

A Survey of Chlorinated Pesticide Residues in Black Duck Eggs

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Winter surveys conducted by the Bureau of Sport Fisheries and Wildlife have shown that the black duck population in the Atlantic Flyway has declined since 1955 and is now at the lowest level recorded during the past 20 years. In addition, analysis of wings mailed in by hunters indicates a smaller proportion of young birds in the population. In 1960, the ratio of immature to adult birds was 2.11; in 1961 - 1.75; 1962 - 1.32; 1963 - 1.51; 1964 - 1.47; and 1965 - 1.38. These ratios are weighted to allow for regional differences in the kill, but they have not been adjusted for possible annual variations in vulnerability to shooting.

An exploratory survey of chlorinated pesticide residues in field collected eggs was initiated to help determine if these compounds were involved in the decline of the duck population.

Methodology

In the spring of 1964, two eggs from each of 85 nests were collected by cooperators from Canada to Maryland (Fig. 1). One egg from each clutch was randomly selected for analysis except that all eggs from New Jersey were analyzed. All analyses were

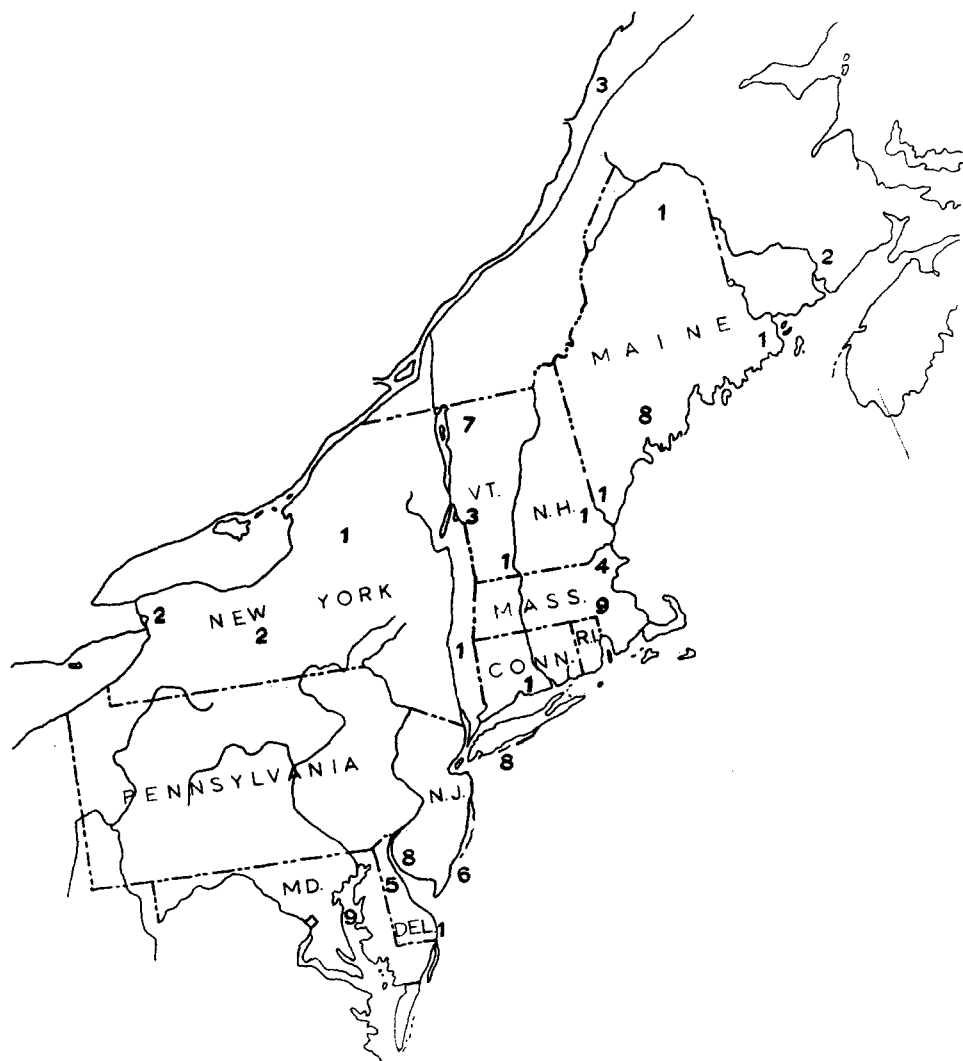


Figure 1. Number and locations (within a 50 mile radius) of nests sampled.

made by thin layer chromatography; results were confirmed by gas chromatography on specimens picked at random from each State.

