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DDT AND DIELDRIN RESIDUES FOUND IN WISCONSIN FISHES FROM THE SURVEY OF 1966

Preliminary Report

By

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WISCONSIN CONSERVATION DEPARTMENT
Research and Planning Division

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ACKNOWLEDGEMENTS

Finances for the 1966 survey were made available by Chapter 36, 1965 Supplement to the Wisconsin Statutes (36.245), known as "The Accelerated Water Resources Research and Data Collection Program". This support provided funds for salaries of project personnel and for equipment required in analyzing the fish samples.

Implementing the 1966 survey required the coordinated efforts of many Wisconsin Conservation Department personnel. Collections of living fish were made by field personnel stationed in many locations of the State. Donald R. Thompson provided technical assistance in planning and reporting the study. --- Edited by Ruth L. Hine

INTRODUCTION

Background

The chlorinated hydrocarbon pesticides usually reach our waters in concentrations non-lethal to fish. Unfortunately these substances tend to accumulate in the environment, may persist in the toxic form for years and become absorbed in plants and animals, and absorbed on organic matter and soils. When present in sufficient concentrations, toxic residues of chlorinated hydrocarbon pesticides have been shown to produce behavioral pathology, interfere with reproduction, and sometimes kill a variety of animal life. It is officially estimated that in the United States, agricultural chemicals were responsible for 32 percent of all known sources of fish kills in 1960, 21 percent in 1961, and 18 percent in 1962 (Tarzwell, 1965).

Certain evidence of significant residues of the chlorinated hydrocarbon insecticides DDT and dieldrin in Wisconsin fishes prompted the Wisconsin Conservation Department to conduct a survey to determine the amounts of these residues in a variety of fishes from many state waters.

The survey was begun in 1965 and expanded in 1966. This report summarizes the findings of the 1966 phase of the survey program and reviews all of the data obtained to date. It also includes a "Perspective" to acquaint the reader with the nature of the pesticides analyzed and their effects on fish.

The 1965 and 1966 Surveys

Whole fish samples from 31 Wisconsin waters were analyzed by gas chromatography for DDT and dieldrin residues in 1965. All of the fish analyzed contained DDT, and most contained measurable amounts of dieldrin (Thompson, 1966). Distinct differences in DDT residue levels in fish from different waters were noted. Dieldrin residues in fish were present in much smaller amounts and showed less variation from one body of water to another.

To obtain a wide geographical sampling of fishes from Wisconsin waters, the 1965 survey was greatly expanded in 1966. The selection of waters and fishes to be sampled was determined by a committee representing the Research and Planning, Fish Management, Game Management, Forest Management, and Engineering Divisions of the Wisconsin Conservation Department. A cross-section of Wisconsin lakes and streams, as well as a number of waters located near urbanized, agricultural, or pest control areas, thought to be high pesticide use areas, were selected for sampling. The fishes chosen for sampling chiefly consisted of the common game, pan, and rough fish species of wide distribution in State waters.

MATERIALS AND METHODS

Collections

Collections of living fish were made chiefly between the months of May and October, 1966. These collections conformed as closely as possible with the instructions applied to the field specifying species, size, and number of fish to be collected. Most of the samples consisted of 3 to 10 fish of the same species; however, larger fish were used singly in most cases. A total of 322 samples, representing 1,734 fish of 31 species from 32 lakes

and 31 streams representing 31 counties, were analyzed for DDT and dieldrin residues from the 1966 survey.

Analysis

All fish samples were wrapped tightly in aluminum foil, frozen shortly after capture, and held in the Nevin laboratory freezer. The frozen fish constituting each sample were ground whole in a meat grinder, mixed, and re-ground three times; aliquots of each sample were selected and stored in capped sample bottles at -20° F. until analysis. Throughout sample preparation, the fish samples were kept in a frozen, or near frozen condition.

Moisture determinations were made by drying ground-whole fish samples for eight to twelve hours in a forced-air oven at 102° C. Fat determinations were made on the dried samples by continuous extraction with ethyl ether for eight to ten hours.

Ten grams of ground, frozen fish were prepared for pesticide analysis according to procedures described for animal tissues in Pesticides Analytical Manual, Vol. I (Revised July, 1965), U. S. Department of Health, Education and Welfare. This procedure was modified by excluding acetonitrile partitioning. Thus, the concentrated extracts were placed directly on deactivated florisil columns and eluted with 6 percent ethyl ether and 94 percent redistilled hexane elutant. The deactivated florisil columns passed both DDT and dieldrin on the first elution. The cleanup procedure was completed by passing 1 ml. of extracted sample through a sweep codistillation apparatus consisting of glass tubes packed with glass wool. This sample was then ready for injection into the gas chromatograph.

DDT and dieldrin residue levels were determined by electron capture gas chromatograph (Bechman Model GC-5), utilizing a mixed bed column, 2 mm. i.d. by 6 feet glass, packed with 9 parts 10 percent DC200 on gas chrom Q, and 5 parts 10 percent QFL on gas chrom Q, 60-80 mesh. The column temperature was 210° C., and the flow rate was 26 ml. helium per minute. The detector temperature was 250° C. The injector temperature 220° C.

The laboratory reported residues of DDT, DDD, DDE, and dieldrin as parts per million of the whole fish ("whole fish basis").

PERSPECTIVE

Pesticide Use in the United States

The worldwide use of pesticides has substantially increased since the development of DDT in the early 1940's. It is estimated that 350 million pounds of insecticides were used in the United States during 1962. Pesticides were used on about one out of every twelve acres within the 48 contiguous states. About 45 million pounds are used each year in urban areas and around homes, much of this by individual homeowners. The annual sale of aerosol "bug bombs" amounts to more than one per household.

DDT and Dieldrin Use in Wisconsin

Comprehensive records of the amounts of pesticides used in Wisconsin do not exist. Neither are figures available on the amounts of pesticides sold in Wisconsin. DDT is used to control household, lawn, agricultural, orchard, and forest insects. DDT has been extensively used to control elm

bark beetles, the carriers of the Dutch elm disease. DDE and DDD are analogs of DDT which may have been degraded either in the fish, in other organisms, or in the environment before entering fish.* DDD has also been used as an insecticide. Aldrin, which degrades to dieldrin, and dieldrin have been used chiefly in agricultural insect pest control.

Transport of Pesticides

Pesticides may reach our waters by direct application, discharge of waste, and drainage from treated areas. Aerially applied pesticides may also be picked up by air currents, circulated through the lower troposphere, and later deposited by rainfall in distant places (Woodwell, 1967). Dieldrin, DDT, and its analog DDE have been found in water samples from all major river basins of the United States (Weaver, et al., 1965).

Uptake and Biological Concentration in Fish

Fish may pick up pesticides by eating contaminated food or by direct uptake from water via the gills. Some pesticides may also enter fish through the skin. Apparently uptake via the gills is very rapid, as appreciable amounts of DDT have been shown to enter fish within five minutes of exposure to water containing DDT (Premdas and Anderson, 1963). Fish and certain other aquatic animals have a fantastic ability to biologically concentrate chlorinated hydrocarbon pesticides in their bodies. Living fish have been found to contain a concentration of DDD more than 50,000 times the concentration applied to their environment for gnat control (Hunt and Bischoff, 1960).

Toxicity of DDT, DDD, DDE, and Dieldrin

Of the DDT analogs, DDT is most toxic with DDD less toxic, and DDE of apparently low toxicity. Dieldrin has a considerably higher toxicity. Typically these insecticides are less toxic to higher organisms than lower; insects and aquatic invertebrates are most sensitive and mammals, including man, are least sensitive.

DDT and dieldrin are known to be fat soluble and to accumulate in fatty tissues. At acutely toxic levels, the chlorinated hydrocarbons damage the central nervous system, causing instability, difficulty in respiration, and sluggishness (Holden, 1965). Sublethal concentrations may endanger fish indirectly by reducing the food supply, producing behavioral pathology (Warner, et al. 1966), or preventing or curtailing reproduction (Burdick, et al., 1964, Allison, et al., 1964, Boyd, 1964). There are some indications that pesticides may, under conditions of long-term exposure to sublethal concentrations, be concentrated in the bodies of fishes to such levels that, under starvation or spawning conditions, they are reabsorbed into the blood to lethal levels (Tarzwell, 1965).

The rate at which these substances degrade in the aquatic environment or in the bodies of fishes is little understood. However, the chemical half-life of stable chlorinated hydrocarbons in soils, and the time they remain active against some soil insects, are measured in years (Kennedy, 1963).

* Whenever DDT is mentioned it is meant to include the analogs DDD and DDE unless otherwise indicated.

Reports of resistance to pesticides in fishes with short generation span (Vinson, Boyd, and Ferguson, 1963; Ferguson, et al, 1964) were based on relative toxicity data from areas of heavy pesticide usage and fish known to be free of contamination. Other studies (Holland, et al., 1966) demonstrated an increased sensitivity to pesticides in off-spring of adult sheepshead minnows exposed to DDT and endrin in the laboratory.

FINDINGS

DDT and Dieldrin Residues -- 1966 Survey

Every sample of fish analyzed contained DDT or its analogs and nearly 60 percent of the samples contained dieldrin. In all of the whole fish samples, DDT, DDD, and DDE averaged 29, 24, and 47 percent of the total DDT complex identified. Individual samples ranged from 0 to 100 percent DDT, from 0 to 52 percent DDD, and from 0 to 100 percent DDE. In the samples, DDT and its analogs were present in amounts of from .021 to 16.20 ppm while dieldrin either was absent or was present in amounts up to 4.18 ppm (Table 1). Dieldrin residues were generally much lower than DDT residues. However, a positive correlation (nearly significant at the .05 level with 77 d.f.) was noted between the levels of residues of DDT and dieldrin in fish samples from each of the various waters.

Distinct differences in DDT and dieldrin residue levels in fish from different waters were noted. The higher DDT and dieldrin residue values were most frequently observed in samples taken from the southeastern portion of the State (Figs. 3 and 4). Instances of high DDT residues in other scattered locations of the State were also detected. Very high dieldrin residues were present in fish from the Mississippi, Milwaukee, and Pike Rivers.

Fish samples taken from the lower portions of certain streams contained DDT residues many times those observed upstream, indicating sources of contamination between collecting sites. Some samples taken in the 1966 survey contained substances which could be detected but were not identified. These substances were present in samples from the more highly polluted waters--the Mississippi and Milwaukee Rivers.

Pesticide levels did not appear to differ consistently among the different species of fish sampled. Where rough, pan, and game fishes were sampled from one location, residue values for all species were usually of similar magnitude (Figs. 1 and 2). An exception to this observation was noted in stream samples where trout contained at least twice as much DDT and analogs as suckers in four of ten stream collections.

The fat content of samples of the same species showed considerable variation. Generally speaking, however, carp, catfish, sheepshead, buffalo, lake trout, cisco, walleye, sauger, and white bass were the fatter fish (Table 2). There appeared to be some correlation between the amount of fat in the fish samples and the amount of pesticide residues present--the fatter fish from some of the waters sampled tended to harbor greater amounts of pesticides.

The present study did not permit an investigation of the correlation of age and residue levels since none of the collections contained samples of a sufficient number of age groups of each species.

