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BIODEGRADATION CAPACITY AND RESIDUE PATTERN OF ORGANOCHLORINES IN GANGES RIVER DOLPHINS FROM INDIA

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Concentrations of PCBs (including non-*ortho* coplanar congeners), DDTs, HCHs, HCB, aldrin, dieldrin, heptachlor, heptachlor epoxide and chlordanes were determined in river dolphins from the Ganges, India. Residue levels of DDTs were the highest followed by PCBs and HCHs. Noticeable amounts of toxic non-*ortho* coplanar PCBs were also detected in the blubber. A continuing exposure of the Ganges biota to organochlorine chemicals was found to be evident. The observed isomer/metabolite pattern indicated that river dolphins exhibit a lower metabolic capacity to organochlorines as documented for other small cetaceans in the marine ecosystem. HCHs and CHLs were considered to be metabolized to a small extent, while PCBs and DDTs were the least metabolizable compounds by river dolphins. The degree of contamination, proximity to pollution source and the metabolic ability of river dolphins found in the present study suggest that river dolphins are at greater risk from environmental contamination by organochlorines than marine cetaceans.

KEY WORDS: Aldrin, dieldrin, heptachlor, DDT, hexachlorocyclohexane, chlordane, dolphins, biodegradations, coplanar PCBs

INTRODUCTION

River dolphins belonging to the superfamily Platanistoidea (order: Cetacea) are reported as endangered around the world due to the vulnerability of the riverine habitat to increasing pollution and environmental deterioration[1].

The Ganges river dolphin, *Platanista gangetica*, predominantly inhabits the Ganges and its tributaries in India (Figure 1). The Ganges is highly polluted by a number of industries which discharge a heavy load of organic matter into the river[2]. Pollution by persistent chemicals is potentially harmful to the higher trophic animals of food

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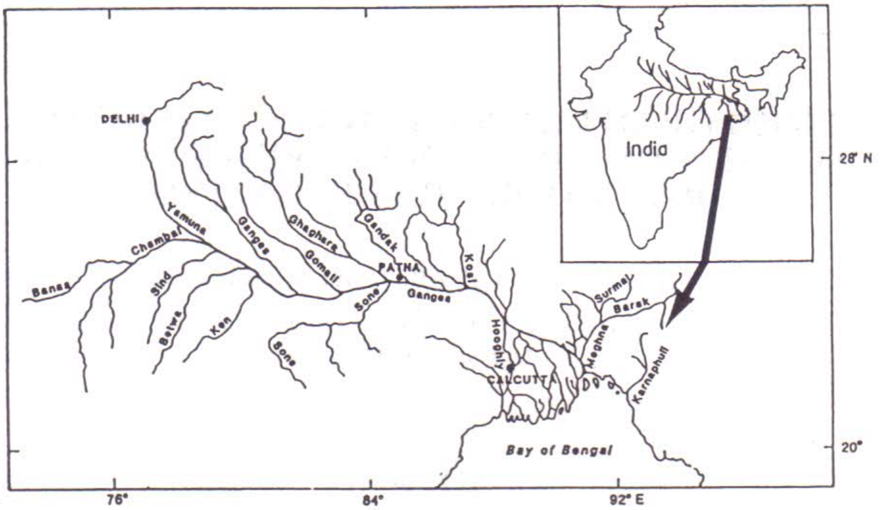

Figure 1. The Ganges River system, showing major tributaries in India. Dolphin samples were collected from Patna.

chain. The freshwater dolphins are top predators and are relatively sensitive to environmental perturbations and are therefore useful indicators for monitoring the health of riverine ecosystems. Despite this, little is known for the levels of contaminants and their impact on river dolphin populations[3]. An earlier study has reported the concentrations of organochlorines and heavy metals in the Chinese river dolphin, *Lipotes vexillifer* and suggested the need for protecting river dolphins from chemical pollution[4]. A recent survey evoked a reduction in the population of the Ganges river dolphin and indicated the need for studying the impact of pollutants on dolphin populations[2].

