Mercury levels in Wisconsin fish and wildlife. No. 52 1972

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MERCURY LEVELS IN WISCONSIN FISH AND WILDLIFE

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ABSTRACT

Mercury determinations were made on 1,824 fish fillet samples representing 139 locations covering 52 of Wisconsin's 72 counties and boundary waters of Lake Michigan, Green Bay, Lake Superior, and the Mississippi River. All Wisconsin fish analyzed contained some mercury. Mercury levels in fish from waters removed from any known source of mercury use averaged .19 ppm and ranged between .01 and .60 ppm mercury. The highest mercury levels, averaging about 1 ppm and ranging between .10 and 4.89 ppm, occurred in fish taken from sections of the Chippewa, Flambeau, and Wisconsin Rivers located below paper mills and below a mercury cell chlorine-caustic soda plant. Different species vary in mercury content, and the larger fish often contain higher concentrations of mercury than do smaller fish of the same species taken from the same water.

Fish samples taken from the following areas contained mercury levels averaging above the .5 ppm guideline established by the Food and Drug Administration for banning fish from interstate markets: the 350-mile stretch of the Wisconsin River below Rhinelander, 40 miles of the Flambeau River between Cedar Rapids and the junction with the Chippewa River, and 50 miles of the Chippewa River from the junction with the Flambeau River to Eau Claire.

Sportsmen were warned to limit consumption of fish from these waters to one meal per week, which would not constitute a health hazard.

Mercury determinations were made on 234 wildlife muscle samples and 220 wildlife liver samples. The common game species were sampled including deer, rabbits, squirrels, ruffed grouse, pheasants, puddle ducks, diving ducks and geese. Swans, pied-bill grebes, and blue herons were also sampled. Mercury levels in muscle and liver tissue of most Wisconsin wildlife was well below .5 ppm. Water birds, including waterfowl, contained more mercury than mammals or upland game birds. Livers of diving ducks, herons, and grebes approached or exceeded .5 ppm. No geographic locations were noted where mercury seemed to be more concentrated in wildlife.

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By

Stanton J. Kleinert and Paul E. Degurse

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INTRODUCTION

The Wisconsin Department of Natural Resources began a survey in April 1970 to determine mercury levels in fish from a variety of Wisconsin waters, including waters receiving industrial and municipal wastes, waters draining agricultural areas, lakes and streams removed from the urban population centers, and waters situated in the various soil and bedrock provinces of the state. The investigation followed Swedish (Hannerz, 1968) and Canadian (Bligh, 1970) reports of mercury contamination of fish.

The fishery investigation was part of a general investigation precipitated by the Canadian announcement in March of widespread mercury contamination of fish in Lake St. Clair associated with industrial pollution. Fish, wildlife, waters, and sediments were monitored. Industrial and municipal sources of mercury discharge were investigated and evaluated. Public hearings were held by the Department in Madison in May, August, and October 1970 to consider aspects of mercury pollution. In December 1970, the Department issued general orders establishing effluent standards for mercury discharges to state waters.

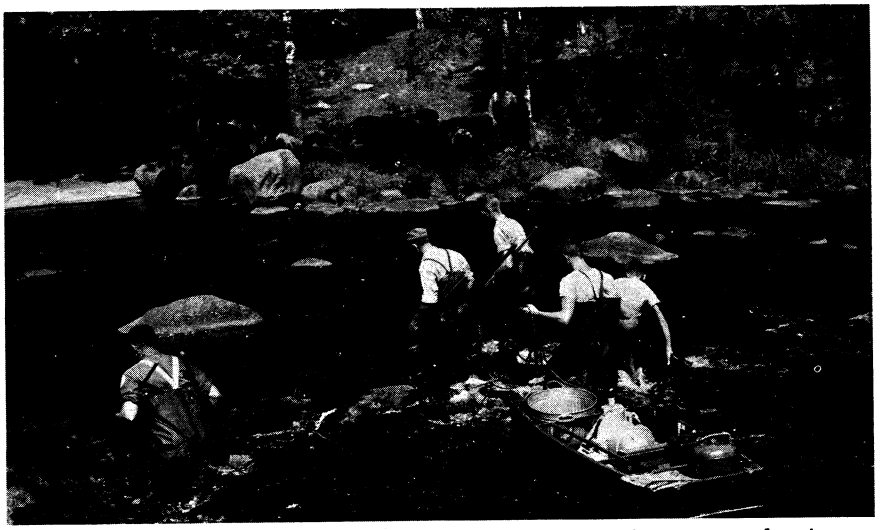
Preliminary reports concerning mercury levels in Wisconsin fish (Kleinert and Degurse, 1971) and mercury content of sediments, sewage treatment plant effluents and water supplies (Konrad, 1971) were issued. This report updates the earlier fisheries report and presents mercury levels found in Wisconsin wildlife.