Comparison of 1965 and 1966 Residue Values

The range of pesticide residue values obtained in the 1966 survey was greater than those obtained in 1965. Total DDT analogs ranged from .021 to 5.24 ppm in 1965 samples and from .021 to 16.20 ppm in 1966 samples. Dieldrin ranged from 0 to .07 ppm in 1965 samples and from 0 to 4.18 ppm in 1966 samples. The greater range of pesticide residue values observed in the 1966 samples was expected since the 1966 collection contained many more samples than the 1965 collection. However, the observation of dieldrin levels greatly in excess of values shown by previous sampling was surprising.

DISCUSSION

Significance of DDT and Dieldrin Residues in Wisconsin Fish

Both the 1965 and 1966 surveys demonstrate a widespread and significant level of contamination in our inland fishes with DDT and in a number of cases with dieldrin. Residues in fishes from certain Wisconsin waters may have already reached levels harmful to fish.

Sources of Pesticides in Fish

The universal occurrence of DDT in all Wisconsin fishes examined and in animal life reported elsewhere in the world indicates some DDT is born by winds and deposited with precipitation. However the amount of DDT in fish appears to bear a close relationship to pesticide use in the watershed. The higher residue values were observed in various urbanized, outdoor recreation, and agricultural locations known or suspected to be areas of frequent pesticide use. Fish samples from known pesticide treatment areas contained as much as 250 times the amount of DDT found in fish from waters where little or no pesticide use is known.

Dieldrin was less prevalent than DDT, and was generally present in lower concentrations. The surprisingly high dieldrin levels of the magnitude observed in the Milwaukee River, Pike River, and certain Mississippi River samples did not occur elsewhere in the state. These high residue levels are believed to have resulted from one or more sources including agricultural pest control, pest control in urban areas, and industrial pollution.

Human Consumption of Fish Containing Pesticide Residues

As expressed in the earlier report of pesticide residues in Wisconsin fishes, it is not our intent to make any implication concerning the suitability of our inland fishes as human food. Apparently neither the state Department of Agriculture nor the Board of Health believes there is any great health hazard in consuming Wisconsin fish. The federal Food and Drug Administration has not set tolerance levels for DDT and dieldrin residues for fishes used as human food.

RECOMMENDATIONS

The President's Science Advisory Committee (Kennedy, 1963) recommended the elimination of persistent toxic pesticides as a goal in a report "Use of Pesticides". Today there is little evidence this goal is being met. The trend is toward increasing use of pesticides, many of which are of the persistent variety.

In view of the fact that little is known about the recycling of persistent pesticides in the ecosystem or of the long-term effects of these materials on the environment, future concern and study are mandatory.

Additional sampling will be needed both in unsampled inland waters and in Wisconsin coastal waters of Lakes Michigan and Superior to complete the DDT and dieldrin residue picture for Wisconsin fish. Thus far, residue levels observed in our single fish sample and in samples reported by Hickey (1965) in the Green Bay region of Lake Michigan, suggest DDT residue values are equal to the higher values observed in inland waters.

Wisconsin Conservation Department studies currently underway on the reproduction of fish of various pesticide levels should be expanded and continued. Studies of aquatic ecosystems which have received or are receiving heavy treatments of chlorinated hydrocarbon insecticides should also be undertaken.

It is also recommended that future statewide surveys should include detection of other substances in addition to DDT and dieldrin, which may be extensively applied to the environment, and potentially harmful to fish. Where high residue levels are obtained, an investigation of the pollution source should be undertaken.

In the immediate future, it is recommended that a study committee be appointed to identify current and potential dangers of persistent pesticides to the fishery resource, together with a list of recommendations for protecting this resource in Wisconsin.

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TABLE 1. FISH ANALYSIS FOR DDT AND ITS ANALOGS AND DIELDRIN

AREA	COUNTY AND WATERS SAMPLED	SPECIES	COLLECTION DATE	NO. IN SAMPLE	SIZE RANGE	PERCENT FAT	WHOLE FISH BASIS – PPM					FAT BASIS – PPM	
							DDE	DDD	DDT	TOTAL DDT ANALOGS	DIELDRIN	TOTAL DDT ANALOGS	DIELDRIN
S	CRAWFORD												
	Mississippi R. (1)	Redhorse	6–10–66	2	?	7.49	.176	.167	.160	.503	——	6.72	——
		Carp	6–10–66	2	17" avg.	7.38	.104	.072	.077	.253	——	3.43	——
		Bullhead	6–10–66	2	11" avg.	1.85	.064	.040	.048	.152	——	8.22	——
		Catfish	6–10–66	2	15" avg.	11.93	.180	.099	.193	.472	——	3.96	——
		Perch		1									
		Bluegill	6–10–66	3	7" avg.	3.12	.063	.036	.084	.183	——	5.87	——
		Crappie	6–10–66	3	9" avg.	2.40	.077	.035	.042	.154	——	6.42	——
		SM Bass	6–10–66	5	9" avg.	.86	.060	.036	.045	.141	——	16.40	——
		Sauger	6–10–66	2	18–23"	6.59	.395	.140	.185	.720	.034	10.93	.516
		Northern Pike	6–10–66	3	20–22"	2.31	.157	.098	.222	.477	——	20.65	——
	Kickapoo R. (2)	Redhorse		2	10–14"								
		Suckers	6–9–66	3	10–12"	5.69	.055	.066	.005	.126	——	2.21	——
		Buffalo	6–9–66	2	20–23"	6.64	.230	.312	.202	.744	Trace	11.20	Trace
		Quillback	1–9–66	1	20"	5.34	.216	.196	.184	.596	.048	11.16	.899
	Kickapoo R. (3)	Redhorse	6–7–66	3	16"	8.12	.103	.117	.107	.327	.046	4.03	.566
		Buffalo	6–10–66	1	21"	10.14	.121	.087	.116	.324	.048	3.20	.473
		Carp	6–8–66	3	12–22"	7.16	.137	.057	Trace	.194	.034	2.71	.475
		Shad	6–8–66	5	8–13"	4.39	.213	.059	.112	.384	——	8.75	——
		Catfish	6–8–66	3	14–16"	6.04	.103	.091	.061	.255	.033	4.22	.546
		Walleye	6–8–66	1	16"	7.70	.072	.016	.039	.127	——	1.65	——
	DANE												
	Kegonsa L.	Carp	6–14–66	3	18"	12.42	.193	.049	.033	.275	.015	2.21	.121
		Bullhead	6–2–66	10	8–12"	4.03	.590	.312	.150	1.052	.028	26.10	.695
		Bluegill	6–2–66	5	7–8"	5.45	.160	.090	.080	.330	.026	6.06	.477
		Bluegill	6–16–66	5	8–9"	3.48	.552	.541	.642	1.735	.026	49.86	.747
		Perch	6–16–66	9	9–11"	6.91	.220	.135	.205	.560	.039	8.10	.564
		Walleye	6–13–66	3	18–19"	5.10	.241	.062	.184	.487	——	9.55	——
		Northern Pike	6–13–66	3	25"	2.03	.189	.052	.141	.382	——	18.82	——
	Mendota L.	Carp	5–20–66	3	16–20"	7.17	1.10	.83	.155	2.085	Trace	29.08	Trace
		Bullhead	5–20–66	4	10–12"	1.35	.500	.351	.200	1.051	——	77.85	——
		Bullhead	7–29–66	6	8–12"	1.73	.594	.362	.150	1.106	——	63.93	——
		Bluegill	5–20–66	5	7–9"	5.76	.671	.479	.765	1.915	Trace	33.25	Trace
		Bluegill	5–20–66	5	7–8"	4.08	.594	.345	.400	1.339	.054	32.82	1.32
		LM Bass	5–20–66	1	15"	3.46	2.62	1.83	2.98	7.43	.005	214.7	.145
		LM Bass	5–20–66	1	20"	5.65	.831	.545	.450	1.826	.027	32.32	.478
		Perch	7–16–66	9	8–11"	4.33	.578	.552	.646	1.776	.045	41.02	1.04
		Northern Pike	5–20–66	3	22–25"	1.48	.193	.049	.033	.275	.015	18.58	1.01

(1) Cold Springs
(2) Above Orchard
(3) Below Orchard

TABLE 1. FISH ANALYSIS FOR DDT AND ITS ANALOGS AND DIELDRIN

AREA	COUNTY AND WATERS SAMPLED	SPECIES	COLLECTION DATE	NO. IN SAMPLE	SIZE RANGE	PERCENT FAT	WHOLE FISH BASIS – PPM					FAT BASIS – PPM	
							DDE	DDD	DDT	TOTAL DDT ANALOGS	DIELDRIN	TOTAL DDT ANALOGS	DIELDRIN
S	GRANT												
	Wisconsin R. (4)	Redhorse	6–7–66	5	15"	5.06	.068	.059	.073	.200	.014	3.95	.277
		Carp	6–6–66	3	16"	5.33	.100	.045	.100	.245	.025	4.60	.469
		Catfish	6–6–66	3	14–18"	4.76	.131	.077	.100	.308	.015	6.47	.315
		Bluegill		5	6–7"								
		Crappie	6–6,8–66	3	10–11"	.73	.102	.072	.133	.307	----	42.06	----
		Bluegill		2	6"								
		Crappie	6–7–66	1	6"	1.57	.180	.080	.202	.462	.008	29.43	.510
		SM Bass	6–6–66	3	12–17"	1.05	.054	.036	.053	.143	.006	13.62	.571
		Walleye		1	17"								
		Sauger	6–7–66	2	11–15"	3.68	.331	.154	.240	.725	----	19.70	----
		Northern Pike	6–6–66	1	30"	.34	.217	.139	.300	.656	----	192.9	----
		Northern Pike	6–8–66	1	25"	.50	.045	.026	.040	.111	Trace	22.20	Trace
	Mississippi R. (5)	Sheepshead	6–10–66	2	12–14"	9.68	.107	.048	.063	.218	.062	2.25	.641
		Carp	6–10–66	1	19"	7.59	.084	.053	.010	.147	.028	1.94	.369
		Catfish	6–10–66	1	14"	7.17	.126	.106	.102	.334	.067	4.66	.934
		Bluegill		7									
		Crappie	6–10–66	1	7"	2.27	.053	.038	.052	.143	.021	6.30	.925
		LM Bass	6–10–66	2	10–14"	.99	.087	.038	.089	.214	----	21.62	----
		Walleye	6–10–66	3	14–17"	7.63	.416	.116	.202	.734	.025	9.62	.328
		Northern Pike	6–10–66	3	23–25"	2.47	.144	.068	.117	.329	.017	13.32	.688
S	IOWA												
	Birch L.	Rainbow Trout	3–22–66	1	15"	7.27	.101	.039	.053	.193	----	2.65	----
		Rainbow Trout	3–22–66	1	16"	3.93	.125	.043	.035	.203	----	5.17	----
		Rainbow Trout	3–22–66	1	15"	2.33	.095	.040	.026	.161	----	6.91	----
	Cox Hollow L.	Bullhead	4–19–66	2	10"	1.05	.032	.013	.023	.068	----	6.48	----
		Bluegill	5–12–66	10	4–6"	.37	.017	----	.012	.029	----	7.84	----
		LM Bass	5–12–66	8	7–9"	.60	.025	.006	.019	.050	----	8.33	----
		Northern Pike	4–19–66	3	23–24"	4.34	.058	.016	.046	.120	----	2.76	----
	JEFFERSON												
	L. Ripley	Sucker	10–15–66	3	12–16"	.867	.060	.028	.034	.122	Trace	14.07	Trace
		Carp	10–15–66	3	13–15"	3.63	.034	.020	.014	.068	.022	1.87	.606
		Bullhead	10–15–66	2	8"	.666	.031	.011	.017	.059	.009	8.86	1.35
		Bluegill	10–15–66	10	7–8"	2.92	.127	.057	.139	.323	.079	11.06	2.71
		LM Bass	10–16–66	3	13–20"	5.23	.355	.202	.345	.902	.057	17.25	1.09
		Perch	10–16–66	13	4–6"	.65	.089	.043	.077	.209	.009	32.15	1.38
		Walleye	10–16–66	2	17–20"	1.40	.770	.052	.370	1.192	.015	85.14	1.07
		Northern Pike	10–16–66	2	24–27"	1.01	.222	.095	.219	.536	.019	53.07	1.88
		Northern Pike	10–16–66	1	31"	1.71	.198	.085	.174	.457	.020	26.73	1.17

