Mallard

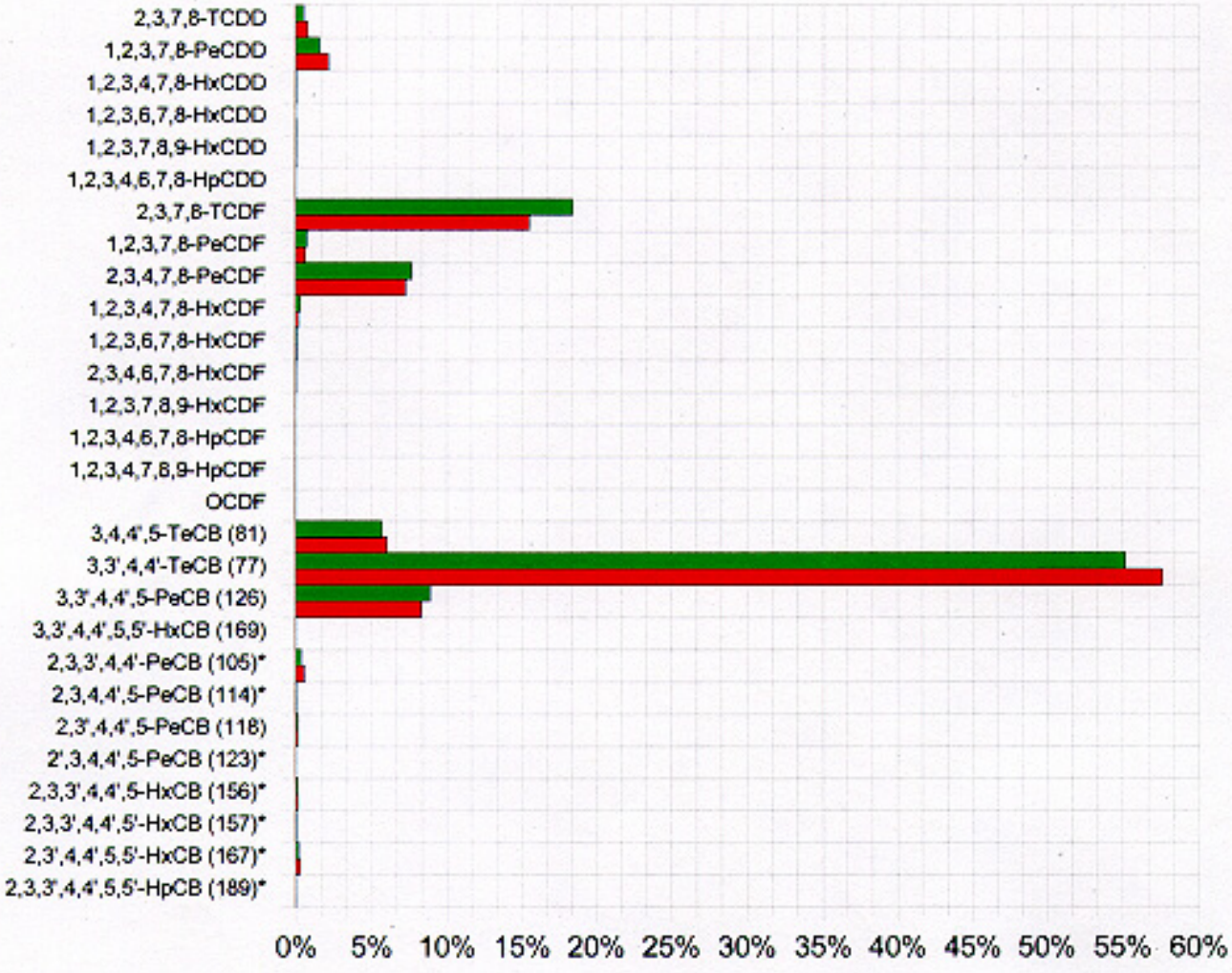

Figure 7d. Percent fraction of total TCDD-equivalents in mallard eggs (N=2) collected in Commencement Bay in 1996.