STUDY METHODS

Fish and Wildlife Collections

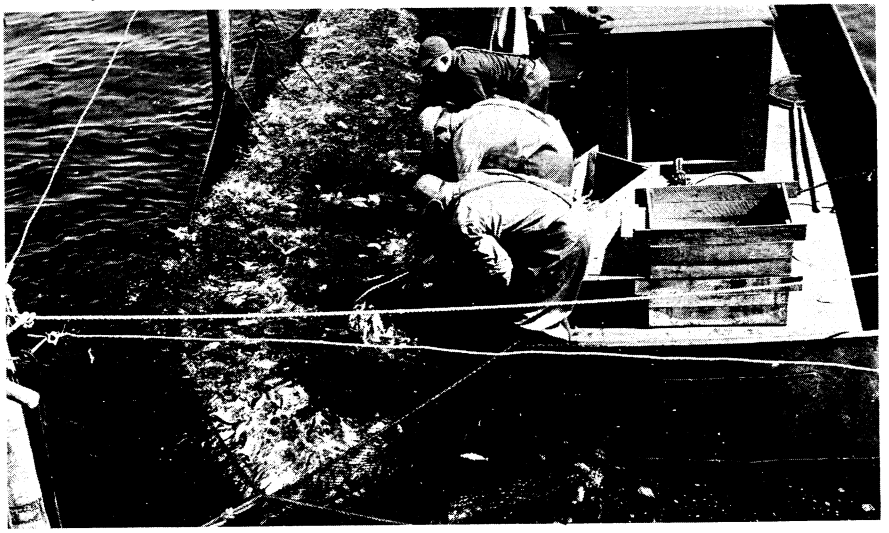
Fish and wildlife collections were made by field personnel of the Wisconsin Department of Natural Resources from April through November 1970. Fish collections were again made between March and June 1971. Fish were most commonly collected by either trap nets or electrofishing gear with some collections furnished by sport and commercial fishermen. Road kills provided many of the wildlife specimens, with live trapping, shooting, or contributions from sportsmen yielding the remainder.

Fish samples consisted of 1 to 20 fish of the same species. Almost all samples contained medium or larger fish of sufficient size for use as human food or commercial processing. Wildlife samples consisted of whole specimens in the case of small mammals or birds. Deer tissue samples consisted of one pound of muscle tissue from the hind quarters and one pound of liver. Field personnel were instructed to wrap each fish species or wildlife specimen in separate plastic bags and freeze until delivery could be made to the laboratory.



Samples for mercury analysis were obtained from DNR personnel using electrofishing gear in streams, from sport fishermen . . .

. . . and from commercial fishermen.



Laboratory Analysis

Fish fillets, or more specifically fish muscle tissue excluding bone, wildlife muscle and liver tissue, were processed for mercury analysis. Breast muscle of birds and muscle tissue from the hind quarters of small mammals and deer were selected for analysis. Analysis was made on the wet (not previously dried) sample as follows: The sample (10 g) was digested in a mixture of H_2SO_4-HNO_3 by the standard AOAC procedure (Assoc. Official Anal. Chem., 1965). The digestate was oxidized with 5 percent $KMnO_4$ (drop–wise to a persistent color) prior to reduction with $SnCl_2$ and analysis by the flameless atomic absorption procedure of Rathje (1969). A Beckman Model DU atomic absorption spectrometer, equipped with a 10 x 2 cm flow cell and rapid response recorder, was used for analysis. Mercury values were expressed as ppm (parts per million) of total mercury on a wet weight animal tissue basis. Extraction procedures were checked by spiking samples with mercuric chloride; subsequent digestions yielded mercury recoveries ranging from 92 to 102 percent.

Mercury determinations were made on 1,824 fish fillet samples representing 139 locations covering 52 of Wisconsin's 72 counties and boundary waters of Lake Michigan, Green Bay, Lake Superior and the Mississippi River (Fig. 1). The species composition of the collections generally reflected the fish populations of the waters sampled. Thirty-four percent of the fish sampled were rough fish and 66 percent were game and panfish (Table 1). Wildlife were collected from 35 counties (Fig. 2 and Table 2). Mercury determinations were made on 234 wildlife muscle and 220 wildlife liver samples representing the following species: white-tailed deer, rabbit, squirrel, ruffed grouse, ring-necked pheasant, puddle ducks, diving ducks, coot, geese, whistling swan, pied-bill grebe, great blue heron, and hooded merganser. Both local and migrating waterfowl were included.

Alkalinity and pH in river waters were determined by the methods described in Standard Methods (Amer. Pub. Health Assoc., 1965).