Among a large number of man-made chemicals, persistent organochlorine pesticides and PCBs are reported to have deleterious effects on cetaceans due to their low drug-metabolizing enzyme activities[5,6]. Therefore, monitoring of organochlorine contaminants in river dolphins is vital towards conservation, especially in countries such as India, where the use of organochlorine pesticides is increasing. In this study, we examined the residual pattern of PCBs (including the highly toxic non-*ortho* coplanar congeners), DDTs, HCHs, HCB, aldrin, dieldrin, heptachlor, heptachlor epoxide and chlordanes in the Ganges river dolphins collected from India. The capacity of *Platanista gangetica* in metabolizing organochlorines was assessed from the isomer/metabolite composition of residues as well as from the residual pattern in their diet.

Table 1 Sample details

Specimen no.	*Sex*	*Growth stage*	*Length (cm)*	*Age (yrs)*	*Collection date*
1	Male	Neonatal	70.4	Few days	January 24, 1988
2	Male	Immature	104	1.0	October 6, 1991
3	Female	Immature	115	1.3	July 21, 1991
4	Female	Adult	233	30	March 27, 1992

MATERIALS AND METHODS

Sampling

Since the population of Ganges river dolphins is too small (roughly estimated to be between 4,000 and 5,000 in India)[2], only four specimens found entangled in fishing nets were used for analysis. The animals were alive and the tissues were fresh at the time of collection. Blubber, muscle, liver and kidneys were obtained from four animals taken near Patna in India (Figure 1) between January 1988 and March 1992. Biometric data and other informations are given in Table 1. Kasuya[7] reported that the length of Ganges dolphin at the time of birth is 70 cm and reaches 199 cm at 28 yrs. Based on the above length measurements, age of the dolphins was estimated. In order to estimate the biomagnification of organochlorines in food chain and to assess their metabolism, we collected gut contents (food organisms) from the dolphins. Mud-frequenting fish such as *Chela laubuca*, *Colisa fasciatus*, *Mastacembelus pancalus* and *Puntius sophore* (the length of each fish was < 6 cm) were often identified in the gut. All four species of fish were pooled (whole body contents) to obtain sufficient quantity of material for chemical analysis. Tissues were preserved in 10% formalin and stored at 4°C until analysis.

Analysis of Organochlorine Pesticides and PCBs

Determination of organochlorine pesticides and PCBs in dolphin tissues and fish followed the procedure of Tanabe *et al*[8]. Briefly, samples were homogenized with anhydrous sodium sulfate and extracted with mixed solvents of diethyl ether and hexane using a Soxhlet apparatus. Extractable lipid content was determined gravimetrically from concentrated aliquots of these extracts. The remaining extracts were then transferred to a glass column packed with 20 g of Florisil (Floridin Co.) followed by elution with 80% acetonitrile and 20% hexane-washed water. The eluate was transferred to hexane and the concentrated hexane layer was fractionated by 1.5 g silica gel (Wako gel S-1) packed in a glass column (12 mm i.d.). The first fraction eluted with 160 ml of hexane contained PCBs, HCB, *p,p'*-DDE, aldrin and heptachlor. The second fraction eluted with 20% dichloromethane in hexane (100 ml v/v) contained HCH isomers (α-, β-, γ- and δ-HCH), *o,p'*-DDT, *p,p'*-DDD, *p,p'*-DDT, chlordane compounds (*trans*-chlordane, *cis*-chlordane, *trans*-nonachlor, *cis*-

nonachlor and oxychlordane), dieldrin and heptachlor epoxide. Each fraction was concentrated and after retaining 1 ml for the quantification of aldrin, dieldrin and heptachlor epoxide, the extracts were subjected to further clean up with 5% fuming sulfuric acid in conc. H_2SO_4.

Quantification of organochlorines was made on a gas chromatograph (Hewlett-Packard 5890) equipped with ^{63}Ni electron capture detector and moving needle type injection port. Fused silica capillary columns (30 m × 0.25 mm i.d.) coated with DB-1 (100% dimethyl polysilaxone) and DB-1701 (14% cyanopropylphenyl and 86% dimethyl polysilaxone) having a film thickness of 0.25μ (J & W Scientific, CA, USA) were used for the determination of PCBs and organochlorine pesticides respectively. The column temperature was programmed from 160 to 240°C at a rate of 2°C/min with a final hold of 20 min. The injector and detector temperatures were kept at 250 and 300°C respectively. Helium was used as carrier gas while nitrogen was the make-up gas. Concentrations of individually resolved peaks of PCB congeners were summed to obtain the total PCB concentration. Organochlorine pesticides were quantified from individually resolved peak heights with corresponding peak heights of standards. Recoveries ranged from 90 to 105%. All reported concentrations were not corrected for recovery. Detection limit was 0.01 ng/g for all organochlorines except aldrin and dieldrin with 0.1 ng/g.