(4) At Boscobel
(5) At Wyalusing

TABLE 1. FISH ANALYSIS FOR DDT AND ITS ANALOGS AND DIELDRIN

AREA	COUNTY AND WATERS SAMPLED	SPECIES	COLLECTION DATE	NO. IN SAMPLE	SIZE RANGE	PERCENT FAT	WHOLE FISH BASIS – PPM					FAT BASIS – PPM	
							DDE	DDD	DDT	TOTAL DDT ANALOGS	DIELDRIN	TOTAL DDT ANALOGS	DIELDRIN
S	KENOSHA												
	Fox R. (6)	Sucker	7–28–66	4	12–14"	2.64	.475	1.195	.500	2.170	——	82.20	——
		Carp	7–28–66	4	12–13"	3.88	.555	2.33	.115	3.00	——	77.32	——
		Bullhead	7–28–66	12	4–9"	1.94	.325	.530	.295	1.15	——	59.28	——
		SM Bass	7–28–66	1	10"	3.41	.535	.490	.265	1.290	——	37.83	——
		Perch	7–28–66	18	4–5"	1.94	.180	.415	.105	.700	——	36.08	——
		Northern Pike	7–28–66	1	15"	1.45	.750	1.255	.490	2.495	——	172.1	——
	Pike R.	Sucker	6–23–66	5	11–12"	2.71	.863	.792	.973	2.628	1.53	96.97	56.46
		Carp	6–23–66	3	15–19"	10.43	1.49	1.20	.63	3.32	1.14	31.83	10.93
		Alewife	6–23–66	22	6–7"	6.18	2.75	1.06	1.60	5.41	1.78	87.54	28.80
	LAFAYETTE												
	Yellowstone L.	Carp	3–3–66	5	11–13"	7.02	.030	.033	Trace	.063	——	.897	——
		Carp	6–3–66	5	11–13"	6.30	.034	.033	.010	.077	——	1.22	——
		Bluegill	3–3–66	10	6–7"	.55	.026	.003	Trace	.029	——	5.27	——
		LM Bass	8–22–66	3	12–14"	3.92	.039	.035	.034	.108	——	2.76	——
		Perch	8–22–66	20	4–7"	2.61	.021	.036	.025	.082	——	3.14	——
		Northern Pike	6–3–66	1	25"	1.05	.068	.026	.035	.129	——	12.29	——
	MILWAUKEE												
	Milwaukee R. (7)	Sucker	8–9–66	12	5–10"	3.00	.67	.82	.84	2.33	1.10	77.67	3.67
		Carp	8–9–66	4	10–15"	12.95	1.13	.78	.20	2.11	1.24	16.29	9.58
S	RACINE												
	Brown's L.	Carp	10–19–66	2	15–19"	4.25	.169	.167	.023	.359	——	8.45	——
		Bluegill	10–19–66	20	5–6"	.982	.540	.227	.651	1.418	.239	144.4	24.34
		LM Bass	10–19–66	2	13–19"	3.11	.960	.380	.460	1.80	Trace	57.88	Trace
		Perch	10–19–66	20	5–6"	1.17	.110	.073	.064	.247	.007	21.11	.598
	Eagle L.	Bullhead	6–9–66	5	11–13"	1.66	.055	.022	.091	.168	——	10.12	——
		Bullhead	6–9–66	5	11–12"	1.51	.051	.027	.085	.163	——	10.80	——
		Bluegill	6–9–66	5	7–9"	6.55	.045	.032	.010	.087	——	1.33	——
		Bluegill	6–10–66	6	7–9"	6.44	.037	.016	.014	.067	——	1.04	——
		LM Bass	6–10–66	2	16–17"	2.38	.092	.017	.045	.154	——	6.74	——
		Perch	6–10–66	3	8–9"	7.26	.095	.025	.036	.156	——	2.15	——
		Walleye	6–9–66	3	19–22"	6.62	.145	.026	.089	.260	.048	3.93	.725
		Northern Pike	6–9–66	3	17–19"	.92	.047	.032	.062	.141	——	15.33	——
	Fox R. (8)	Sucker	6–30–66	5	14–16"	3.63	2.43	2.41	1.46	6.30	.018	173.6	.496
		Carp	6–30–66	3	14–16"	4.91	.177	.141	.090	.408	——	8.31	——
		Bullhead	6–30–66	3	7–9"	1.23	.095	.043	.067	.205	Trace	16.67	Trace
		SM Bass	6–30–66	4	12–14"	3.01	.167	.047	.151	.365	——	12.13	——
		Perch	6–30–66	74	3–6"	4.27	.280	.160	.180	.620	——	14.52	——
		Walleye	6–30–66	2	13–15"	7.59	1.35	.70	1.07	3.12	.043	41.11	.567

(6) Near Wilmot
(7) Above Dam
(8) At Waterford

TABLE 1. FISH ANALYSIS FOR DDT AND ITS ANALOGS AND DIELDRIN

AREA	COUNTY AND WATERS SAMPLED	SPECIES	COLLECTION DATE	NO. IN SAMPLE	SIZE RANGE	PERCENT FAT	WHOLE FISH BASIS – PPM					FAT BASIS – PPM	
							DDE	DDD	DDT	TOTAL DDT ANALOGS	DIEL-DRIN	TOTAL DDT ANALOGS	DIEL-DRIN
S	WALWORTH												
	L. Geneva	Sucker	8–24–66	6	13–19"	4.15	.812	.368	.408	1.588	.032	38.26	.771
		Bullhead	8–24–66	1	9"	2.28	1.58	.40	.716	2.696	Trace	118.2	Trace
		Bluegill	8–24–66	10	6–7"	3.39	.440	.188	.696	1.324	.032	39.06	.944
		LM Bass	8–24–66	3	11–18"	4.28	2.40	.684	1.14	4.224	.068	98.69	1.59
		Perch	8–24–66	20	6–8"	3.33	.792	.312	.620	1.724	.052	51.77	1.56
		Cisco	3–10–66	5	10–12"	2.76	.508	.392	.996	1.896	.052	68.70	1.88
	Honey Creek Millpond(9)	Sucker	8–4–66	6	12–13"	2.65	.082	.137	.029	.248	.095	9.36	3.58
		Carp	8–4–66	3	14–15"	6.45	1.05	1.37	.107	2.53	.10	39.23	1.55
		LM Bass	8–4–66	3	11–14"	2.36	.187	.250	.047	.484	.078	20.51	3.31
	WAUKESHA												
	Fox R. (10)	Sucker	8–3–66	4	12–17"	5.86	.235	.285	.167	.687	——	11.72	——
		Carp	8–3–66	4	11–13"	6.86	.209	.291	.044	.544	——	7.93	——
		Bullhead	8–3–66	2	8"	1.74	.423	.492	.126	1.041	——	59.83	——
		Pumpkinseed	8–3–66	6	4–7"	2.43	.132	.178	.110	.420	Trace	17.28	Trace
		Perch	8–3–66	2	6–9"	3.85	.315	.549	.480	1.344	Trace	34.91	Trace
		Northern Pike	8–3–66	1	14"	2.15	1.08	.635	1.08	2.795	——	130.0	——
	Lac La Belle	Sucker	6–15–66	6	10–16"	6.91	1.81	1.43	.930	4.170	Trace	60.35	Trace
		Carp	6–15,22–66	6	12–14"	8.15	.586	.645	.500	1.731	Trace	21.24	Trace
		Bluegill	6–15,22–66	15	8–9"	2.23	1.02	.51	.864	2.394	.036	107.4	1.61
		Bluegill	6–15–66	13	6–7"	3.79	.948	.558	.978	2.484	.054	65.54	1.42
		Bluegill	6–15,22–66	7	7–10"	1.71	.996	.474	.906	2.376	.03	138.9	1.75
		LM Bass	6–15–66	9	7–10"	1.95	1.28	.875	.545	2.70	Trace	138.5	Trace
		Perch	6–15–66	26	5–6"	3.67	.80	.830	.765	2.395	——	65.26	——
		Perch	6–15–66	34	3–5"	3.64	.640	.640	.765	2.045	Trace	56.18	Trace
		Walleye	6–15–66	6	15–17"	4.68	2.6	1.82	2.24	6.66	Trace	142.3	Trace
		Walleye	6–15–66	17	5–9"	1.74	2.1	.81	.47	3.38	Trace	194.3	Trace
		Northern Pike	6–15–66	1	20"	.222	.39	.21	.26	.86	——	387.4	——
	Nagawicka L.	Walleye	10–17–66	3	16–18"	4.96	.068	.034	.024	.126	.025	2.54	.504
	Upper Nemahbin L.	Walleye	8–11–66	4	14–19"	4.38	1.14	.66	.83	2.63	Trace	60.05	Trace
	Pewaukee L.	Sucker	10–17–66	3	16–17"	1.99	.10	.062	.056	.218	——	10.95	——
		Carp	10–17–66	2	19–22"	6.39	.270	.178	.288	.736	.019	11.52	.297
		Bullhead	10–17–66	1	13"	2.46	.282	.166	.044	.492	——	20.0	——
		Bluegill	10–17–66	10	6–8"	3.44	.095	.071	.078	.244	.001	7.09	.029
		LM Bass	10–17–66	3	12–19"	1.82	.276	.107	.095	.478	Trace	26.26	Trace
		SM Bass	10–17–66	2	15–20"	5.63	.093	.037	.034	.164	.007	2.91	.124
		Perch	10–17–66	10	5–9"	1.14	.067	.040	.052	.159	Trace	13.95	Trace
		Walleye	10–17–66	2	19–24"	4.70	.715	.275	.640	1.63	Trace	34.68	Trace