*Not analyzed in Canada goose and glaucous-winged gull.

Species	Dioxins/Furans		PCBs		Total	Mean
	TEQ	% Fraction	TEQ	% Fraction		
Canada Goose	6.88	69.87%	2.96	30.13%	9.84	
Canada Goose	8.44	60.72%	5.46	39.28%	13.90	
Canada Goose	3.29	44.42%	4.12	55.58%	7.41	**9.43**
Canada Goose	4.67	71.05%	1.90	28.95%	6.57	
Glaucous-winged Gull	5.61	11.10%	44.89	88.90%	50.50	
Glaucous-winged Gull	1.28	6.06%	19.80	93.94%	21.08	
Glaucous-winged Gull	5.42	14.67%	31.54	85.33%	36.96	**30.82**
Glaucous-winged Gull	1.85	12.58%	12.88	87.42%	14.73	
Great Blue Heron	61.35	36.50%	106.74	63.50%	168.09	
Great Blue Heron	103.59	21.02%	389.31	78.98%	492.90	
Great Blue Heron	32.60	28.73%	80.86	71.27%	113.46	**118.39**
Great Blue Heron	29.15	25.78%	83.93	74.22%	113.08	
Great Blue Heron	13.03	23.94%	41.39	76.06%	54.42	
Mallard	175.48	29.33%	422.78	70.67%	598.26	
Mallard	107.24	26.86%	292.01	73.14%	399.25	**498.76**

Table 9. Total TEQs in pg/g (ppt) wet weight and percent fraction between Dioxins/Furans and PCBs in avian egg tissues collected in Commencement Bay in 1995 and 1996.

Figure 8 further illustrates the relationship between total TEQ values, the four avian species, and the three groups of dioxin-like compounds. With the exception of goose, TEQ contribution appears primarily attributable to PCBs for all samples. Dibenzofurans were a more prominent contributor in mallards and some of the heron and goose samples than dibenzodioxin. However, dibenzodioxins appeared to be a more prominent contributor in the remaining heron samples and a distant second over PCBs in gulls. **Table 10** summarizes adverse effects associated with avian egg TEQ values from field studies on five different bird species.

Species	Adverse Effect(s)	TCDD-Eq.[1]	2,3,7,8 -TCDD	Reference
Forster's tern	Embryo mortality Impaired reproductive success Subcutaneous edema of head and neck AHH[2] induction Hard tissue deformities	**618 - 7,366 ppt**	14 - 105 ppt	Kubiak *et al.* 1989 Hoffman *et al.*1987 Tillitt *et al.* 1993
Caspian tern	Multiple deformities Edema Embryo mortality Impaired reproductive success	**1,300 - 2,800 ppt**	8 - 22 ppt	Ludwig *et al.* 1993 Yamashita *et al.* 1993 Tillitt *et al.* 1991
Double-crested cormorant	Embryonic mortality Beak deformities Club foot	**350 - 1,300 ppt**	5.3 - 22 ppt	Fox *et al.* 1991a,b,c Tillitt *et al.* 1991 Yamashita *et al.* 1993
Wood duck	General reproductive impairment Beak deformities Subcutaneous edema of head and neck	**3 - 611 (52)[3] ppt**	2 - 482 (36)[3] ppt	White *et al.* 1994 White *et al.* 1995
Great blue heron	Altered embryonic growth Shortened beak Scarcity of down follicles Subcutaneous edema MFO[4] induction Intercerebral asymmetry	**227 ± 36 ppt**	211 ± 34 ppt	Hart *et al.* 1991 Bellward *et al.* 1990 Henshel *et al.* 1995

Table 10. Field studies measuring exposure in eggs and effects in TCDD-equivalents and 2,3,7,8 -TCDD values (ppt) for selected species (modified and adapted from Hoffman et al. 1996).

[1]calculated from congener chemistry

[2]aryl hydrocarbon hydroxylase

[3]geometric mean

[4]mixed-function oxygenase