Isomer-Specific Analysis of PCBs and Non-Ortho Coplanar Congeners

Representative samples of river dolphin blubber and fish were examined to identify the pattern of PCB isomers and congeners including non-*ortho* coplanar PCB residues. For isomer-specific analysis, the extraction, clean up and quantitation were followed by the method of Wakimoto *et al*[9]. In brief, the method consists of alkaline-alcohol digestion and extraction, silica gel column chromatography clean up followed by 5% fuming sulfuric acid treatment. An aliquot of this hexane solution was used for the determination of PCB isomers and congeners. The remaining extract was subjected to carbon column chromatography for the separation of non-*ortho* coplanar PCBs as described by Tanabe *et al*[10].

A gas chromatograph-mass spectrometer (Hewlett-Packard 5890 GC with 5970 mass selective detector) having an electron impact (EI) mode at 70 eV was used for the determination of PCB isomers and congeners. Fused silica capillary columns, DB-1 and DB-1701 with same dimensions and film thickness as mentioned above were employed for the determination of isomer-specific PCBs and non-*ortho* coplanar congeners respectively. The oven temperature was programmed from 160 to 230°C for DB-1 and from 180 to 250°C for DB-1701 at a rate of 2°C/min. The injector and ion-source (transfer line) temperatures were kept at 260 and 280°C respectively. The carrier gas was helium with a flow rate of 1.2 ml/min. A Hewlett-Packard 5970C data system was employed in the quantification of PCB isomers and congeners. PCB homologues were determined by selective ion monitoring (SIM) at m/z 222, 256, 292, 326, 360, 394, 430 and 464 for di-, tri-, tetra-, penta-, hexa-, hepta-, octa- and nonachlorobiphenyls respectively. An equivalent mixture of Kanechlors 300, 400, 500 and 600 with known PCB composition and content[11] was used as standard for the

GC-MS quantification. For coplanar PCBs, M^+ and $(M + 2)^+$ cluster ions were monitored at m/z 290 and 292 for 3,3′,4,4′-T_4CB, m/z 324 and 326 for 3,3′,4,4′,5-P_5CB and m/z 358 and 360 for 3,3′,4,4′,5,5′-H_6CB. The three non-*ortho* congeners were quantitated using authentic standards of high purity (>98%).

RESULTS AND DISCUSSION

Organochlorine Pesticides

A wide range of organochlorine pesticides such as DDT and its metabolites (DDTs), HCH isomers (HCHs), aldrin, dieldrin, heptachlor, heptachlor epoxide, chlordane compounds (CHLs) and HCB were detected in river dolphin tissues (Table 2). Among these organochlorine pesticides, DDTs were the prominent compounds, followed by HCHs, aldrin and dieldrin, chlordanes, heptachlor and heptachlor epoxide.

Concentrations of DDTs in blubber were high, and ranged between 4.7 and 13 μg/g wet wt (14–29 μg/g fat wt). Widespread use of DDT for malaria eradication programme in India and its consequent environmental contamination has drawn considerable attention in recent years. DDT is also being used for the control of sand fly (*Phlebotomus argintepes* and *P. papatasi*), the vector of kala-azar disease, in areas nearby the Ganges. A large number of DDT manufacturing factories are located along the banks of Ganges, which renders this riverine ecosystem highly vulnerable to DDT pollution[2].

An extensive survey performed by the Industrial Toxicology Research Centre in Lucknow, India during 1985–91 showed the frequent occurrence of DDT in Ganges river water; the concentration in 1990–91 was reported to range from <0.001 to 0.18 μg/l near Patna (the present study area)[12]. Considering the mean DDT concentration as 0.01 μg/l, the average bioconcentration factors (BCFs: concentration ratio of organochlorine in biota to water) in fish, male and female dolphins (blubber) were obtained to be 1.6×10^4, 6.9×10^5 and 1.2×10^6 respectively.