(9) At East Troy
(10) At Waukesha

TABLE 1. FISH ANALYSIS FOR DDT AND ITS ANALOGS AND DIELDRIN

AREA	COUNTY AND WATERS SAMPLED	SPECIES	COLLECTION DATE	NO. IN SAMPLE	SIZE RANGE	PERCENT FAT	WHOLE FISH BASIS – PPM					FAT BASIS – PPM	
							DDE	DDD	DDT	TOTAL DDT ANALOGS	DIEL-DRIN	TOTAL DDT ANALOGS	DIEL-DRIN
S	WAUKESHA												
	Pine L.	Carp	6–30–66	3	16–18"	4.36	3.71	2.60	1.39	7.70	---	176.6	---
		Bullhead	6–29,30–66	5	9–11"	1.24	1.15	.56	.24	1.95	---	157.3	---
		Bluegill	6–28–66	20	5–6"	1.74	1.12	.41	.32	1.85	---	106.3	---
		LM Bass	6–30–66	3	13–14"	1.06	1.06	.54	.37	1.97	---	185.8	---
		Perch	6–30–66	8	4–7"	1.44	1.50	.99	.44	2.93	---	203.5	---
		Walleye	6–29–66	2	19–22"	9.50	5.00	4.35	2.14	11.49	---	120.9	---
		Northern Pike	6–28–66	1	25"	2.44	.095	.015	.008	.118	---	4.84	---
		Cisco	2–28–66	3	8–9"	Not enough in sample	.106	.135	.152	.393	.022	---	---
EC	Lake Michigan at Green Bay	Rainbow	5–1–66	1	21"	13.89	2.95	1.16	2.46	6.57	Trace	47.30	Trace
	GREEN LAKE												
	Big Green L.	Cisco	11–2–66	3	14"	12.82	1.004	.264	.296	1.564	.080	12.20	.624
		Lake Trout	11–2–66	4	12–17"	7.92	.990	.200	.198	1.388	.120	17.52	1.52
		Splake	11–3–66	4	?	3.24	.309	.112	.080	.501	.024	15.46	.741
	Upper Fox R.	Catfish	9–26–66	3	11–22"	4.90	.081	.027	.046	.154	.012	3.14	.245
	MARQUETTE												
	Lawrence Creek	Sucker	9–21–66	10	4–8"	1.64	.029	.019	.024	.072	Trace	4.39	Trace
		Brook Trout	9–21–66	11	6–7"	2.91	.06	.040	.054	.154	Trace	5.29	Trace
	OZAUKEE												
	Milwaukee R. (11)	Sucker	8–10–66	5	9–13"	2.34	.450	.450	.80	1.70	4.18	72.65	178.6
		Carp	8–10–66	4	12"	4.68	.80	.575	.375	1.750	.255	37.39	5.45
		Bullhead	8–10–66	4	6–9"	1.35	.18	.15	.255	.585	1.50	43.33	111.1
		Pumpkinseed	8–10–66	8	5–6"	1.14	.325	.225	.625	1.175	3.23	103.1	283.3
	PORTAGE												
	Buena Vista (12)	Sucker	9–12–66	3	12"	1.91	.044	.032	.051	.127	.007	6.65	.366
		Brook Trout	9–12–66	10	6–9"	5.35	.054	.031	.051	.136	.010	2.54	.187
	WAUPACA												
	Crystal R. (13)	Northern Pike	9–8–66	6	12–17"	1.15	.234	.063	.033	.330	.017	28.70	1.48
	Emmon Creek (14)	Brown Trout	9–8–66	3	9–10"	3.65	.164	.032	.044	.240	Trace	6.58	Trace
	WAUSHARA												
	Big Roche-a-Cri	Brook Trout	8–18–66	10	6–8"	3.42	.966	.043	.177	1.186	Trace	34.68	Trace

(11) At Thiensville
(12) Ditch #4
(13) At Dayton
(14) Below potato fields

TABLE 1. FISH ANALYSIS FOR DDT AND ITS ANALOGS AND DIELDRIN

AREA	COUNTY AND WATERS SAMPLED	SPECIES	COLLECTION DATE	NO. IN SAMPLE	SIZE RANGE	PERCENT FAT	WHOLE FISH BASIS – PPM					FAT BASIS – PPM	
							DDE	DDD	DDT	TOTAL DDT ANALOGS	DIELDRIN	TOTAL DDT ANALOGS	DIELDRIN
EC	WAUSHARA												
	Pine R. (15)	Sucker	9–28–66	3	9–11"	.94	.025	.016	.022	.063	----	6.70	----
		Brown Trout	9–28–66	3	9–13"	4.65	.065	.039	.065	.169	Trace	3.63	Trace
	Pine R. (16)	Sucker	9–28–66	3	10–11"	1.79	.033	.025	.035	.093	----	5.20	----
		Brown Trout	9–28–66	8	8–13"	3.20	.042	.019	.029	.090	Trace	2.81	Trace
	White R. (17)	Sucker	10–14–66	3	?	.93	.076	.045	.136	.257	----	27.64	----
		Brown Trout	10–14–66	3	9–11"	3.59	.163	.062	.109	.334	Trace	93.04	Trace
	WINNEBAGO												
	L. Winnebago	Sheepshead	5–5–66	5	15" avg.	14.43	.077	.047	.056	.180	----	1.25	----
		Bullhead	5–5–66	10	8–15"	3.94	.089	.049	.041	.179	.014	4.54	.355
		Catfish	7–?–66	2	?	16.27	.206	.055	.105	.366	.018	2.25	.111
		Pumpkinseed	5–5–66	6	7–8"	3.52	.075	.071	.107	.253	.020	7.19	.568
		Bluegill	5–5–66	10	7–11"	6.06	.088	.045	.037	.170	.010	2.81	.165
		Crappie	5–5–66	10	9–12"	4.92	.084	.054	.057	.195	Trace	3.96	Trace
		LM Bass	5–5–66	3	12–18"	1.04	.100	.072	.081	.253	.015	24.33	1.44
		White Bass	5–6–66	10	11–13"	5.81	.086	.063	.078	.227	.023	3.91	.396
		Perch	5–5–66	2	10"	3.54	.055	.050	.028	.133	.018	3.76	.508
		Perch	5–6–66	10	9–11"	3.19	.123	.082	.073	.278	.021	8.71	.658
		Sauger	5–6–66	4	15–17"	5.47	.208	.075	.086	.369	Trace	6.75	Trace
		Walleye	5–5–66	5	16–18"	4.44	.120	.106	.157	.383	----	8.63	----
		Northern Pike	5–5–66	1	34"	4.17	.333	.171	.223	.727	Trace	17.43	Trace
		Northern Pike	5–5–66	1	36"	2.85	.303	.151	.214	.668	Trace	23.44	Trace
EC	WAUSHARA												
	L. Winnebago	Northern Pike	5–5–66	1	23"	----	.086	.050	.105	.241	----	----	----
		Sturgeon (cross section)	1966	1	8" across 2½" thick	12.7	.15 avg.	.122	.076	.348	----	2.74	----
		Sturgeon (entrails)	1966	1		24.97	.236	.184	.076	.496	.074	1.99	.296
		Trout Perch	5–5–66	24	3–4"	1.51	.039	.044	.056	.139	----	9.21	----
WC	BUFFALO												
	Lighthouse slough	Catfish	7–21–66	1	15"	12.92	obscured	.245	.485	obscured	Approx. .20	obscured	Approx. 1.55
	Mississippi R. (18)	White Bass	7–21–66	2	10–12"	9.12	Approx. .377	Approx. .293	obscured		Approx. .172	obscured	Approx. 1.89
		Walleye	7–22–66	1	19"	8.68	.655	.360	obscured		Approx. .360	obscured	Approx. 4.15

(15) At Leon
(16) At Springwater
(17) Main Branch
(18) Below Chippewa River, Wabasha Branch

TABLE 1. FISH ANALYSIS FOR DDT AND ITS ANALOGS AND DIELDRIN

AREA	COUNTY AND WATERS SAMPLED	SPECIES	COLLECTION DATE	NO. IN SAMPLE	SIZE RANGE	PERCENT FAT	WHOLE FISH BASIS – PPM					FAT BASIS – PPM	
							DDE	DDD	DDT	TOTAL DDT ANALOGS	DIELDRIN	TOTAL DDT ANALOGS	DIELDRIN
WC	BUFFALO												
	Mississippi R. (19)	Carp	6–10–66	3	14–15"	8.07	.147	.102	.178	.427	----	5.29	----
		Catfish	6–10–66	2	15"	9.23	.419	.222	.681	1.322	Trace	14.32	Trace
		Bluegill	6–10–66	10	6–8"	2.21	.105	.032	.115	.252	Trace	11.40	Trace
		LM Bass	6–10–66	3	12–14"	.65	.127	.103	.164	.394	Trace	6.06	Trace
		Perch	6–10–66	6	5–10"	3.88	.105	.032	.115	.252	Trace	6.50	Trace
		Northern Pike	6–10–66	2	13–24"	1.79	.334	.159	.454	.947	----	52.91	----
		Northern Pike	6–10–66	1	33"	6.90	.739	.584	1.20	2.523	----	36.57	----
	CLARK												
	Arbutus L.	LM Bass	6–21–66	2	12"	1.36	.074	.045	.037	.156	.015	11.47	1.10
		SM Bass	6–21–66	3	9–14"	1.43	.107	.048	.081	.236	.010	16.50	.699
		Walleye	6–21–66	5	11–16"	1.27	.075	.037	.065	.177	.010	13.94	.787
	DUNN												
	Knights Creek	Brook Trout	10–5–66	10	7–9"	2.92	.030	.017	.030	.077	.008	2.64	.274
		Brown Trout	10–5–66	1	14"	5.18	.051	.019	.024	.094	.012	1.81	.232
	Menominee L.	Bullhead	5–18–66	10	10–12"	2.94	.042	.023	.024	.089	----	3.03	----
		Bluegill	5–18–66	10	7–8"	3.52	.113	.038	.060	.211	.015	5.99	.426
		LM Bass	5–18–66	3	15–16"	3.23	.021	Trace	Trace	.021	----	.650	----
		Perch	5–18–66	10	7–9"	1.64	.023	Trace	Trace	.023	----	1.40	----
		Walleye	5–18–66	3	15–18"	3.70	.127	.032	.065	.224	----	6.05	----
		Northern Pike	5–18–66	3	19–24"	.61	.076	.029	.040	.145	Trace	23.77	Trace
	JACKSON												
	Halls Creek (20)	Sucker	10–14–66	10	9–11"	.67	obscured	.018	.023		obscured		
	Halls Creek (21)	Sucker	10–14–66	9	8–12"	1.24	obscured	.057	.059		obscured		
	L. Arbutus	Catfish	6–28–66	10	8–12"	2.57	.091	.064	.087	.242	.013	9.42	.506
		Bluegill	6–28–66	12	6–8"	1.56	.051	.018	.068	.137	.012	8.78	.769
		Northern Pike	6–28–66	1	18"	.85	.102	.070	.096	.268	.029	31.53	3.41
	Perry Creek (22)	Sucker	10–13–66	5	7–14"	2.64	.246	.120	.044	.410	----	15.53	----
		Brown Trout	10–13–66	?	11–13"	4.07	.870	.210	.119	1.199	----	29.46	----
	Robinson Creek (23)	Brook Trout	10–7–66	12	5–10"	3.38	.028	.008	.005	.041	.006	1.21	.178
		Brown Trout	10–13–66	4	9–16"	2.88	1.38	.120	.138	1.638	----	56.87	----
	Robinson Creek (24)	Sucker	10–13–66	3	13–17"	2.56	.095	.064	.070	.229	----	8.95	----

(19) At Wabasha, Minnesota
(20) South Fork above Strawberry bed
(21) South Fork below Strawberry bed
(22) Below Cranberry marsh
(23) Above marsh
(24) Below marsh

