POLYCHLORINATED BIPHENYLS, DIBENZO-*p*-DIOXINS, DIBENZOFURANS AND DDE IN WHITE-TAILED SEA EAGLE LIVERS FROM EASTERN GERMANY, 1979-1998

Kurunthachalam Kannan[1], Kurunthachalam Senthil Kumar[2], Jerzy Falandysz[3], Ghnther Oehme[4] and Shigeki Masunaga[2]

[1]National Food Safety and Toxicology Center, Michigan State University, East Lansing, MI 48824, USA
[2]Graduate School of Environment and Information Sciences, Yokohama National University, Japan
[3]Department of Environmental Chemistry and Ecotoxicology, University of Gdañsk, Gdañsk, Poland
[4]Martin Luther Universistät Halle-Wittenberg, Institut fhr Zoologie, Halle, Germany

Introduction

White-tailed sea eagles (*Haliaeetus albicilla*) are top predators in the food chain and feed mainly on fish, mammals (including arctic foxes) and other fish-eating birds. Concentrations of organochlorine pollutants such as DDT and PCBs in white-tailed sea eagles are among the highest reported in organisms from the Baltic Sea. A reduction in the reproductive ability of white-tailed sea eagles was observed since the early 1950s until the mid 1980s due to the effects of DDT, PCBs and other organochlorines on the structural integrity of the eggs. Following the ban of DDT and PCBs, the reproductive success of the eagles has increased and almost 60 to 75% of the eggs produce hatchling. Population of sea eagles in Germany has increased from a low of 120 pairs during the last century to a current population of 360 pairs in 2000. Few studies have reported the occurrence of PCBs and DDT in sea eagle blood or eggs[1]. Information on the occurrence of organochlorines including PCDDs and PCDFs in white-tailed sea eagles from eastern Germany is meager. In this study, concentrations of PCBs, DDE, PCDDs and PCDFs were measured in livers of white-tailed sea eagles (*Haliaeetus albicilla*) collected since 1979 until 1998 from inland and coastal regions of eastern Germany.

Materials and Methods

Livers of white-tailed sea eagles collected since 1979 until 1998 from eastern Germany were analyzed. All the eagles were found dead. Liver samples were wrapped in aluminum foil cleaned with solvents and stored frozen at -20°C until analysis. Sampling locations are shown in Figure 1. Details of the analytical procedures have been reported earlier[2]. Identification and quantification of 2,3,7,8-substituted congeners of PCDD/DFs, dioxin-like PCBs (non- and mono- *ortho*- substituted congeners) and DDE was performed by, Hewlett Packard 6890 Series high-resolution gas chromatography interfaced with a Micromass Autospec - Ultima high-resolution mass spectrometer and Hewlett Packard 6890 Series gas chromatograph with electron capture detector (GC-ECD).

Results and Discussion

Concentrations of sum of seven 2,3,7,8-substituted PCDD and ten PCDF congeners in livers of white-tailed sea eagles are shown in Table 1. The greatest concentration of 341 pg/g, wet wt, PCDDs and 651 pg/g, wet wt, PCDFs was found in an adult female eagle collected in 1979. The same individual had the greatest concentration of total PCBs and DDE. *p,p'*-DDE concentration of 686000 ng/g, wet wt, in liver is one of the highest values ever reported.

Table 1. Concentrations of 2,3,7,8-substituted PCDDs, PCDFs (pg/g, wet wt), PCBs and *p,p'*-DDE (ng/g, wet wt) in white-tailed sea eagle livers from eastern Germany