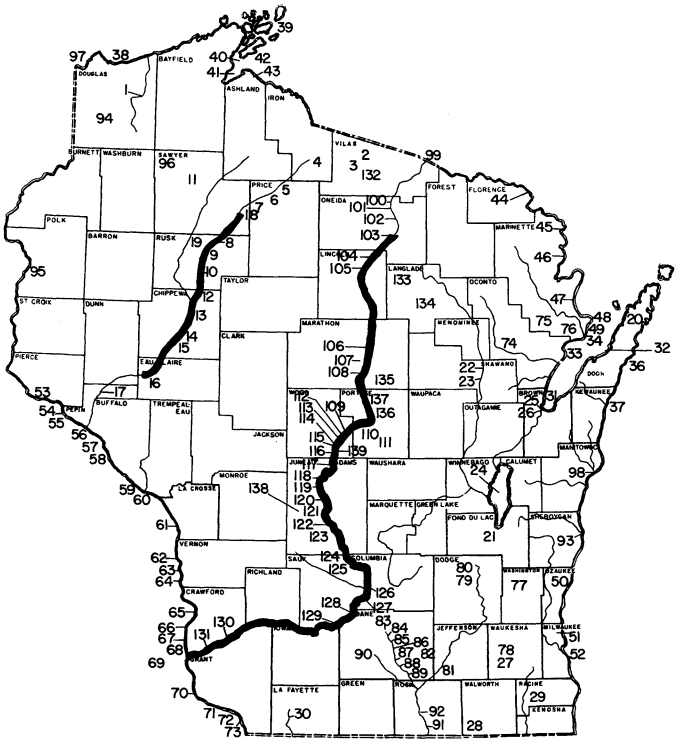


FIGURE 1. *Location of Fish Collections and Fish Consumption Warning Areas.*

TABLE 1. Fish Species Collected and Analyzed for Mercury

Fish Species		Letter	Percent of
Common Name	Scientific Name	Code	All Samples
Rough Fish and Minnows			
Sucker	*Catostomus* spp.	S	14
Redhorse	*Moxostoma* spp.	R	3
Buffalo	*Ictiobus* spp.	BF	M
Quillback	*Carpiodes cyprinus*	Q	1
Freshwater drum	*Aplodinotus grunniens*	D	3
Carp	*Cyprinus carpio*	C	12
Goldfish	*Carassius auratus*	GF	M
Shiner	*Notropis* spp.	SH	M
Mooneye	*Hiodon tergisus*	MO	M
Burbot	*Lota lota*	BB	M
Bowfin	*Amia calva*	BW	M
Alewife	*Alosa pseudoharengus*	A	M
Game Fish and Panfish			
Largemouth bass	*Micropterus salmoides*	LMB	6
Smallmouth bass	*Micropterus dolomieui*	SMB	3
Bluegill	*Lepomis macrochirus*	B	4
Crappie	*Pomoxis* spp.	CR	5
Pumpkinseed	*Lepomis gibbosus*	P	2
Rockbass	*Ambloplites rupestris*	RB	2
Muskellunge	*Esox masquinongy*	M	M
Northern pike	*Esox Lucius*	NP	11
Bullhead	*Ictalurus* spp.	BU	3
Catfish	*Ictalurus* spp.	CC	3
Yellow perch	*Perca flavescens*	YP	5
Sauger	*Stizostedion canadense*	SA	1
Walleye	*Stizostedion vitreum*	W	12
Cisco	*Coregus artedii*	CI	M
Brook trout	*Salvelinus fontinalis*	BT	1
Lake whitefish	*Coregonus elupeaformis*	LW	M
Brown trout	*Salmo Trutta*	BR	1
Rainbow trout	*Salmo gairdneri*	RT	1
Lake trout	*Salvelinus namaycush*	LT	1
Coho salmon	*Oncorhynchus kisutch*	CS	1
White bass	*Roccus chrysops*	WB	3
Yellow bass	*Roccus mississippiensis*	YB	1
Sturgeon	*Acipenser* spp.	ST	M
Burbot	*Lota lota*	L	M

M denotes minor use in the survey constituting less than .5 percent of all fish samples.

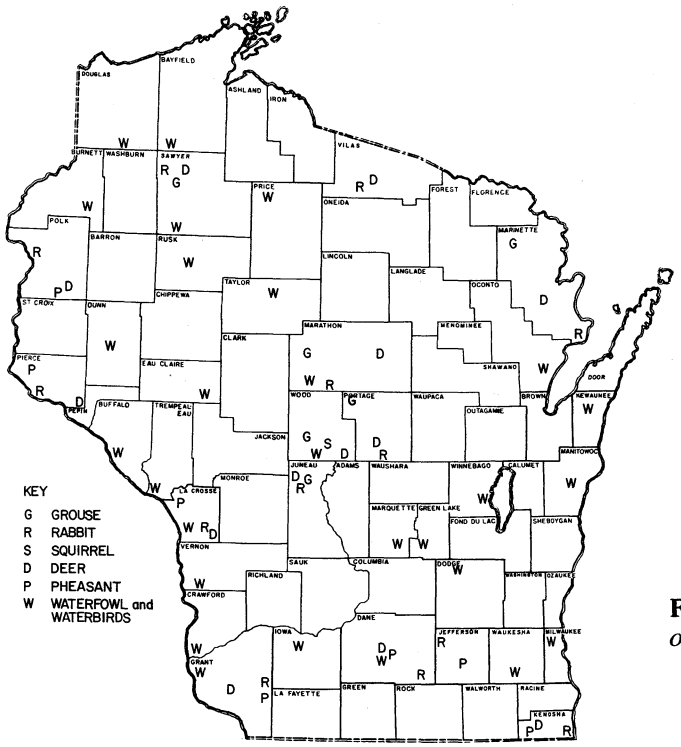


FIGURE 2. *Locations of Wildlife Collections.*

TABLE 2. Wildlife Species Collected and Analyzed for Mercury.