TABLE 1. FISH ANALYSIS FOR DDT AND ITS ANALOGS AND DIELDRIN

AREA	COUNTY AND WATERS SAMPLED	SPECIES	COLLECTION DATE	NO. IN SAMPLE	SIZE RANGE	PERCENT FAT	WHOLE FISH BASIS – PPM					FAT BASIS – PPM	
							DDE	DDD	DDT	TOTAL DDT ANALOGS	DIELDRIN	TOTAL DDT ANALOGS	DIELDRIN
WC	PEPIN												
	Mississippi R. (25)	Bluegill	6–9–66	6	6–8"	1.64	1.03	.410	1.14	2.58	----	157.3	----
		SM Bass		2									
		LM Bass	6–9–66	1	11–12"	1.86	.430	.222	.454	1.106	----	59.46	----
		LM Bass	6–9–66	3	10–11"	1.00	.124	.044	.204	.372	----	37.20	----
		Walleye	6–9–66	3	16–20"	8.15	.118	.035	.186	.339	----	4.16	----
		Northern Pike	6–9–66	2	18–19"	1.22	.172	.037	.100	.309	----	25.33	----
	Mississippi R. (26)	Carp	7–21–66	1	15"	7.57	Approx. .161	Approx. .129	obscured		.125	obscured	1.65
		Carp	8–21–66	2	14–16"	5.49	.490	.210	obscured		.055	obscured	1.00
		Catfish	8–21–66	3	11–13"	14.15	.255	.655	obscured		.235	obscured	1.66
		Perch	7–21–66	4	7–10"	4.60	obscured	.285	.555	obscured	.220	obscured	4.78
NE	FLORENCE												
	Pine R. (27)	Brook Trout	11–2–66	10	6–10"	1.21	.033	.022	.02	.075	----	6.20	----
		Brown Trout	11–2–66	4	9–15"	1.08	.053	.039	.038	.130	.009	12.04	.833
	Popple R.	Brook Trout	11–2–66	10	6–10"	2.67	.042	.002	.041	.085	.007	3.18	.262
	LANGLADE												
	Upper Elton Creek	Brook Trout	9–1–66	10	5–8"	6.15	.057	.021	.018	.096	Trace	1.56	Trace
	Oconto R. (28)	Brook Trout	9–2–66	10	5–8"	3.68	.050	.019	.027	.096	Trace	2.61	Trace
		Brown Trout	9–2–66	5	5–8"	4.59	.107	.016	.022	.145	Trace	3.16	Trace
		Brown Trout	9–2–66	3	7–8"	4.45	.064	.016	.022	.102	Trace	2.29	Trace
	Oconto R. (29)	Suckers	9–2–66	3	6–10"	2.04	.372	.36	.258	.990	.066	48.53	3.24
		Brown Trout	9–2–66	10	6–10"	3.96	1.17	.273	.412	1.855	.041	46.84	1.04
	Upper Evergreen R.	Brown Trout	9–1–66	2	10–12"	6.24	.034	.016	.028	.078	Trace	1.25	Trace
	MENOMINEE												
	Lower Elton Creek	Brook Trout	9–1–66	10	6–9"	3.74	.642	.260	.153	1.055	----	28.21	----
	Lower Evergreen R.	Brook Trout	9–1–66	7	7–9"	4.11	.685	.295	.26	1.24	----	30.17	----
		Brook Trout	9–1–66	3	10–12"	4.65	.059	.022	.042	.123	----	2.65	----
		Brown Trout	9–1–66	3	9–13"	6.89	.575	.222	.174	.971	----	14.09	----
	Wolf R.	Redhorse	9–1–66	2	13–15"	5.70	.192	.074	.138	.404	----	7.09	----
NE	VILAS												
	Big Muskellunge L.	Walleye	5–2–66	1	30"	11.62	1.10	.55	1.16	2.81	.014	24.18	.120
		Walleye	5–4–66	1	29"	7.97	1.59	.625	1.74	3.955	.013	49.62	.163
		Walleye	5–5–66	1	30"	7.37	1.20	.43	1.00	2.63	.054	35.69	.733

(25) At Lake Pepin
(26) Above Chippewa River
(27) At Chipmunk Rapids
(28) Upper South Branch
(29) Lower South Branch

TABLE 1. FISH ANALYSIS FOR DDT AND ITS ANALOGS AND DIELDRIN

AREA	COUNTY AND WATERS SAMPLED	SPECIES	COLLECTION DATE	NO. IN SAMPLE	SIZE RANGE	PERCENT FAT	WHOLE FISH BASIS – PPM					FAT BASIS – PPM	
							DDE	DDD	DDT	TOTAL DDT ANALOGS	DIELDRIN	TOTAL DDT ANALOGS	DIELDRIN
NE	VILAS												
	Big Muskellunge L.	Walleye	5–5–66	1	31"	8.05	1.28	.61	1.48	3.37	.042	41.86	.522
		Walleye	5–5–66	1	28"	9.87	2.04	.68	2.27	4.99	.021	50.56	.213
		Muskellunge	4–27–66	1	32"	4.80	.600	.348	.492	1.440	.054	30.00	1.12
		Muskellunge	4–28–66	1	33"	5.52	.250	.135	.095	.480	——	8.70	——
		Muskellunge	4–29–66	1	44"	2.63	1.23	.45	.82	2.50	Trace	95.06	Trace
		Muskellunge	5–3–66	1	37"	3.23	1.22	.43	.65	2.30	.035	71.21	1.08
	Escanaba L.	Perch	5–6–66	2	——	1.90	.042	.034	.023	.099	Trace	5.21	Trace
		Northern Pike	5–6–66	3	18–20"	.16	.057	.025	.036	.118	——	73.75	——
		Muskellunge	5–8–66	1	33"	5.98	.170	.069	.103	.342	.020	5.72	.334
	Trout L.	Perch	11–1–66	1	10"	2.77	.035	obscured	.029	obscured	.007	obscured	.253
		Walleye	11–3–66	1	15"	4.69	.228	.054	.206	.488	.014	10.41	.299
		Cisco	11–2–66	3	11"	5.86	.263	.064	.182	.509	.017	8.69	.290
		Whitefish	11–(1,3)–66	4	9–15"	1.84	.179	.044	.098	.321	Trace	17.45	Trace
		Lake Trout	11(1–2)–66	2	19–20"	8.81	.536	.208	.408	1.152	.032	13.08	.363
NW	BARRON												
	Big Moon L.	Rainbow Trout	7–14–66	3	14"	9.0	Interference by Toxaphene				Trace	?	Trace
		Rainbow Trout	5–24–66	3	8–19"	9.93	——	——	.022	.022	——	.222	——
	Brill R.	Sucker	9–2–66	4	10–13"	2.04	.265	.167	.152	.584	——	28.63	——
		Sucker	9–2–66	9	7–10"	.58	.137	.043	.040	.220	——	37.93	——
		Brown Trout	9–2–66	4	10–16"	5.26	1.97	.46	.269	2.699	——	51.31	——
	BAYFIELD												
	Bibon L.	Perch	6–14–66	10	10–13"	3.05	.126	.106	.102	.334	.067	10.95	2.20
		Northern Pike	6–14–66	4	18–21"	1.61	.112	.063	.066	.241	.064	14.97	3.98
	Namekagon L.	Bullhead	6–14–66	3	12–13"	2.75	.455	.120	.240	.815	——	29.64	——
		Bluegill	6–14–66	5	6–10"	3.90	.407	.114	.254	.775	.017	19.87	.436
		Bluegill		2									
		Rock Bass	6–14–66	3	6–10"	4.34	.284	.182	.312	.778	——	17.93	——
		Walleye	6–14–66	3	17–19"	3.52	.540	.180	.312	1.032	.021	29.32	.597
		Northern Pike	6–14–66	6	10–18"	.56	.211	.063	.138	.412	Trace	73.57	Trace
	Unnamed L.	LM Bass	6–6–66	3	7–12"	1.52	.228	.133	.049	.410	——	26.97	——
	BURNETT												
	Lipsett L.	Bullhead	6–28–66	10	5–11"	1.15	.042	.018	.016	.076	.037	6.61	3.22
		Bluegill	6–28–66	10	5–7"	2.05	.050	.017	.024	.091	.090	4.44	4.39
		LM Bass	6–28–66	3	13–16"	.89	.057	.018	.023	.098	.043	11.01	4.38
		Rock Bass	6–28–66	6	7–10"	1.67	.071	.021	.030	.122	.089	7.31	5.33
		Perch	6–28–66	20	5–8"	2.18	.045	.017	.020	.082	.071	3.76	3.26

TABLE 1. FISH ANALYSIS FOR DDT AND ITS ANALOGS AND DIELDRIN

AREA	COUNTY AND WATERS SAMPLED	SPECIES	COLLECTION DATE	NO. IN SAMPLE	SIZE RANGE	PERCENT FAT	WHOLE FISH BASIS – PPM					FAT BASIS – PPM	
							DDE	DDD	DDT	TOTAL DDT ANALOGS	DIELDRIN	TOTAL DDT ANALOGS	DIELDRIN
NW	BURNETT												
	Lipsett L.	Walleye	6–28–66	6	10–16"	4.28	.100	.034	.043	.177	.116	4.13	2.71
		Northern Pike	6–28–66	3	17–23"	.71	.063	.023	.025	.111	.043	15.63	6.06
	St. Croix R.	Redhorse	6–14–66	3	14–15"	3.03	7.83	5.46	2.91	16.20	——	534.6	——
		SM Bass	6–14–66	4	10–12"	.97	.244	.120	.078	.442	Trace	45.57	Trace
		Northern Pike	6–14–66	2	20–27"	.09	.101	.080	.088	.269	——	29.89	——
		Northern Pike	6–14–66	3	14–19"	4.59	.279	.092	.162	.533	——	11.61	——
	DOUGLAS												
	Amnicon L.	LM Bass	6–23–66	3	10–16"	.92	1.07	.53	.88	2.48	.050	269.6	5.44
		Walleye	6–23–66	3	19–24"	4.76	.485	.129	.249	.863	.025	18.13	.525
		Muskellunge	6–23–66	1	25"	2.26	.192	.094	.104	.390	.007	17.26	.310
	Brule R. (30)	Sucker	9–19–66	3	12"	1.83	.014	.011	.043	.068	——	3.72	——
		Brown Trout	9–19–66	10	6–9"	2.56	.038	.018	.032	.088	——	3.44	——
		Rainbow Trout	9–19–66	6	6–10"	3.17	.038	.009	.021	.068	——	2.15	——
	Brule R. (31)	Sucker	9–16–66	3	11–15"	1.98	.030	.013	.022	.065	——	3.28	——
		Sucker	9–19–66	3	14–15"	.22	.018	.025	.048	.091	——	41.36	——
		Brown Trout	9–19–66	3	13–16"	4.03	.052	.012	.015	.079	Trace	1.96	Trace
		Rainbow Trout	9–19–66	5	8–10"	4.20	.037	.018	.018	.073	.021	1.74	.50
	Brule R. (32)	Brook Trout	10–3–66	6	6–8"	2.54	.038	.009	.021	.068	——	2.68	——
	St. Croix R. (33)	Sucker	6–6–66	1	21"	3.61	.049	.039	.032	.120	——	3.32	——
		Redhorse	6–6–66	1	——	.46	.074	.056	.103	.233	——	50.65	——
		LM Bass	6–6–66	2	11–17"	.39	.129	.041	.046	.216	Trace	55.38	Trace
		Walleye	6–6–66	1	19"	4.63	.391	.146	.321	.858	——	18.53	——
		Northern Pike	6–6–66	6	5–25"	.80	.097	.039	.048	.184	——	23.00	——
	Sand L.	Sucker	6–16–66	2	20"	5.27	.105	Trace	Trace	.105	——	1.99	——
		Bullhead	6–16–66	10	8–10"	1.69	.058	.023	.024	.105	——	6.21	——
		Bluegill	6–16–66	10	6–8"	3.21	.241	.086	.155	.482	.022	15.02	.685
		LM Bass	6–16–66	3	12–13"	1.09	.205	.054	.100	.359	Trace	32.94	Trace
		Perch	6–16–66	7	6–9"	2.94	.054	.018	.012	.084	Trace	2.86	Trace
		Northern Pike	6–16–66	5	14–19"	.48	.088	.028	.041	.157	——	32.71	——
	Simms L.	Sucker	6–9–66	3	14–23"	1.39	.148	.032	.055	.235	——	16.90	——
		Pumpinseed Bluegill	6–9–66	10	6–9"	1.21	.129	.019	.049	.197	——	16.28	——
		LM Bass	6–13–66	4	10–11"	2.73	.137	.052	.029	.218	——	7.99	——
		Perch	6–13–66	20	5–7"	1.06	.179	.063	.105	.347	——	32.74	——
		Rainbow Trout	6–9–66	5	9"	.17	.047	.021	.031	.099	Trace	58.24	Trace
		Rainbow Trout	6–9–66	5	9"	.32	.076	.025	.037	.138	——	43.13	——