Sample I.D.	Fat%	Date	Location	Biometry	SPCDDs	SPCDFs	SPCBs	DDE
BB93/19	6.82	1/10/93	Wilmersdorf	4750g, Ju,F	4.8	7.8	202	241
MV94/19	4.83	17/5/94	Karow	4225g,ad,M	8.3	11.6	340	330
SA93/17	7.72	4/9/93	Stackelitz	5420g, im,F	135.9	178.8	37400	23600
MV94/11	4.75	10/4/94	Dobbin	3620g, ad,F	170.7	186.1	25800	44350
MV91/12	6.82	25/6/91	Bossow	4830g,juv,F	6.0	8.7	313	325
MV93/2	4.17	15/2/93	Muritz	4505g,ad,F	72.7	101.0	11500	28600
MV91/8	4.4	6/4/91	Bergfeld	4105g,ad,M	66.2	52.4	10300	22500
MV91/10	4.41	6/5/91	Julchendorf	5517g,ad,F	89.5	69.9	4360	8370
MV95/5	5.37	21/2/95	Kolpinsee	6500g,ad,F	26.6	40.6	4040	866
79/6	5.95	2/5/79	Muritz	5700g,ad,F	91.0	119.5	10100	15700
79/8	5.01	12/6/79	Stegelitz	4200g,ad,F	341.3	650.5	89400	686000
79/5	5.79	17/4/79	Waldlewitz	6640g,im,F	63.6	113.2	4830	3760
M90/3	4.82	28/3/90	Babke	4425g,ad,M	7.4	12.0	2820	4430
90/7	4.41	15/8/90	Melzower Forst	2970g,ad,M	90.7	129.6	29400	88400
90/4	4.9	12/4/90	Kotzow	5640g,ad,F	60.0	93.1	12200	15300
MV87/21	5.69	29/3/87	Dabelow	4325g,ad,F	55.3	60.2	7000	19100
MV92/3	5.5	6/2/92	Lewitz	3805g,juv,F	25.0	38.9	7800	1090
BB94/2	4.83	15/1/94	Thomsdorf	4300g,ad	103.0	152.9	41500	61100
MV92/2	7.92	5/1/92	Lahnvitz	juv,M	5.9	10.9	340	353
87/18	5.95	4/11/87	Dassow	4374g,juv,M	8.4	5.3	305	98
MV92/9	7.03	28/4/92	Torgelow	4280g,ad,M	11.1	19.3	6000	2170
S97/22	4.82	28/8/97	Ebersbach-Rodern	3800g, ad,M	23.0	47.7	1810	2790
S96/7	4.44	4/3/96	Niederspree	3400g,im,F	107.2	100.0	10000	11400
S98/18	9.9	28/7/98	Klein Krauscha	4920g, im,F	7.4	5.2	220	184

im=immature; ad= adult; juv=juvenile; F=Female; M=male.

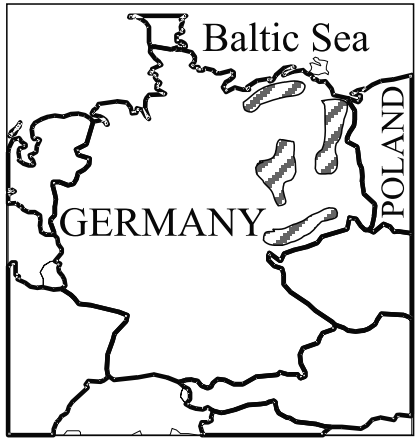


Fig. 1. Map of Germany showing sampling areas of white-tailed sea eagles (shaded)

Mean concentration of PCDDs and PCDFs in white-tailed sea eagles collected over a period of 20-years was 66 and 92 pg/g, wet wt, respectively. Mean concentrations of PCDFs were greater than those PCDDs in most of the samples. Among PCDF congeners, 2,3,4,7,8-penta CDF is the most abundant in

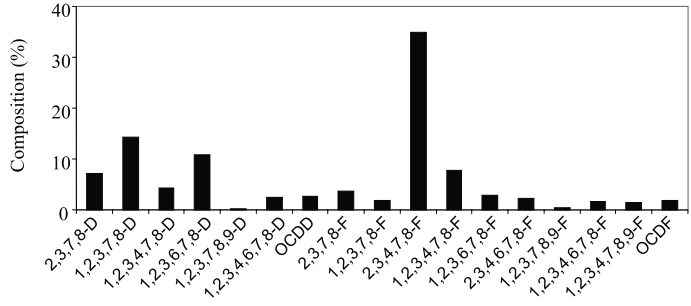


Figure 2. Percentage composition of PCDD and PCDF congeners in white-tailed sea eagle livers.