The major DDT metabolite in river dolphins was *p,p′*-DDE, constituting 46% of the total DDT burden (Figure 2). This proportion of *p,p′*-DDE in dolphin blubber was comparable to those in their fish diet (48%). *p,p′*-DDE was followed by *p,p′*-DDD (30%), *p,p′*-DDT (20%) and *o,p′*-DDT (4%) in dolphins. A similar pattern was noticed in fish implying that the river dolphin possesses a lower metabolic capacity to DDTs.

Mean HCH concentration in blubber was 430 ng/g wet wt (560–1,500 ng/g fat wt) which was ~22 times lower than DDT level. The HCH levels are in the same order of magnitude as those reported for dolphins from the Bay of Bengal[13]. HCH levels in river dolphins were higher by a factor of 3 than those reported for narwhals in the remote areas of pollution sources such as the Canadian Arctic[14]. Even though the average annual consumption of HCH (47,000 metric tons) in India is more than that of DDT (19,750 metric tons) in recent years[15], lower levels in dolphins indicate the smaller bioaccumulation potential of this insecticide. Similar to DDT, HCH isomers were often detected in Ganges river water and the level varied between <0.001 and 0.045 μg/l in Patna during 1990–91[12]. Assuming a mean HCH level of

Table 2 Concentrations of organochlorine pesticides and polychlorinated biphenyls (ng g^{-1} wet wt) in Ganges river dolphins and their fish diet

*Specimen no.**	*Tissue*	*Fat (%)*	*PCBs*	*DDTs*	*HCHs*	*HCB*	*Aldrin*	*Dieldrin*	*Heptachlor*	*Hept. epoxide*	*Chlordanes*
1	Blubber	34	360	4,700	190	2.8	11	54	8.7	1.4	9.1
	Muscle	10	120	2,200	120	1.0	2.4	0.65	2.8	0.13	21
	Kidney	1.2	16	110	28	2.4	1.9	6.6	2.5	0.33	5.8
	Liver	1.2	21	160	30	0.19	2.7	4.0	4.1	2.1	14
2	Blubber	31	410	9,100	470	7.2	29	55	4.8	7.1	56
	Muscle	19	310	5,100	300	4.6	16	30	5.1	5.6	76
	Kidney	1.3	46	220	21	0.38	0.89	1.9	0.56	0.33	4.9
	Liver	2.2	36	400	50	0.66	0.62	0.16	0.56	0.15	5.9
3	Blubber	41	620	12,000	430	7.0	2.9	1.0	0.81	4.8	60
	Muscle	16	210	3,700	170	2.1	1.0	0.84	0.70	1.7	23
	Kidney	2.7	50	460	28	0.43	1.5	1.9	0.12	0.31	1.1
	Liver	3.3	38	520	42	0.53	0.30	1.7	0.18	0.13	4.9
4	Blubber	74	420	13,000	610	5.2	13	59	0.75	8.5	21
	Muscle	1.4	4.6	100	8.7	0.06	0.15	0.8	0.14	0.20	1.4
	Kidney	1.7	7.2	88	8.8	0.11	0.11	0.9	0.06	0.15	1.3
	Liver	1.5	12	77	23	0.08	1.7	1.1	1.7	2.0	9.3
Fish	Whole	3.4	20	160	77	0.24	2.7	2.9	3.5	1.1	30

* See Table 1 for sample details

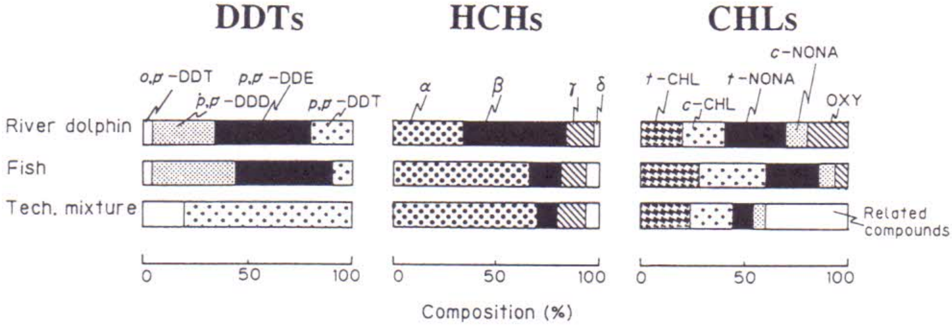

Figure 2. DDT, HCH and CHL compositions in the Ganges river dolphin and fish.