(30) Stones Bridge Area
(31) Big Lake Area
(32) Above County Highway "C"
(33) Below Cranberry Bog

TABLE 1. FISH ANALYSIS FOR DDT AND ITS ANALOGS AND DIELDRIN

AREA	COUNTY AND WATERS SAMPLED	SPECIES	COLLECTION DATE	NO. IN SAMPLE	SIZE RANGE	PERCENT FAT	WHOLE FISH BASIS – PPM					FAT BASIS – PPM	
							DDE	DDD	DDT	TOTAL DDT ANALOGS	DIEL-DRIN	TOTAL DDT ANALOGS	DIEL-DRIN
NW	PRICE												
	Cranberry L.	Bluegill	6–17–66	10	8–10"	2.20	.165	.065	.115	.345	——	15.68	——
		Crappie	6–17–66	6	11–12"	3.39	.274	.170	.364	.808	——	23.84	——
		Crappie	6–7–66	4	7–11"	4.11	.184	.110	.137	.431	Trace	10.49	Trace
		LM Bass	6–7–66	3	15–17"	3.95	.274	.154	.240	.668	Trace	16.91	Trace
		Northern Pike	6–7–66	4	18–22"	.23	.061	.031	.034	.126	——	54.78	——
	RUSK												
	Hemlock Creek	Brook Trout	9–30–66	10	6–10"	1.80	.020	.024	.038	.082	——	.456	——
	Murphy Flowage	Sucker	6–13–66	2	13–17"	3.09	.020	.019	.023	.062	Trace	2.01	Trace
		Bullhead	6–13–66	10	9–12"	1.18	.024	.0	Trace	.024	——	2.03	——
		Bluegill	6–13–66	10	6–7"	1.11	.015	.014	.027	.056	——	5.05	——
		LM Bass	6–17–66	3	13–15"	.72	.005	.015	.025	.045	——	6.25	——
		Perch	6–17–66	20	5–9"	2.33	.025	.015	.028	.068	——	2.92	——
		Northern Pike	6–13–66	3	18–21"	.36	Trace	Trace	Trace	Trace	——	Trace	——
	WASHBURN												
	Beaver Brook (34)	Brook Trout	9–2–66	8	7–10"	2.97	.102	.056	.04	.198	.098	6.67	3.30
		Brown Trout	9–2–66	5	6–9"	2.91	.059	.028	.019	.106	.042	3.64	1.44
	Beaver Brook (35)	Sucker	9–2–66	4	8–9"	5.37	.076	.057	.027	.160	.073	2.98	1.36
	Beaver Brook (36)	Brown Trout	9–2–66	3	9–12"	3.02	.103	.057	.025	.185	.090	6.13	2.98

(34) Near Cranberry Bogs between Dam and Sandbags
(35) Sandbanks
(36) Dam Area below sandbanks

Table 2. FAT CONTENT OF WHOLE FISH SAMPLES ANALYZED IN THE 1966 SURVEY

Species	Number Samples	Percent Fat	
		Range	Average
Sucker	31	.22 - 6.91	2.53
Redhorse	6	.46 - 8.12	4.98
Buffalo	2	6.64 - 10.14	8.39
Sheepshead	2	9.68 - 14.43	12.06
Quillback	1	5.34	5.34
Carp	23	3.63 - 12.95	6.89
LM Bass	26	.39 - 5.65	2.17
SM Bass	7	.86 - 5.63	2.34
Bluegill	26	.37 - 6.55	3.09
Crappie	4	2.40 - 4.92	3.71
Sunfish	3	1.14 - 3.52	2.36
Rock bass	1	1.67	1.67
Muskellunge	6	2.26 - 5.98	4.07
Northern Pike	33	.09 - 6.90	1.62
Bullhead	21	.67 - 4.03	1.89
Catfish	10	2.57 - 16.27	8.99
Perch	26	.65 - 7.26	3.05
Sauger	2	5.47 - 6.59	6.03
Walleye	27	1.27 - 11.62	5.82

Table 2. FAT CONTENT OF WHOLE FISH SAMPLES ANALYZED IN THE 1966 SURVEY (page 2)

Species	Number Samples	Percent Fat	
		Range	Average
Cisco	3	2.76 - 12.82	6.98
Whitefish	1	1.84	1.84
Brook Trout	15	1.21 - 6.15	3.43
Brown Trout	18	1.08 - 6.89	4.01
Rainbow Trout	10	.17 - 13.89	5.42
Lake Trout	2	7.92 - 8.81	8.37
Splake	1	3.24	3.24
White Bass	2	5.81 - 9.12	7.47
Alewife	1	6.18	6.18
Shad	1	4.39	4.39
Troutperch	24	1.51	1.51

Figure 1. GRAPHIC COMPARISON OF DDT LEVELS IN COMMON SPECIES (page 1)

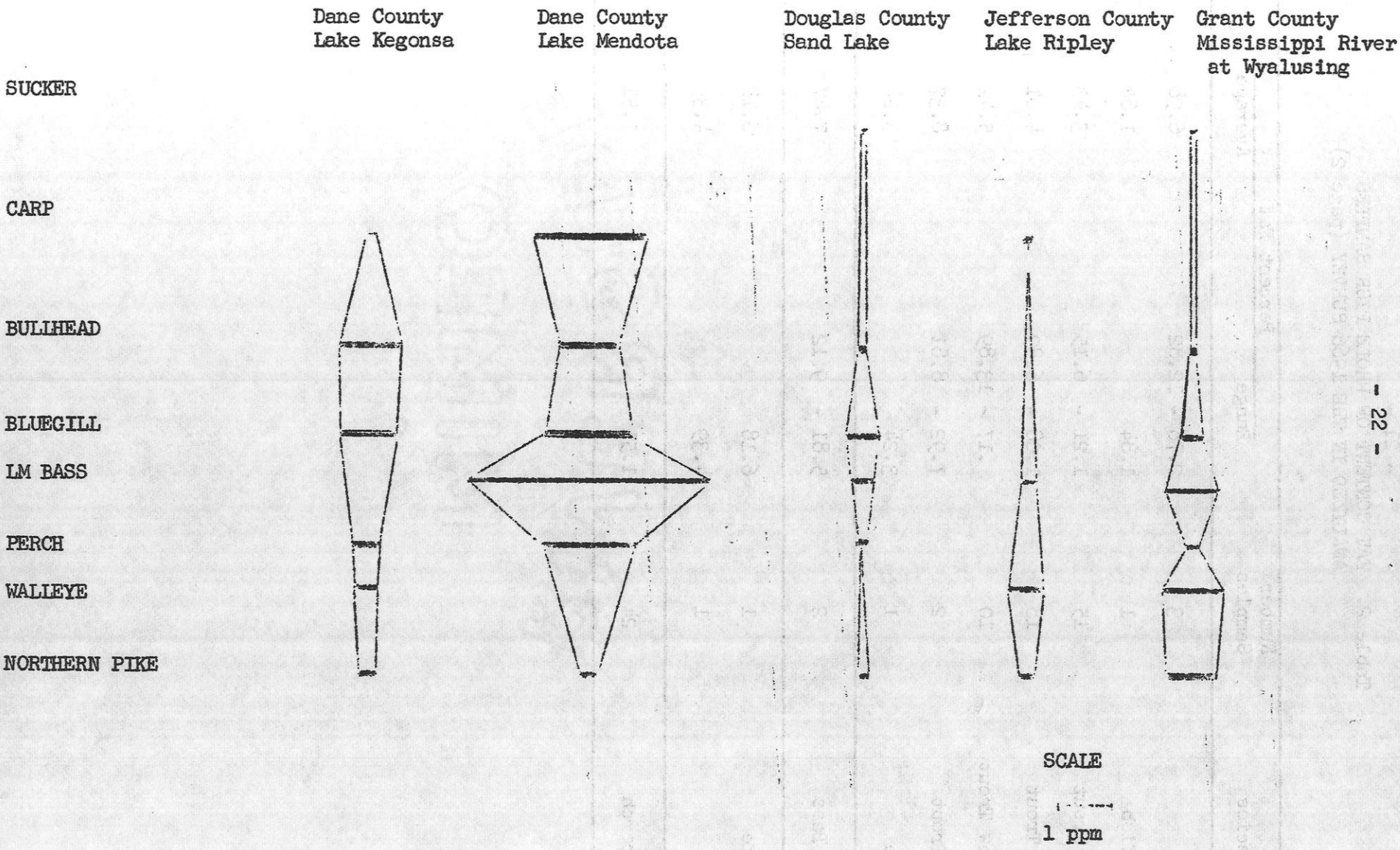


Figure 1. GRAPHIC COMPARISON OF DDT LEVELS IN COMMON SPECIES (page 2)