Common Name	Scientific Name
Mammals	
White-tailed deer	*Odocoileus virginianus*
Cottontail rabbit	*Sylvilagus floridanus*
Snowshoe rabbit	*Lepus americanus*
Gray squirrel	*Sciurus carolinensis*
Red squirrel	*Tamiasciurus trouessart*
Birds	
Puddle ducks	
American widgeon	*Mareca americana*
Black duck	*Anas rubripes*
Blue-winged teal	*Anas discors*
Green-winged teal	*Anas carolinensis*
Mallard	*Anas platyrhynchos*
Pintail	*Anas acuta*
Shoveler	*Spatula clypeata*
Wood duck	*Aix sponsa*
Diving ducks	
Bufflehead	*Bucephala albeola*
Canvasback	*Aythya valisineria*
Goldeneye	*Bucephala* spp.
Greater scaup	*Aythya marila*
Lesser scaup	*Aythya affinis*
Redhead	*Aythya americana*
Ring-necked duck	*Aythya collaris*
Ruddy duck	*Oxyura jamaicensis*
Other birds	
American coot	*Fulica americana*
Canada geese	*Branta canadensis*
Great blue heron	*Ardea herodias*
Hooded merganser	*Lophodytes cucullatus*
Pied-billed grebe	*Podilymbus podiceps*
Ring-necked pheasant	*Phasianus colchicus*
Ruffed grouse	*Bonasa unbellus*
Whistling swan	*Cygnus columbianus*

FINDINGS

Mercury Levels in Fish

Mercury levels in fish collections from various waters are summarized in Table 7 (Appendix). These data are summarized by collection rather than individual sample to reduce the length of the tabular data required in this report. Complete data are maintained in Department of Natural Resources files.

All Wisconsin fish analyzed contained mercury. Mercury levels in fish from waters removed from any known source of mercury use averaged .19 ppm and ranged between .01 and .60 ppm (sites 1, 2, 3, 4, 11, 19, 30, 82, 99, and 100 in Table 7). These values are believed to be normal background levels of mercury present in Wisconsin fish.

Fish samples taken from the 350-mile stretch of the Wisconsin River below Rhinelander, 40 miles of the Flambeau River between Cedar Rapids and the junction with the Chippewa River, and the 50 miles of the Chippewa River from the junction with the Flambeau to Eau Claire contained mercury levels averaging above .5 ppm, the guideline established by the Food and Drug Administration for banning fish from interstate markets. These levels were found in both 1970 and 1971. The Wisconsin Department of Health and Social Services warned against the frequent consumption of these fish but advised that one meal of fish per week would not constitute a health hazard. The Department of Natural Resources has advised sportsmen to limit fish consumption to one meal per week from these waters.

Mercury levels in fish collections from the Wisconsin River averaged: headwaters .24 ppm, upper river .51 ppm, middle river 1.25 ppm, and lower river .73 ppm (Table 3). There was a marked increase in the mercury levels of fish below Rhinelander (Lakes Alice and Mohawksin). Farther downstream, from Lake Wausau to Wisconsin Rapids, mercury levels in fish diminished to an average of about .5 ppm. The highest mercury levels in fish in the state occurred in the Castle Rock and Petenwell Flowages and

Dells area of the Wisconsin River. Here fish fillets commonly averaged 1.25 ppm mercury. Farther downstream in the Lower Wisconsin River, mercury levels in fish averaged .73 ppm.

Mercury levels in fish from the upper and lower sections of the Flambeau River averaged .35 and .87 respectively (Table 3). Mercury levels in fish from the Chippewa Flowage and the middle and lower sections of the Chippewa River averaged .14, .60 and .36 ppm respectively (Table 3). Monitoring results to date show mercury levels in fish sampled in the various sections of the Wisconsin, Chippewa and Flambeau Rivers did not change significantly between 1970 and 1971.

Samples from the St. Louis River mouth averaged .62 ppm. The St. Louis River flows through Minnesota; the last miles of the river are shared by Minnesota and Wisconsin. In December 1970, the Minnesota Department of Conservation advised fish consumption be limited to one meal per week on the St. Louis River from Cloquet, Minnesota to Lake Superior. This fish consumption caution should also be observed by Wisconsin fishermen.

Averaged mercury values in fish for other Wisconsin waters were Rock River .09 ppm, Lake Michigan .14 ppm, Milwaukee River and harbor .18 ppm, Mississippi River .24 ppm, Green Bay .27 ppm, Fox (Illinois) River .29 ppm, Lake Superior .36 ppm, and the Menominee River .43 ppm. In addition to these waters, many streams and lakes were also monitored and the data are presented in Table 7 (Appendix). Individual fish samples from the same collection site sometimes varied considerably in mercury content. In many of the waters sampled, individual fish, particularly large catfish, sucker, walleye, and northern pike, exceeded .5 ppm mercury, while the average mercury content of samples taken from the collection site was well below .5 ppm mercury. This suggests that there are differences in the mercury content of fish depending on species and age groups.

Bluegills from a Wisconsin Lake. Mercury levels in bluegills and other panfish were generally lower than in other species.