Preparation of Samples. Only specimens that were not cracked were analyzed. Egg contents were ground with anhydrous sodium sulfate in a blender and extracted for 7 hours with petroleum ether in Soxhlet apparatus. Extracts were concentrated, taken up in 50 ml hexane and partitioned four times with 50 ml portions of acetonitrile. The acetonitrile was evaporated to dryness at room temperature, and the pesticides were eluted on a 2x15 cm column of partially inactivated florisil with 200 ml of 3:1 hexane-benzene mixture. Recoveries of 90 to 99 percent were obtained from chicken eggs fortified with 100 µg each of DDE, DDD, and DDT.

Analysis. The purified extracts were concentrated and a semiquantitative determination was performed by TLC using aluminum oxide G and hexane as the developing solvent. The sensitivity achieved for quantitation was approximately 0.2 ppm in these samples.

The gas chromatograph was equipped with an electron capture detector, ½"x44" glass column packed with 5 percent SE-30 on 80/90 mesh Anakrom ABS and nitrogen carrier gas at 30 pounds pressure.

Results and Discussion

The eggs contained DDT, DDE, DDD, and dieldrin, as shown in Table 1. In addition, trace amounts of heptachlor epoxide were

TABLE 1-Summary of Mean Residue Values Detected in Black Duck Eggs

Area	No. of Eggs	ppm Wet Weight, Ranges in Parentheses ^{1/}				DDD	Dieldrin
		DDE	SD	DDT	SD		
New Hampshire	1	1.4		0.5		T	0.2
Connecticut	1	2.1		2.1		T	0.2
Maryland	9	0.4 (0.1-1.2)	0.3	0.3 (T-0.8)	0.3	T (0-T)	T (0-0.2)
Vermont	11	1.2 (0.2-2.5)	0.8	0.5 (T-1.5)	0.4	0.1 (0-0.2)	T (0-T)
Maine	11	1.4 (0.2-2.4)	0.7	0.7 (T-1.6)	0.5	T (0-T)	T (0-0.5)
Canada	5	1.6 (0.9-2.5)	0.7	1.3 (0.5-3.1)	1.1	T (T-0.3)	T (0-0.2)
Delaware	6	1.7 (0.5-2.3)	0.7	1.7 (0.2-6.8)	2.6	0.2 (0-0.5)	T (0-T)
New York	14	4.4 (0.5-10.6)	3.3	3.1 (0.2-11.2)	3.4	1.3 (T-10.6)	0.3 (0-1.3)
New Jersey	23	4.6 (0.3-12.1)	3.5	2.3 (0.2-6.4)	2.0	0.3 (T-1.3)	0.2 (0-0.6)
Massachusetts	13	5.5 (1.4-10.5)	3.2	4.1 (0.5-10.5)	3.0	0.9 (T-2.5)	0.5 (0-2.0)

^{1/} SD = Standard deviation, T = trace, less than 0.1 ppm

detected in 31 specimens. DDT and DDE were found in all samples analyzed. Because of the presence of heterogeneous variance between the area means, even after a square root transformation, a statistical analysis of the data could not be performed. However, it would appear from these data that eggs from New Jersey, New York, and Massachusetts contained appreciably higher residues of DDT and metabolites than did those from other States.

TABLE 2
Residues in Pairs of Eggs Collected in New Jersey

Pair	ppm DDT + DDE + DDD		Difference
	Group A	Group B	
1	3.3	6.4	3.1
2	13.3	11.5	1.8
3	3.4	3.2	0.2
4	17.4	12.1	5.3
5	6.1	16.1	10.0
6	16.1	10.6	5.5
7	1.3	1.3	0.0
8	2.1	1.2	0.9
9	3.6	4.7	1.1

The residue content of the pairs of eggs from the same nests are shown in Table 2. Results from the two eggs of a pair were randomly assigned to group A or B for presentation in the table. The eggs from the same nest compare favorably except for pair numbers 4, 5, and 6 where the differences are 5.3, 10.0, and 5.5 ppm, respectively.

This survey indicates that pesticide residues occur widely in the eggs of black ducks throughout the Atlantic Flyway. The quantity of these residues that will have an adverse effect on hatching and survival is not known, and will require experimental studies.

Acknowledgements

We are indebted to the Biologist and Management personnel of the Fish and Wildlife Service, to Cooperators of the Atlantic Flyway, and Eastern Canada who submitted specimens and to Nancy C. Coon who prepared the area map.