0.02 μg/l, the mean BCFs estimated for fish, male and female dolphins were 3.9×10^3, 1.7×10^4 and 2.6×10^4 respectively. These values are lower than those observed for DDTs. Despite the order of concentration in water was HCH > DDT, lower BCFs for HCH reiterate a smaller bioaccumulative potential and relatively biodegradable nature in the aquatic food chain.

The percentage compositions of α- and β-HCHs were similar in all dolphin samples except in a neonatal male which contained >78% of ΣHCH as β-HCH. Fish had HCH isomeric patterns resembling the technical HCH formulation (Figure 2), suggesting that small fish have a reduced capacity to metabolize HCHs. Furthermore, it is also clear that the technical HCH has been used for agricultural and public health purposes in India. In comparison with the HCH isomer composition in fish, smaller proportion of α- and γ-isomers in dolphin delineates that at least HCHs are metabolized by river dolphins.

Considerable amounts of aldrin and dieldrin were found in dolphin tissues; concentrations ranged between 3.9 and 84 ng/g wet wt (10–270 ng/g fat wt), with the minimum level noticed in an immature female dolphin. Aldrin and dieldrin are reported to be used for the control of crop pests in India and have been detected in a variety of foodstuffs meant for human consumption[16]. Detection of significant quantities of aldrin relative to dieldrin in river dolphin tissues reiterates their lower metabolic capacity as well as existing usage of this insecticide in India.

Concentrations of chlordanes in blubber varied between 9.1 and 60 ng/g wet wt. *Trans*-nonachlor was the predominant metabolite accounting for 29% of the chlordanes detected (Figure 2). The proportion of oxychlordane was low. A similar trend has been noticed in cetaceans from the Canadian Arctic[14]. *Cis*- and *trans*-chlordanes were also detected in river dolphins along with heptachlor. This suggests the recent use of chlordane in the Ganges basin. River dolphins might be able to transform CHLs slightly, as evidenced by an increase in the percentage of oxychlordane in dolphins than in fish (Figure 2). Levels of heptachlor, heptachlor epoxide and HCB were low. The small amounts of HCB might be due to its formation as a by-product of chlorination and combustion processes in industries rather than its use as a fungicide in agriculture.

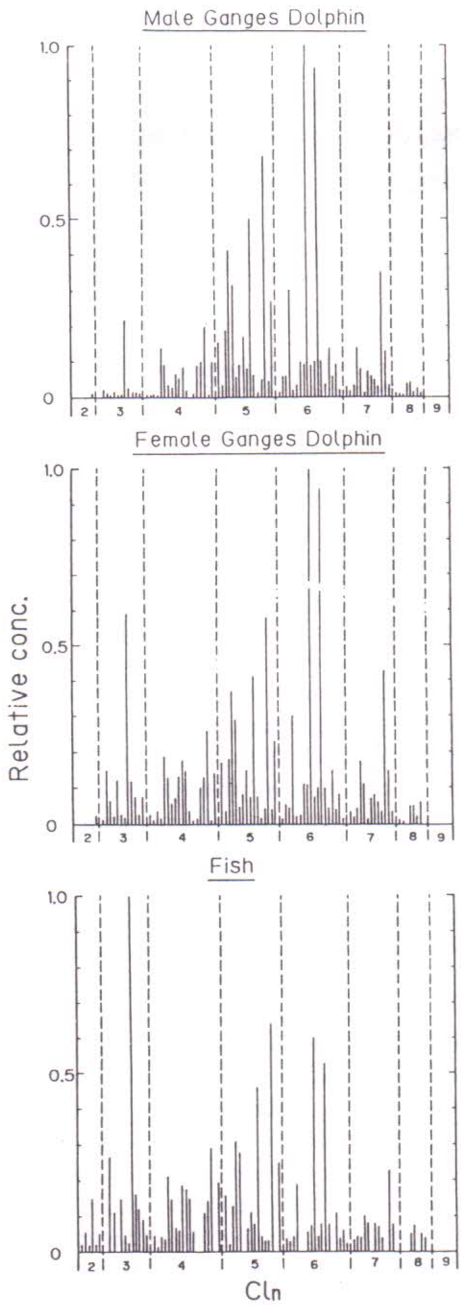

Figure 3. PCB isomer and congener compositions in river dolphin and its fish diet. Each vertical bar represents the relative concentration of individual isomer. Relative concentration shows the ratio of individual PCB concentrations to that of the maximum peak (IUPAC No. 153 for river dolphin and 28/31 for fish) which was treated as 1. For more detailed information on the nomenclature of PCB peaks refer Tanabe *et al.*[11]