TABLE 3. Averaged Mercury Levels in Selected Collections of Fish Fillets from Wisconsin River Systems and the Great Lakes

Location	Sample Sites	Mercury (ppm) Low	Average	High
Rock River	79-81, 91	.01	.09	.20
Lake Michigan	36-37	.05	.14	.70
Milwaukee River & Harbor	50-52	.05	.18	.35
Mississippi River	53-73	.06	.24	.93
Green Bay	31-34	.01	.27	.75
Fox (Illinois) River	29	.05	.29	.95
Lake Superior	38-43	.09	.36	1.17
Menominee River	45-49	.06	.43	1.72
Chippewa River				
(a) Chippewa Flowage	11	.11	.14	.26
(b) Middle River*	12-15	.12	.60	4.89
(c) Lower River	16-17	.11	.36	.75
Flambeau River				
(a) Upper River	4-7	.06	.35	.69
(b) Lower River*	8-10	.11	.87	2.03
Wisconsin River				
(a) Headwaters	99-103	.06	.24	.67
(b) Upper River*	104-112	.10	.51	1.85
(c) Middle River*	113-119, 121-127	.21	1.25	4.62
(d) Lower River*	128-131	.08	.73	2.91

*Fishermen are advised to limit their consumption of fish to one meal per week from these waters.

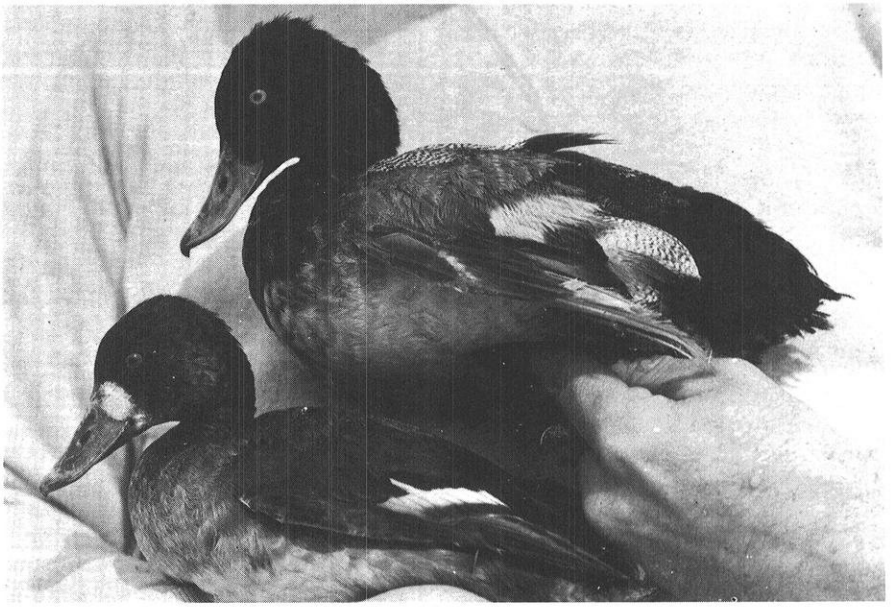
Mercury Levels in Wildlife

Mercury levels in various individual wildlife samples are presented in Table 8 (Appendix). Locations of the samples are shown in Figure 2.

Mercury levels in wildlife muscle and liver tissue are well below the .5 ppm guideline in most cases. Deer and rabbits showed very low levels of mercury averaging only .01 ppm in muscle and liver tissue. Ruffed grouse and ring-necked pheasants averaged .01 ppm in muscle and .04 ppm in liver. Geese averaged .01 ppm in muscle and liver tissue, while swans averaged .06 ppm in muscle and .16 ppm in liver tissue. Puddle ducks averaged .09 ppm in muscle and .23 ppm in liver tissue. Diving ducks averaged .12 ppm in muscle and .45 ppm in liver tissue. The highest mercury values observed in wildlife came from livers of certain ducks, particularly diving ducks, herons and grebes, which approached or exceeded .5 ppm. No geographic locations were noted where mercury seemed to be more concentrated in wildlife. However, species differences in mercury levels were evident. Water birds, including certain waterfowl, contain more mercury than mammals or upland game birds.

Wisconsin white-tailed deer. Analysis of muscle and liver tissue from car-killed deer showed that mercury levels were extremely low, averaging only .01 ppm.

A pair of scaup live–trapped on a Wisconsin marsh. Mercury levels in most Wisconsin geese, ducks and coots were generally small.



Certain water birds, particularly mergansers, pied–billed grebes, and to a lesser extent great blue herons, contained elevated mercury levels. Liver tissue contained higher concentrations of mercury than muscle.

DISCUSSION

Mercury Levels in Fish, Wildlife, and Other Foods in North America

There is little published data on mercury levels in fish and wildlife to compare with the Wisconsin data. Averaged mercury levels reported in various species of Canadian fish sampled from uncontaminated areas varied between .04 and .76 ppm, but averaged well below .5 ppm mercury (Great Lakes Environmental Conference, 1970). These values are similar to those found in Wisconsin fish sampled in uncontaminated areas and probably reflect background levels naturally present in fish muscle tissue. Averaged mercury levels for Canadian fish from contaminated areas ranged as high as 4.14 ppm for rock bass in Lake St. Clair, 2.80 for rock bass in the St. Clair River, and 10.11 ppm for burbot in the Wabigoon–English System (Great Lakes Environmental Conference, 1970). Mercury values in freshwater fish in Sweden range as high as 8 ppm with .03 to .18 ppm regarded as a normal background concentration (Hannerz, 1968).