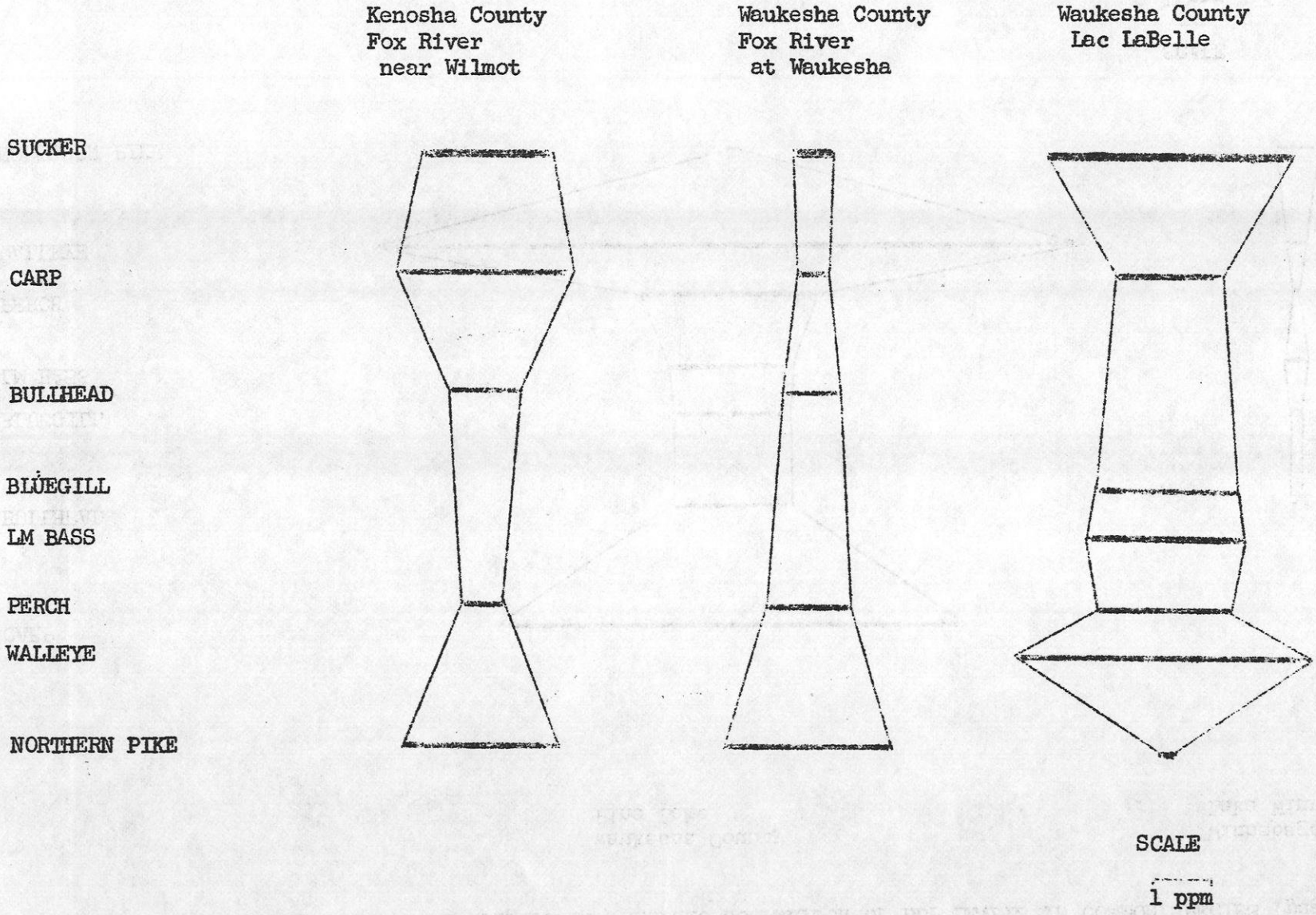


Figure 1. GRAPHIC COMPARISON OF DDT LEVELS IN COMMON SPECIES (page 3)

Waukesha County
Pine Lake

Winnebago County
Lake Winnebago

CARP

BULLHEAD

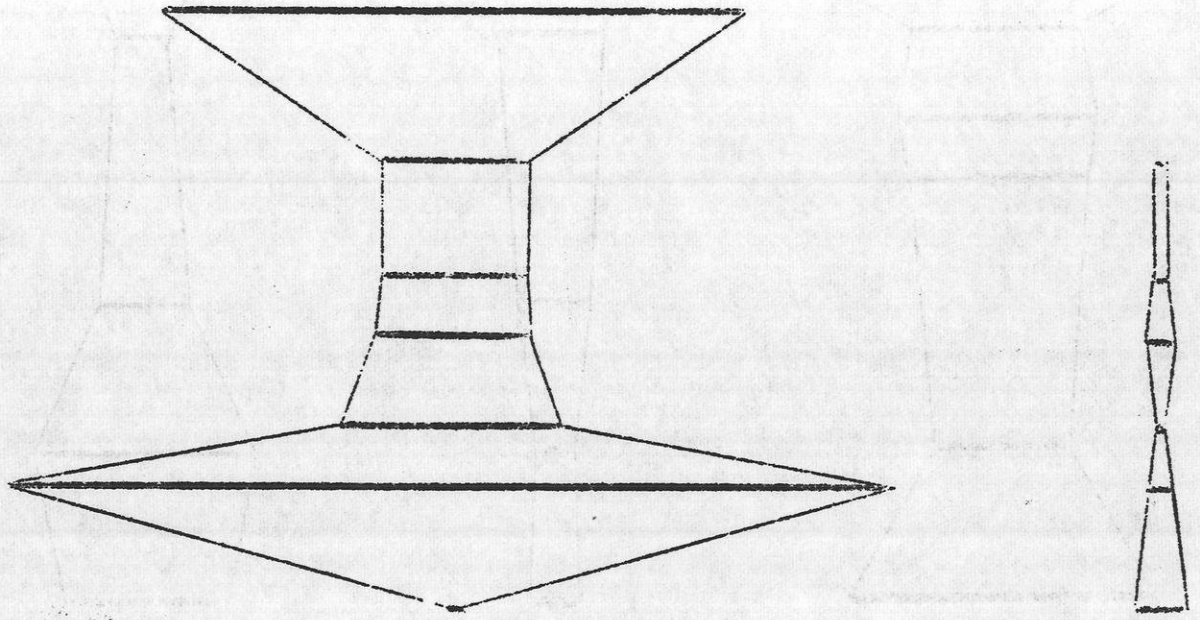
BLUEGILL

LM BASS

PERCH

WALLEYE

NORTHERN PIKE



SCALE

1 ppm

Figure 2. GRAPHIC COMPARISON OF DIELDRIN LEVELS IN COMMON SPECIES (page 1)

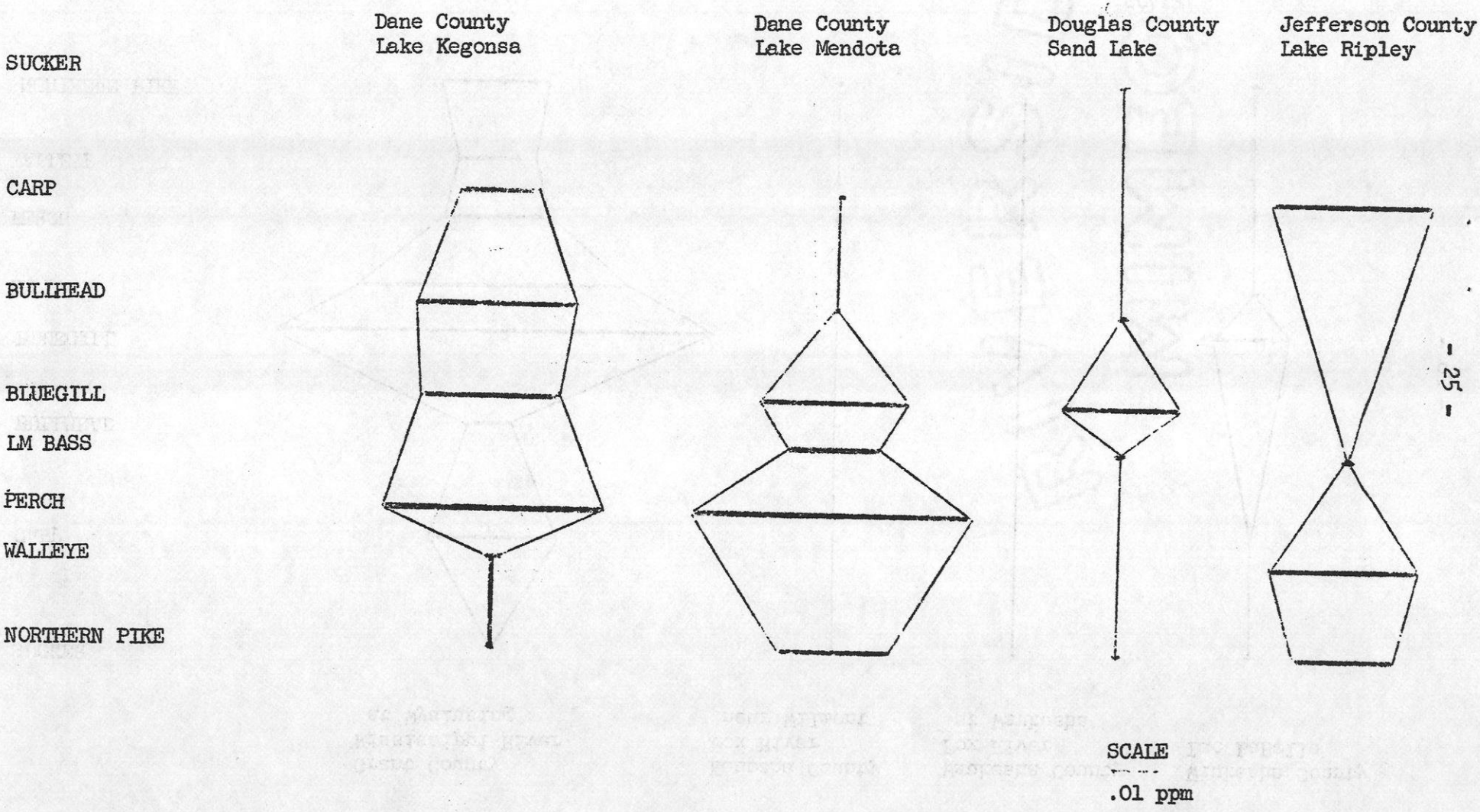


Figure 2. GRAPHIC COMPARISON OF DIELDRIN LEVELS IN COMMON SPECIES (page 2)