PCBs

PCBs were the second most prevalent group of organochlorines in river dolphins next to DDTs (Table 2). Total PCB concentrations were comparable to HCHs and ranged from 360 to 620 ng/g wet wt in blubber (570–1,500 ng/g fat wt). The immature female dolphin registered the highest concentration of 610 ng/g (wet wt) of PCBs whereas the adult female recorded 420 ng/g (wet wt). Similar to those for HCHs and DDTs, the observed PCB concentrations in river dolphins were comparable to those from the Bay of Bengal, India[13]. In contrast, PCB residues in marine mammals from the northern hemisphere including the Arctic region were very high[14,17]. Until recently, PCBs were not serious pollutants in developing countries such as India. However, extensive survey of Indian foodstuffs and wildlife has recently showed the signs of PCBs appearance in India[16,18]. Although the recorded concentrations of PCBs in river dolphins were low, rapid industrialization in India might result in the build up of residue levels in the ecosystem unless adequate safety disposal measures are now taken.

Representative samples of river dolphins and their food organisms were examined to understand the pattern of PCB isomers and congeners and to trace the sources of PCB contamination. Mass fragmentograms of these samples revealed the presence of about 85 individual isomers in dolphins (Figure 3). Penta- and hexachlorobiphenyls constituted 71% of the total PCB concentration in immature males and 57% in adult females (Table 3). Pentachlorobiphenyls of IUPAC nos. 91/95, 84/90/92, 101, 99, 87/117, 118 as well as hexachlorobiphenyls 144/149, 153 and 138 were the dominant congeners in dolphin blubber (Figure 3). The hexachlorobiphenyl of IUPAC no. 153 recorded the highest concentration of 40 ng/g (wet wt) in adult female and 46 ng/g (wet wt) in immature male. Several tri- and tetrachlorobiphenyls were also detected in dolphin blubber. Very low amounts of octachlorobiphenyls were noticed. The observed pattern of PCB residues provides an insight into the relative input of PCBs of industrial origin. Disposal of PCBs used in older transformers and capacitors (consisting of higher chlorinated members) might also form a source of contamination in the future as their disposal is expected to reach a peak in the late 1990's[19].

PCB isomer and congener composition in fish showed almost comparable percentages of tri-, tetra-, penta- and hexachlorobiphenyls, i.e., the composition of di-, tri- and tetrachlorobiphenyl congeners were larger in fish than in dolphins. In fish, the maximum reported PCB congener was 28/31 (2,4,4′/2,4′,5), followed by 118 (2,3′,4,4′, 5), 153 (2,2′,4,4′,5,5′) and 138 (2,2′,3,4,4′,5′).

Based on the concentrations of PCB isomers and congeners in a male dolphin and its fish diet, we calculated the metabolic index as described by Tanabe *et al.*[5,20] and the results are shown in Figure 4. For comparison, the metabolic index calculated for striped dolphin, *Stenella coeruleoalba*, by Tanabe *et al.*[5] is also shown. The metabolic indices elicited for river dolphins were similar to those observed for striped dolphin, which has the least metabolic capacity towards higher chlorinated PCBs even though metabolization of certain lower chlorinated members has been stated. It is discernible that river dolphins, similar to other small cetaceans, have less capability to metabolize PCBs and are at risk from the global contamination by PCBs.