Different species vary in mercury content, and larger fish often contain higher concentrations of mercury than do smaller fish of the same species taken from the same water (Bligh, 1971). In Sweden, northern pike are reported to contain more mercury than other species in the same waters (Nelson et al., 1971). In our Wisconsin study, walleye, sucker, redhorse, northern pike, catfish, and bullhead frequently contained higher mercury levels while the panfishes including bluegill, pumpkinseed, and yellow perch often contained lower levels. Reasons for species differences in mercury content may be related to diet and habitat. Because different species differ in mercury content, it is essential that all important species in the fishery be sampled before a judgment is made regarding the magnitude of mercury levels in the total fish population of any water under study.

Fimreite, Fyfe, and Keith (1970) reported mercury levels up to 5.92 ppm in upland game birds in Alberta and Saskatchewan. Study has shown that small amounts of mercury are present in most foods including wheat, fruits, vegetables, dairy products, turkey, and beef (Table 4). Mercury levels in fish, however, are higher than those reported for other foods. Mercury in fish tissue is predominantly methyl mercury according to Canadian (Bligh, 1971) and Swedish reports (Westoo, 1969). Analysis of Wisconsin fish also shows that most of the mercury in fillets is methyl mercury (Table 5).

TABLE 4. Mercury Levels (ppm Hg Wet Weight) in General Food Items (Toronto)

Sage	0.08
Dill	0.33
Dill (home-grown)	0.17
Parsley	0.03
Poppy seeds	0.01
Sunflower seeds	0.006
Walnut	0.07
Milkpowder	0.01
Cheese	0.01
Custard powder	0.02
Noodle	0.02
Cocoa	0.07
Carrots	0.02
Onion	0.01
Spinach	0.06
Potatoes	0.04
Beans (Wh.)	0.02
Corn	0.02
Pumpkin	0.008
Apple	0.05
Wheat	0.04
Cream of wheat	0.02
Beef	0.01
Turkey	0.03
Fresh oysters	0.06
Salmon	0.08

From Jervis, R. E. *in* Great Lakes Environmental Conference (1970).

Factors Associated With Mercury Levels

Aquatic environments normally contain small amounts of mercury in sediments, waters, and living and nonliving organic matter. Because of mercury's tendency to sorb readily on a variety of earth materials, particulate matter suspended in water and bottom sediments of streams are more likely to contain high concentrations of mercury than the water itself (U. S. Government, 1970b). The tendency of mercury to sink rapidly and combine with sulfide in anaerobic bottom sediments to form cinnabar (HgS) appears to be a major scavenging mechanism. Another mechanism which keeps the content of dissolved mercury low is the relatively high reactivity of mercury with organic substances and the resulting uptake by living and nonliving organic matter. In Sweden, it has been noted that mercury levels in northern pike may be less than expected in biologically rich alkaline waters (Nelson et al., 1971).

Because they serve as sediment traps, lakes, ponds, and flowages are likely to retain the mercury which enters them. The significance of such accumulations depends upon the solubility of the final mercury form in the particular environment (U. S. Government, 1970b). The location of mercury deposits in bottom sediments of Wisconsin rivers has been documented by Konrad (1971). This work showed that the highest concentrations of mercury in sediments were found below industrial discharges (mercury cell chlorine-caustic soda, and pulp and paper industries).

Microbial transformation of mercury deposited in sediments of river and lake bottoms is believed to be the principal means by which mercury is converted to chemical forms readily available to aquatic life. Jernelov (1969) has described the conversion of inorganic mercury and some mercury-containing compounds to monomethyl and dimethyl mercury. Of these two forms, dimethyl mercury is the more volatile and is believed to be lost to the atmosphere by evaporation. Alkaline pH favors the production of the dimethyl form, while acid pH favors the production of the monomethyl form which is retained and readily concentrated by aquatic life. These mechanisms have been cited as pos-

sible factors leading to the contamination of remote acid lakes with high levels of mercury in fish, in the absence of known sources of mercury contamination (Nelson et al., 1971).

It has been demonstrated experimentally that fish accumulate mercury directly from the water and from food (Hannerz, 1968). The most important route of accumulation seems to be directly from the water through the outer epithelium. The accumulation rate is fast while the elimination rate is slow, which leads to high concentration in fish. Northern pike were shown to concentrate methyl mercury in muscle tissue 2,000 times above part per billion concentrations added to the water.

In general, higher levels of mercury in fish can be related to exposure to wastes from pulp and paper mills which used mercury compounds and chlorine-caustic soda plants employing the mercury cell process (Westoo, 1969). In Sweden, major concentrations of mercury exist near mercury cell chlorine-caustic soda plants which may or may not be operating at the present time (Nelson et al., 1971). Similarly, heavy residual contamination persists in many bodies of water from earlier mercuric slimicidal discharges from pulp manufacturing plants. Thus, large amounts of previously discharged mercury still exist. In Canada, mercury contaminated fish were found in the vicinity of every mercury cell chlorine-caustic soda plant (Bligh, 1971). In Canada there also seems to be a positive correlation between elevated mercury levels in fish and the existence and mining of sulfide ores (Bligh, 1971).

More than 90 percent of all fish collections averaging over .5 ppm mercury and 100 percent of all fish collections averaging over 1.0 ppm mercury in the survey came from the Wisconsin, Chippewa, and Flambeau Rivers. Elsewhere in Wisconsin, mercury levels in fish collections averaged less than .5 ppm but occasionally approached or exceeded this level.

