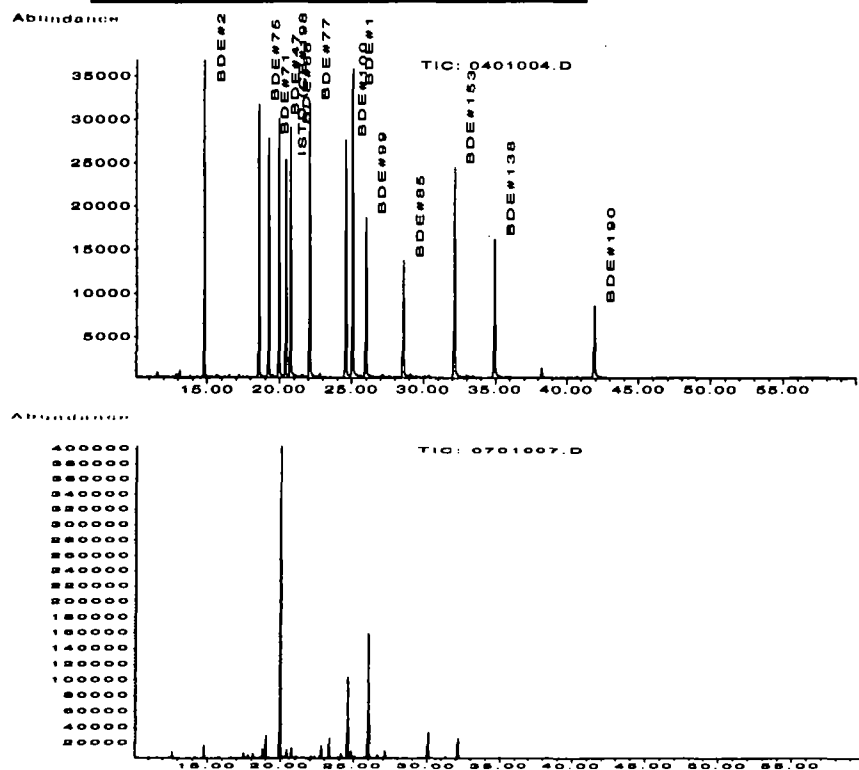


Figure 2. GC-NICIMS chromatograms of (a) BDE congener standard solution, and (b) a blubber extract from porpoise 1997/80 bycaught off NE England in 1997 (see Table 1).

ORGANOHALOGEN COMPOUNDS

POLYBROMINATED FLAME RETARDANTS - POSTERS

Table 1. Concentrations of polybrominated diphenyl ethers in porpoise blubber, as the sum of 13 congeners and for BDE47 alone (μgkg^{-1} wet weight; the percentage lipid content of each sample is also indicated). The reference number indicates the year of stranding.

Reference no.	Sex	Length (cm)	Location	Lipid %	BDE47	Σ 13BDE
SW1997/87	M	111	Tynemouth, Tyne & Wear	90	6109	6899
SW1997/102	F	84	Hunstanton, Norfolk	77	4106	5774
SW1998/4	F	100	Mablethorpe, Lincolnshire	82	2862	4892
SW1998/145	M	84	Greatstone-on-Sea, Kent	64	3153	4803
SW1998/129	F	154	Sea Palling, Norfolk	84	2498	4701
SW1997/111	F	126	off Ulrome, Yorkshire	90	2308	3919
SW1998/139	M	84	Snettisham, Norfolk	80	2317	3356
SW1997/80	F	123	off Runswick Bay, Yorkshire	84	1839	3274
SW1997/89	M	90	Great Yarmouth, Norfolk	60	2341	3239
SW1998/179	M	119	Fishguard, Pembrokeshire	83	1873	3181
SW1997/152	F	107	Seasalter, Kent	70	2194	3147
SW1997/81	F	129	off Runswick Bay, Yorkshire	95	2375	3123
SW1998/127	M	82	Corton Beach, Suffolk	76	2004	3119
SW1997/72	F	110	off Cromer Point, Yorkshire	88	2080	2981
SW1997/142	M	143	off Sandsend, Yorkshire	90	1577	2687
SW1997/141	M	128	off Whitby, Yorkshire	83	1245	2511
SW1997/142b	F	132	off Kettleness, Yorkshire	88	1383	2424
SW1998/71	M	138	off Scarborough, Yorkshire	80	1332	2285
SW1997/174	F	147	Gorleston, Norfolk	90	1459	2218
SW1997/138	F	118	Blackpool, Lancashire	80	1264	2054
SW1997/186(1)	M	113	Whitley Bay, Tyne & Wear	91	1225	1958
SW1997/91	F	89	Black Pill, Swansea,	63	1344	1692
SW1998/167A	F	113	off Lymington, Hampshire	74	993	1579
SW1998/97	F	133	Caldey Island, Pembrokeshire	78	937	1359
SW1998/76	M	141	off Scarborough, Yorkshire	91	618	1237
SW1997/113	F	78	Pembrey, Carmarthenshire	50	723	1176
SW1998/183	M	121	Llanrhystyd, Ceredigion	92	713	1135
SW1998/50	F	131	Westward Ho !, Devon	93	624	968
SW1997/186(2)	F	145	Whitley Bay, Tyne & Wear	93	466	850
SW1998/116	M	77	Borth, Ceredigion	85	452	833
SW1998/75	F	114	off Scarborough, Yorkshire	99	335	661
SW1997/103	F	117	Thurlestone Sands, Devon	76	303	651
SW1997/97	F	70	Pendine, Carmarthenshire	59	418	643
SW1997/93	F	160	Aberystwyth, Ceredigion	91	385	616
SW1997/173	M	137	Sidmouth beach, Devon	91	326	615
SW1997/118	F	172	Prestatyn, Gwynedd	85	205	520
SW1997/96	F	154	Llanrhystyd, Ceredigion	90	213	481
SW1997/94	F	172	Pembrey, Carmarthenshire	87	198	383
SW1997/93foetus	M	74	Aberystwyth, Ceredigion	79	260	356

ORGANOHALOGEN COMPOUNDS