Table 3 Concentrations (ng g^{-1} wet wt) of PCB homologues in the Ganges river dolphin and fish from India

PCB homologue	*River dolphin*		*Fish*
	Immature male	*Adult female*	
2Cl	<1	<1	1.2
	(<1)	(<1)	(6)
3Cl	17	52	4.0
	(4)	(12)	(20)
4Cl	48	72	4.0
	(12)	(17)	(20)
5Cl	143	111	5.3
	(35)	(26)	(26)
6Cl	147	129	4.0
	(36)	(31)	(20)
7Cl	47	49	1.6
	(12)	(12)	(7)
8Cl	7	7.7	0.3
	(1)	(2)	(1)

Figures in parentheses indicate the percentage to total concentration

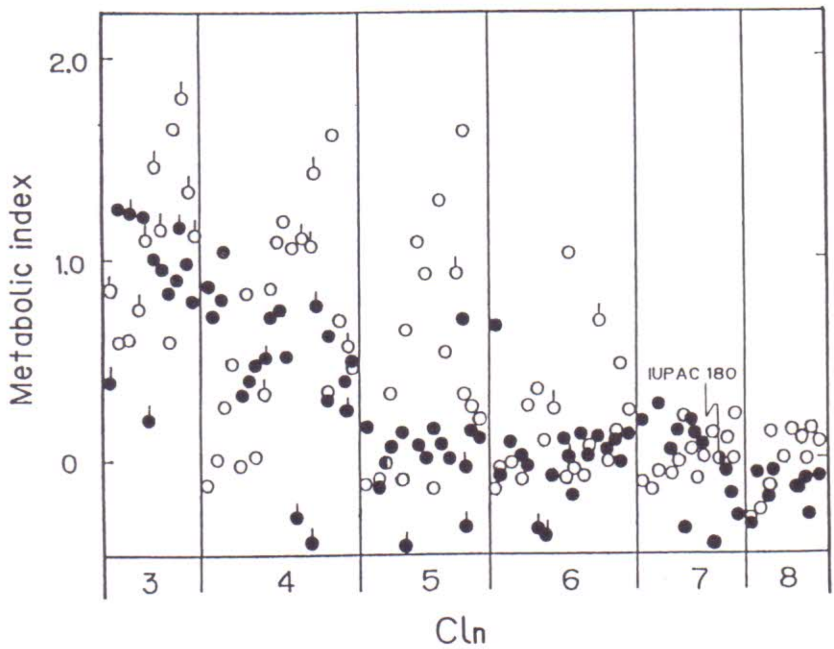

Figure 4. Comparison of the metabolic indices of PCB isomers and congeners in river dolphin (●) with those of striped dolphin (○). Circles with bar show the lower limits of metabolic index of PCB components which were not detected in dolphins but were found in their food organisms. For details on metabolic index refer Tanabe *et al.*[5,20]

Table 4 Concentrations of non-*ortho* coplanar PCBs (pg g^{-1} wet wt) in the Ganges river dolphin and fish

Specimen	*IUPAC no.*		
	77	*126*	*169*
Male (immature)	1,900	330	43
Female (adult)	1,100	170	10
Fish	290	12	3.2

Non-Ortho Coplanar PCBs

The concentrations of non-*ortho* coplanar PCBs in river dolphins and their diet are shown in Table 4. Invariably, the concentration of 3,3′,4,4′-T_4CB was the highest followed by 3,3′,4,4′,5-P_5CB and 3,3′,4,4′,5,5′-H_6CB both in dolphins and fish. Adult female dolphin recorded lower levels of coplanar congeners than immature male, a trend similar to that observed for marine mammals[10]. The recorded concentrations in the Ganges dolphins were comparable to those reported for Dall's porpoise, Baird's beaked whale and finless porpoise from the Pacific regions of Japan but several times higher than those reported for terrestrial mammals from Japan[21]. Figure 5 illustrates the composition of three non-*ortho* coplanar PCBs in river dolphin, marine mammals, fish and human. The observed pattern clearly supports that, as obtained for marine