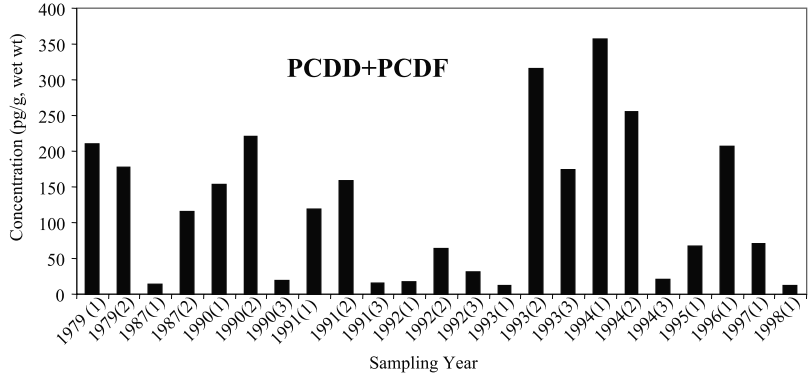
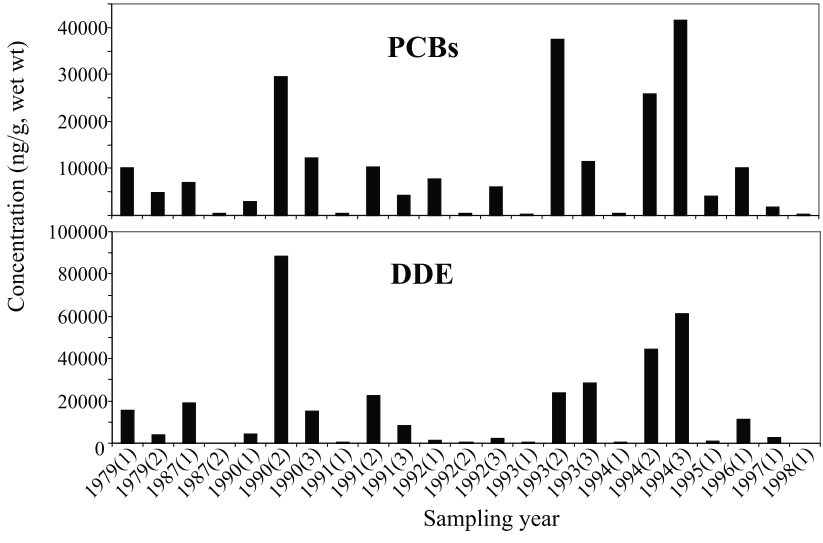


Figure 3. Concentrations of PCDDs+PCDFs, PCBs and DDE in livers of white-tailed sea eagles collected from 1979 to 1998. One sample collected in 1979, that had the highest concentration was removed from this graph.



almost all the livers, accounting for 35% of the total PCDD+PCDF concentrations (Figure 2). In addition, 2,3,7,8-TCDD, 1,2,3,7,8-pentaCDD and 1,2,3,6,7,8-HexaCDD were the major congeners in eagle livers.

There was no clear trend in the concentrations of PCDDs/DFs in eagle livers (Figure 3). Livers of eagles collected in 1993 and 1994 contained elevated concentrations of PCDDs/DFs than those from the earlier years. Similarly concentrations of PCBs and DDE were greater in samples collected in 1993 and 1994 (Figure 3). The observed variations could be explained differences in biological characteristics. Adult white tailed eagles are usually resident while juveniles are more migratory.

References

1. Olsson, A., Ceder, K., Bergman, A., Helander, B. (2000). Environ. Sci.Technol. 34, 2733-2740.
2. Senthil Kumar K., Kannan K., Paramasivan O.N., Shanmugasundaram V.P., Nakanishi J. and Masunaga S. (2001). Environ Sci Technol. 35, 3448-3455.