There are 16 pulp and paper mills between Rhinelander and Nekoosa on the Wisconsin River. The BASF Wyandotte Corporation mercury cell chlorine-caustic soda plant is located at Port Edwards on the Wisconsin River. There are four pulp and paper mills located on the Chippewa-Flambeau River system between Park Falls and Eau Claire. Department of Natural Resources monitoring records show the Chippewa, Flambeau, and Wisconsin Rivers have a total alkalinity ($CaCO_3$) of less than 50 ppm and a pH usually of 7.0 or less.

There are 19 paper mills located on 40 miles of the Lower Fox River, 2 on the Menominee River, 1 on the Peshtigo River, and 1 on the Wolf River. Department of Natural Resources monitoring records show these streams have a total alkalinity above 50 ppm and pH values above 7. Average mercury concentrations in fish collections from these streams and Green Bay waters in the vicinity of the streams sometimes approached but seldom exceeded .5 ppm mercury. Mercury deposits have been identified in the Lower Menominee, Lower Fox River, and a small section of the Wolf River (Konrad, 1970). Fish collections (Collections 45–49) from the Menominee River approached or equalled .5 ppm mercury. The Lower Fox River is an extremely poor if not uninhabitable environment for most fish due to oxygen depletion from pulp and paper manufacturing wastes. Fish collected at the mouth of the Fox River and adjacent waters of Green Bay (Collections 25, 26 and 31) averaged below .5 ppm mercury. Fish samples taken from the Wolf River above Shawano (Collection 22) averaged .27 ppm mercury, while samples taken below Shawano (Collection 23) averaged .64 ppm mercury. Samples from the Peshtigo River (Collections 75–76) averaged well below .5 ppm mercury. Samples from Green Bay (Collections 31-34) averaged well below .5 ppm.

Generally speaking, mercury levels in fish were not of problem significance in waters of southern and eastern Wisconsin (having alkalinities above 50 ppm and pH values above 7)

TABLE 5. Total Mercury and Methyl Mercury Levels in Selected Fish Samples

			Mercury (ppm)			
			DNR Nevin Lab.	Department of Agriculture Laboratory		
Water	Site	Species and Length (inches)	Total Mercury	Total Mercury	Methyl Mercury	% Total Methyl Mercury
Wisconsin River	Above BASF-Wyandotte	Walleye 13	.57	.62	.67	100
	Below BASF-Wyandotte	3 Carp 20-22	.56	.60	.49	82
	Upper Petenwell Flowage	2 Crappie 8-9	1.22	1.45	1.26	86
		Walleye 15	4.62	5.82	4.38	75
		Carp 30	1.01	.83	.71	86
	Below Petenwell Dam	Sucker 14	.64	.62	.51	85
		2 Bullhead 8-11	.93	1.14	.98	86
Flambeau River	Above Ladysmith	Bullhead 11	1.57	1.21	1.03	85
		Walleye 10	1.10	1.08	1.01	93
	Below Ladysmith	Redhorse 20	2.03	2.19	2.44	100
		Walleye 15	1.33	1.52	1.50	98
Chippewa River	Lake Wissota	Northern pike 20	1.20	1.08	.90	83
		Sucker 20	1.13	.98	1.29	100
	Below Lake Wissota	Northern pike 20	1.01	.90	1.06	100
		Northern pike 27	2.12	1.44	1.78	100
Lake Michigan	Kewaunee	Brown trout 21.4	.17	.11	.11	100

even where mercury compounds have been used in the past and can be found above background levels in the sediments.

In Sweden, birds were seriously and sometimes catastrophically affected by mercury–treated seed sown on farm fields. While seed-eating birds declined, predatory birds that fed on them were believed to have been more seriously affected. Wild seed-eating birds in Sweden had liver residues ranging up to 140 ppm, but predatory birds had levels up to 300 ppm mercury (Nelson et al., 1971). Both seed-eating and predatory birds showed marked reductions in mercury content after 1966 when the ban on seed dressing with methyl mercury took force. Levels of mercury in pheasants were back to normal one year after the ban.

Wisconsin has not been a significant consumer of mercury-treated seed in recent years. Less than one percent of Wisconsin's 2 million acres of small grains were given mercury seed treatments (testimony of Dr. Gayle L. Worf, Department of Plant Pathology, University of Wisconsin, at the DNR General Orders–Mercury Hearing, October 12, 1970). In the present survey mammals, upland game birds, most puddle ducks, coots and geese did not show significant mercury levels. However, certain ducks, particularly diving ducks, pied-billed grebe, great blue heron, and hooded merganser, all of which live in an aquatic habitat, contained greater amounts of mercury.

Fish and Wildlife Consumption and Risk of Mercury Poisoning

Testimony by physicians at the Wisconsin Department of Natural Resources mercury hearings and U. S. Senate Subcommittee hearings on mercury and other toxic metals (held in Washington, D. C., in July and August, 1970) and an extensive review of the literature have revealed no known cases of mercury poisoning in the United States due to the consumption of fresh water fish or wildlife. Subsequent testimony at Congressional hearings in 1971 revealed that a Long Island woman was being treated for methyl mercury poisoning after she had eaten a steady diet of swordfish (a marine fish) for several years to lose weight.