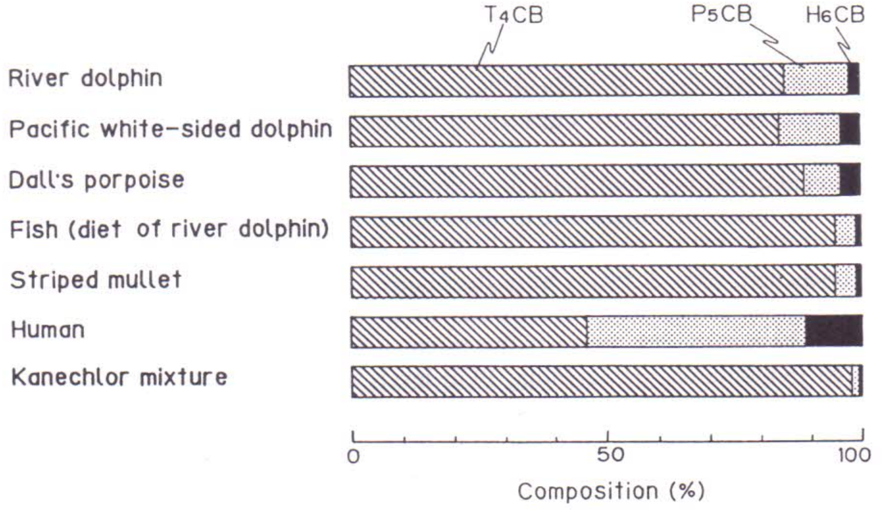

Figure 5. Comparison of the composition of coplanar PCBs (T_4CB: 3,3′,4,4′-tetrachlorobiphenyl, P_5CB: 3,3′,4,4′,5-pentachlorobiphenyl, H_6CB: 3,3′,4,4′,5,5′-hexachlorobiphenyl) in river dolphins with those of other aquatic organisms and humans. Information regarding coplanar PCB compositions in marine mammals and humans were obtained from Tanabe *et al.*[10]

Table 5 2,3,7,8-TCDD toxic equivalents (TEQs) of planar, mono and di-*ortho* PCBs in male and female river dolphin blubbers and fish

PCB congener IUPAC no.	*TEF value*[a]	*Concentration* ($ng\ g^{-1}$ *wet wt*)			*TEQs* ($pg\ g^{-1}$)		
		Male	*Female*	*Fish*	*male*	*Female*	*Fish*
Non-*ortho* PCBs							
77	0.01	1.9	1.1	0.29	19	11	2.9
126	0.1	0.33	0.17	0.012	33	17	1.2
169	0.05	0.043	0.01	0.003	2.15	0.5	0.15
Mono-*ortho* PCBs							
105	0.001	12	9.3	0.50	12	9.3	0.5
118	0.001	31	23	1.3	31	23	1.3
156	0.001	4.1	3.3	0.12	4.1	3.3	0.12
Di-*ortho* PCBs							
128	0.00002	4.1	4.2	0.15	0.082	0.084	0.003
137	0.00002	4.4	4.0	0.17	0.088	0.08	0.003
138	0.00002	42	37	1.1	0.84	0.74	0.022
153	0.00002	46	40	1.2	0.92	0.8	0.024
170	0.00002	5.8	5.9	0.17	0.116	0.118	0.003
180	0.00002	16	17	0.48	0.32	0.34	0.01
194	0.00002	1.2	2.1	ND	0.024	0.042	ND
Total (rounded)					104	66.3	6.25

[a]from Safe (1990)
ND = not detected

cetaceans, river dolphins have a lower metabolic capacity towards coplanar congeners in contrast to humans, due to the larger percentage of 3,3',4,4'-T_4CB in dolphins.

We also attempted to estimate the 2,3,7,8-TCDD toxic equivalents from the concentrations of di-, mono- and non-*ortho* coplanar PCBs identified in dolphin tissues using the toxic equivalent factors (TEF) recommended by Safe[22]. The TCDD-equivalents were 104 and 66 pg/g for male and female dolphins respectively (Table 5). At present no information exists on the TCDD-toxic equivalents in environmental samples from India for comparison. However, this work may provide baseline for future investigations in developing countries like India to prevent the toxic impacts of PCBs on biota.

In conclusion, river dolphins from the Ganges in India have lower levels of most of the organochlorines except DDTs and PCBs. Presence of significant amounts of DDT and its metabolites suggests the recent usage of DDT in India. Considering the rapid industrialization in India, PCB levels are expected to increase in future unless adequate safety disposal measures are taken up. As Cummins[6] reported, of the PCBs held in the third world alone were released into the general environment, the toxic threat to marine mammals would be inevitable. River dolphins exhibit a lower metabolic potential to organochlorines like most marine cetaceans. Since the habitation of river dolphins is close to the point source areas of pollution (pollutant discharging sites), freshwater dolphins are considered to be at greater risk from environmental contamination by persistent organochlorines than marine ones inhabiting remote areas from the pollution source. Continuous monitoring of pollutants in the Gangetic ecosystem and habitat improvement would help in the conservation of river dolphins.

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