Pesticide and Mercury Levels in Pelicans in Idaho

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BACKGROUND

It has been shown that fish-eating and certain other carniverous birds have higher levels of organochlorine pesticides and mercury residues than any other types of birds (MOORE and WALKER, 1964; KEITH, J.O., 1966 and BENSON, W.W., (in press)). This paper reports levels of these residues found in the White Pelican, Pelicanus erythrorhynchos, in southern Idaho. Specimens of these birds were collected specifically for these determinations by one of the authors through a permit from the Idaho Department of Fish and Game and the U.S. Fish and Wildlife Service. The birds were collected during the early summer of 1974.

MATERIALS AND ANALYTICAL METHODS

On June 6, 1974 twelve white pelicans were collected and autopsied to obtain specimens for mercury analysis. They were collected along the Snake River about three miles downstream from the American Falls Reservoir. The American Falls Reservoir is located in southeastern Idaho west of the city of Pocatello. The various autopsied organs were immediately placed in clean plastic bags and transported to the laboratory in Boise within 24 hours.

The Snake River and the Portneuf River flow into the reservoir. GEBHARD, et al. (1971) reported that fish from the free flowing part of the Snake River contained little or no mercury while fish from reservoirs and impoundments along the river contained significant mercury levels. Table 1 shows mercury levels in various species of fish collected from American Falls Reservoir. It is assumed that pelicans obtain mercury from eating contaminated fish.

An additional bird was tested for organochlorine pesticides. This bird was found dead in the Lake Lowell region of Idaho at about the same time the other birds were collected. It was brought into the laboratory and necropsy was performed and tests run immediately.

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TABLE 1

AMERICAN FALLS RESERVOIR

MERCURY LEVELS IN FISH (in ppm)

Species	Sample No.	Average Hg ppm
Rainbow (1/2 - 2 lbs.)	16	.256
Rainbow (over 5 lbs.)	3	.910
Cutthroat (1 - 6 lbs.)	5	.822
Whitefish (12 - 15 inches)	6	.173
Brown Trout (17 inch)	1	.940
Coho (12 inch)	2	.120
Perch (10 - 14 inches)	10	.880
*Perch	7	.474
*Bullhead	3	.133
*Utah Chub	4	.570
Carp	6	.230
Sucker	6	.558

*All or part of collections made in 1970.

Analysis was made on each organ tissue separately and the results reported on a wet weight basis. The methods of analysis are as follows:

Tissue samples were first extracted with petroleum ether and partitioned against acetonitrile, using a modified procedure of de FAUBERT, et al., (1964). The petroleum ether extracted was then subjected to fractionation on a florosil column, details of which have been previously reported by MILLS (1961) and MILLS, et al., (1963). Analysis was by tritrium foil electron capture gas chromotography, using a Micro Tek 220 instrument equipped with two differing columns for confirmatory analysis.

The following gas chromotograph parameters were utilized:

Columns:	4% SE-30, 6% OV-210 on Chromosorb W, DCMS, 80-100 mesh.	
	1.5% OV-17, 1.95% OV-210 on Chromosorb W, DCMS, 100-120 mesh.	
Temperatures:	Columns	200° C
	Injector Chamber	220° C
	Detector	205° C

Carrier Gas Flow: (nitrogen)	SE-30, QF-1	90 ml/min
	OV-17, QF-1	70 ml/min

The analysis for mercury was carried out on the tissue samples and results reported in terms of wet weight. A one gram tissue sample was digested with nitric and sulfuric acid using the A.O.A.C. method and equipment of HOROWITZ (1970). Digests were then analyzed using the Coleman Model 50 cold vapor mercury analyzer.

RESULTS AND DISCUSSION

Table 2 shows levels of these substances in the various organs of these pelicans. The highest levels of mercury were found in the liver tissues, the highest mercury level being 32.80 ppm and the lowest level in the particular tissue 2.33 ppm.

TABLE 2

AMERICAN FALLS RESERVOIR

MERCURY IN PELICAN TISSUE IN ppm (wet weight)

Tissue	N	Pelican Number												$\bar{x}$	σ
		1	2	3	4	5	6	7	8	9	10	11	12		
Liver	12	2.33	7.90	8.63	14.80	14.63	5.24	19.76	11.90	9.25	13.45	32.80	9.65	12.53	7.90
Feathers	12	4.29	0.37	3.87	0.81	1.61	0.84	2.64	3.63	9.15	4.82	10.91	1.44	3.70	3.32
Kideny	12	1.42	3.68	3.87	3.67	3.18	2.13	4.14	3.08	2.74	6.01	6.47	6.08	3.87	1.59
Heart	12	0.98	2.12	2.72	2.35	2.33	1.67	2.52	2.46	2.24	2.74	4.81	1.55	2.37	0.93
Bone	10	0.20	0.34	0.40	0.63	0.10	0.27	0.44	0.17	0.44	0.37	----	----	0.34	0.16
Muscle	11	1.12	2.23	3.03	2.42	10.81	1.92	2.92	2.74	2.05	3.50	4.86	----	3.41	2.64
Brain	12	0.45	0.16	2.04	1.18	1.18	0.98	1.61	1.79	0.96	2.62	1.69	0.56	1.27	0.71

Table 3 shows that the organochlorine residues were so high in the single bird studied for these pesticides as to possibly account for its death. The total DDT residue level of 1498 ppm was significantly higher than levels previously reported by GREICHUS, et al., (1973). This one example serves to illustrate the cumulative and long-lasting effect of these pesticides in flesh-eating animals since the use of DDT was presumably banned in 1971 (Table 2).

TABLE 3

LAKE LOWELL RESERVOIR

PESTICIDES IN PELICAN TISSUE IN ppm (one bird)

Tissue	p,p'DDD	p,p'DDT	p,p'DDE	o,p'DDT	Total DDT	B-BHC	Heptachlor Epoxide	Dieldrin
Kidney	57.90	14.20	98.20	50.90	221	6.40	5.76	89.20
Liver	217.40	494.20	730.00	57.00	1498	13.60	13.20	203.00
Brain	----	0.543	8.94	----	> 19	0.635	0.384	4.74
Heart	68.60	9.65	339.20	16.60	434	5.00	5.00	97.60

According to the report on Minerals and Water Resources in Idaho there are no known sources of mercury in the Snake River valley above American Falls Reservoir. The area is bounded by irrigated farms and large dry farms that raise winter and summer wheat. For many years it has been the practice of these farmers to treat their wheat seed with mercury fungicide compounds. Conceivably this could be the source of the high levels of mercury found in the fish and pelicans collected from the vicinity of the American Falls Reservoir.

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