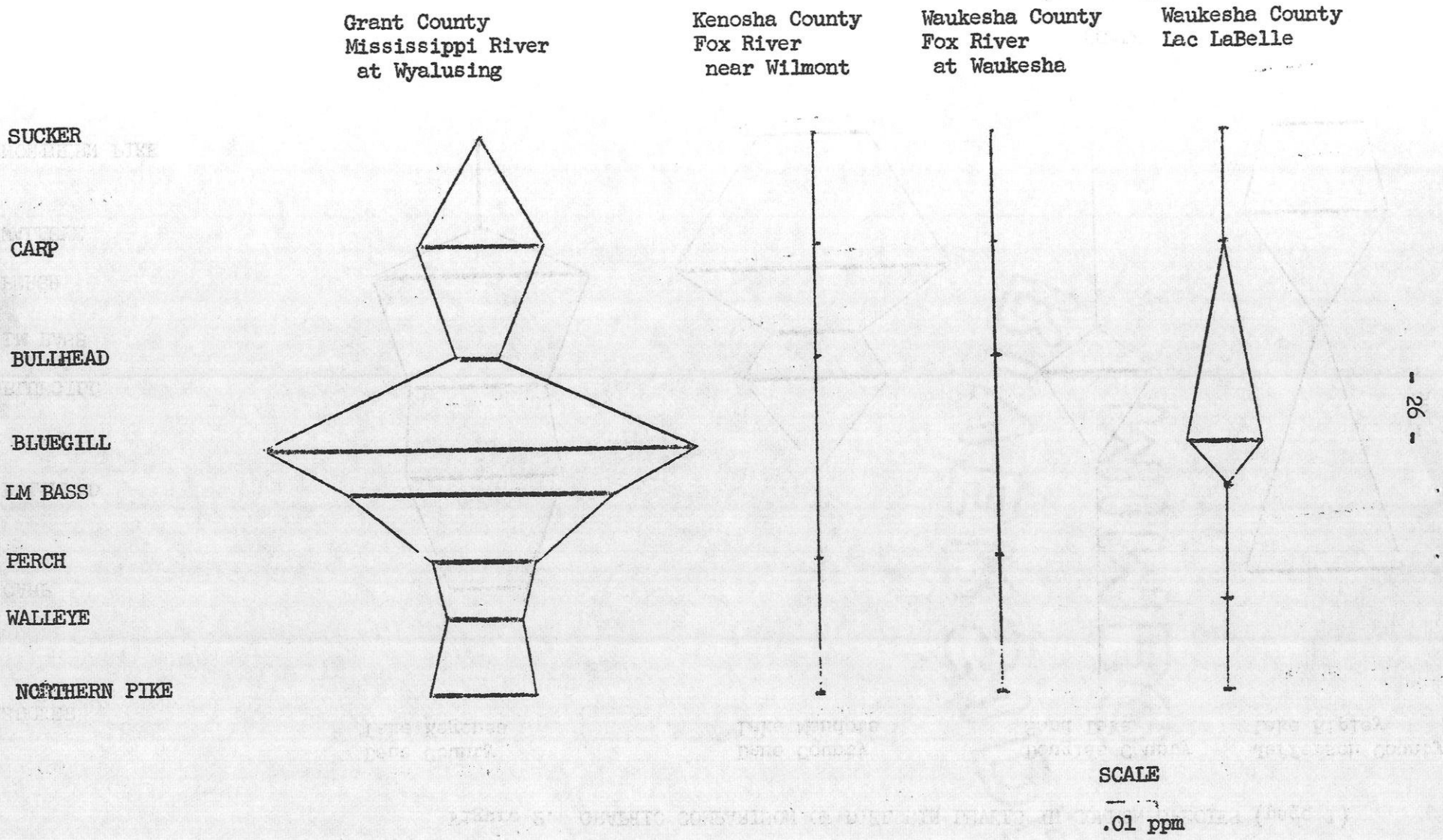
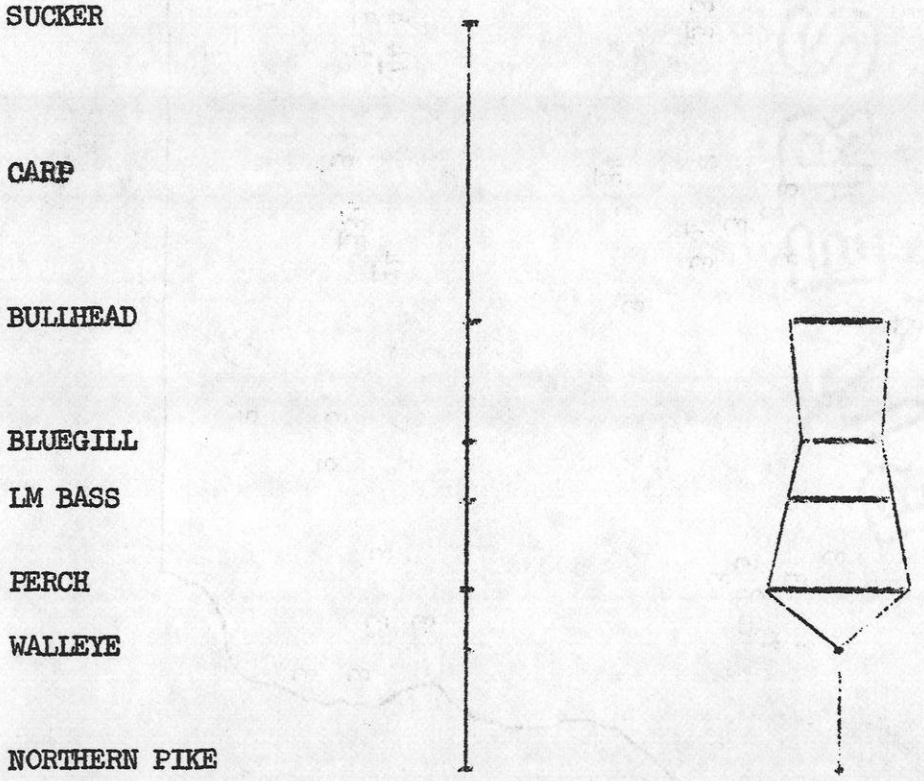


Figure 2. GRAPHIC COMPARISON OF DIELDRIN LEVELS IN COMMON SPECIES (page 3)

Waukesha County
Pine Lake

Winnebago County
Lake Winnebago



SCALE
.01 ppm

Figure 3. AVERAGE DDT LEVELS IN FISH FROM 1965 and 1966 SAMPLING LOCATIONS

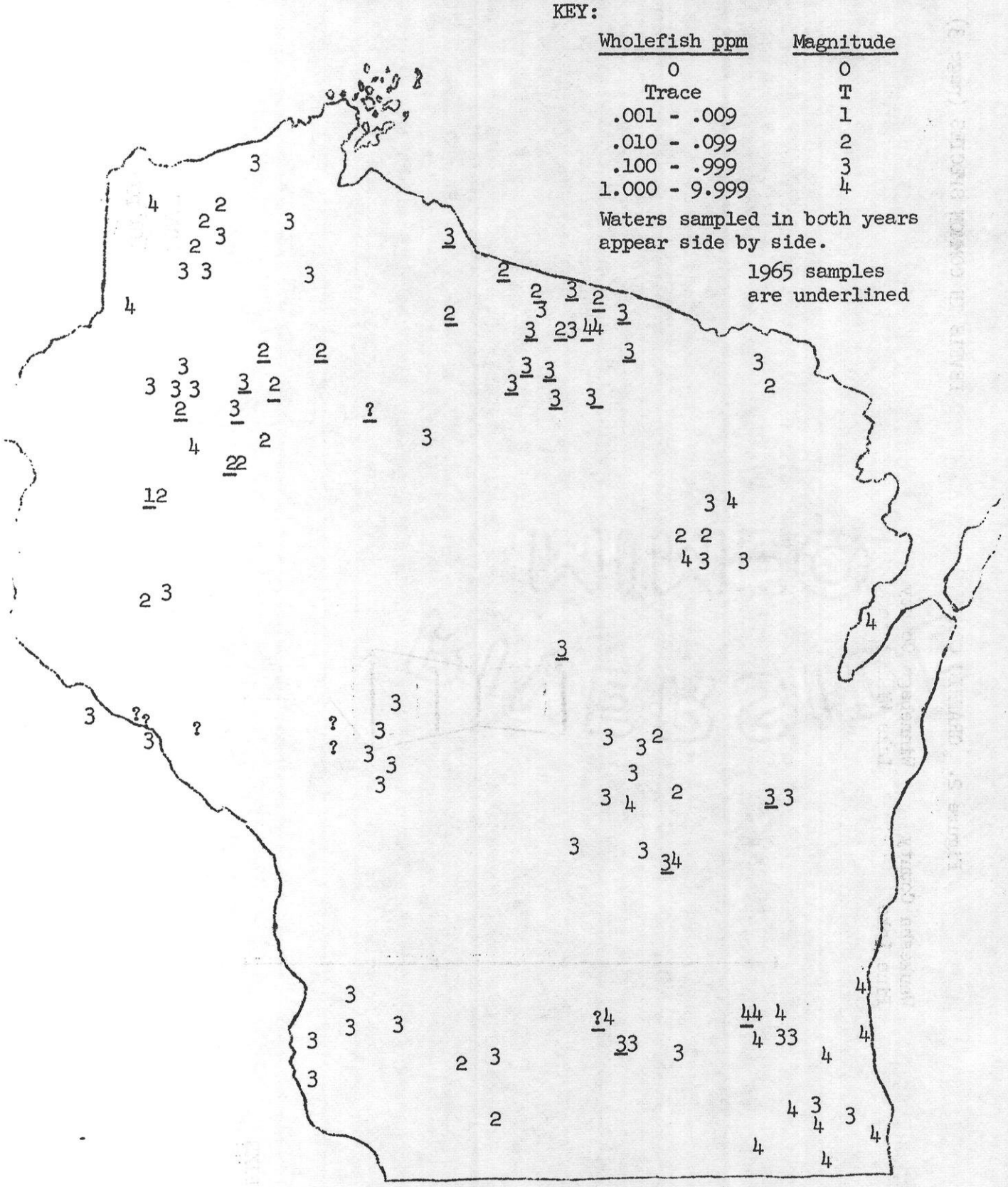
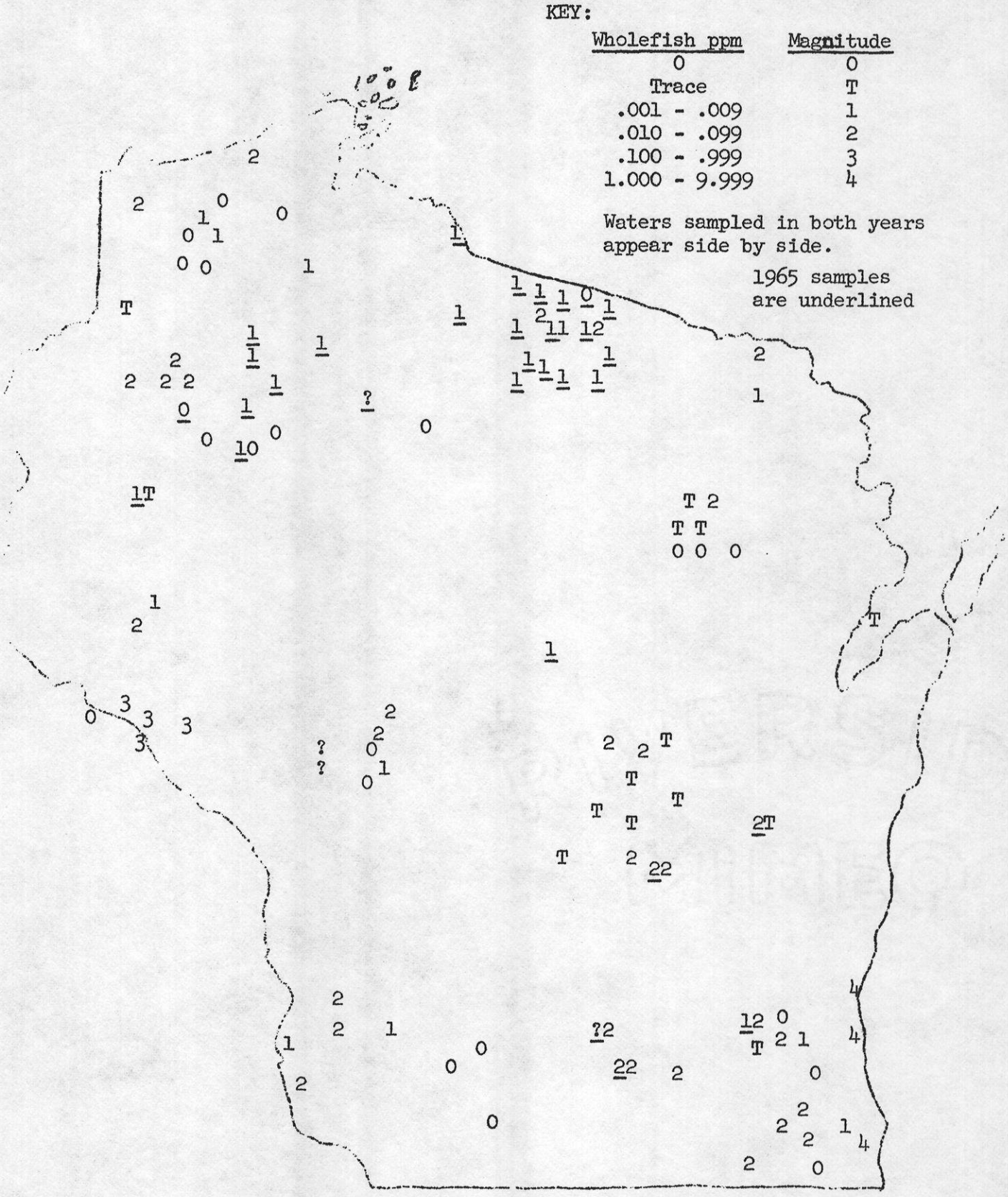


Figure 4. AVERAGE DIELDRIN LEVELS IN FISH FROM 1965 and 1966 SAMPLING LOCATIONS



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