Studies of commercial and sports fishermen in Sweden who had consumed mercury-contaminated fish over an extended period failed to show symptoms of mercury poisoning, although these high fish consumers were shown to have elevated levels of mercury in blood corpuscles, blood plasma and hair (Tejning, 1967). In Minnamata and Nigata, Japan, human illness and death were associated with mercury poisoning from consumption of severely contaminated marine fish. The fish contamination was due to mercury pollution from industries producing plastics from acetaldehyde and vinyl chloride. The diet of the Japanese suffering mercury poisoning was about 0.4 pound of fish per day containing 20 ppm mercury (Takeuchi, 1970).

In spite of the absence of scientific evidence to relate mercurialism with consumption of contaminated fish in the United States, Grant (1971) believes a definite hazard exists. He points out that damage may occur at levels much lower than can be reported by present medical techniques of clinical evaluation and suggests that overt cases have not come to light because fish are an insignificant part of the American diet.

Estimated annual consumption of fish per person is 62 pounds in Japan, 45 pounds in Sweden, and 13 pounds in Canada (Bligh, 1970). The typical American fish eater consumes 10 to 11 pounds of commercial fish products per year, and the average American sport fisherman is estimated to catch 23 pounds of fish annually (Sport Fishing Institute, 1970). Sport fishermen in Wisconsin reported an average catch of 58 fish per angler during the winter of 1968-69 and a catch of 64 fish per angler during the 1969 open water season. Panfish represented 88.5 percent of the catch in winter and 83 percent of the catch during the open water season (Churchill, 1969 and 1970).

Wildlife harvest figures in Wisconsin for the 1970-71 hunting season are

TABLE 6. Estimated Harvest of Wisconsin Wildlife by Licensed Hunters for the 1970-1971 Season*

Species	Estimated Number Harvested	Number Licensed Hunters	Mean Harvest Per Licensed Hunter**
Ring-necked pheasant	622,700	453,700	1.4
Ruffed grouse	905,800	453,700	2
Sharp-tailed grouse	8,200	453,700	.02
Hungarian partridge	27,000	453,700	.16
Cottontail rabbit	766,500	453,700	1.7
Snowshoe rabbit	79,400	453,700	.17
Squirrel	1,595,000	453,700	3.5
Puddle ducks	580,880	149,000	4.0
Diving ducks	145,220	149,000	1.0
Geese	38,700	149,000	.26
Coots	60,000	149,000	.40
Deer	73,000	488,000	.15

*Hunting season covers the period from September 1970 to March 1971.
**Mean harvest per licensed hunter is determined by dividing the estimated harvest of each species by the number of licensed hunters.

presented in Table 6. As can be seen, the amount of wildlife harvested is small and represents a minor part of the diet of most families. Mercury levels in most Wisconsin game species were extremely low. Muscle and liver samples from white-tailed deer, rabbits, pheasant, ruffed grouse and geese were generally less than .05 ppm. Livers of ducks, particularly diving ducks sometimes exceeded .5 ppm mercury.

In Sweden, the National Health Authorities have set a standard of 1 ppm mercury for fish sold commercially but will issue fish consumption warnings at lower mercury concentrations, depending upon estimated health risks (Dr. A. Jernelov, pers. comm.). The .5 ppm interim guideline established by the Food and Drug Administration and adopted by many of the states is a more conservative guideline. The Canadian Food and Drug Directorate has also adopted the .5 ppm guideline.

CONCLUSION

The Department of Natural Resources has conducted extensive investigations of mercury pollution in Wisconsin. Sources of mercury released to the environment have been identified and action has been taken. On December 9, 1970, the Department of Natural Resources issued a general order establishing an effluent discharge limit of .5 ppb organic mercury compounds and .05 pound of inorganic mercury compounds and mercury metal per 1,000,000 gallons of effluent discharged. This general order set stringent limits to control point discharges of mercury into the aquatic environment.

In addition, all alkyl mercury compounds (including those used for seed dressings) were designated restricted use pesticides and cannot be lawfully applied without permit by the Secretary of the Department of Natural Resources (Wisconsin Administrative Code, Chapter N.R. 80).

Use of mercury compounds in the paper industry was greatly reduced after 1958 when the Food and Drug Administration specified that food wraps not contain mercury. Those mills still using mercury slimicides report replacing these compounds with other chemicals since April, 1970. Losses of mercury from the BASF Wyandotte Corporation plant (Wisconsin's only mercury cell chlorine-caustic soda plant) to the Wisconsin River have been reduced to trace amounts in conformance with the general orders for mercury discharges to waters. However, mercury deposits in stream sediments remain below former discharges (Konrad, 1971). Swedish reports (Hasselrot, 1968) suggest that the continuous release of mercury from deposits such as are found in the Chippewa, Flambeau and Wisconsin Rivers may produce elevated levels in fish for many years. Studies are presently underway at the University of Wisconsin to determine the behavior of mercury in river sediments.

By November 1970, eighteen states and Canada had imposed restrictions on fishing or advised limited fish consumption due to mercury contamination (U. S. Government, 1970a). The restrictions imposed included closure of sport or commercial fishing, or fishing with mandatory release of fish. States restricting fishing or advising limited fish consumption due to mercury included Alabama, Georgia, Louisiana, Michigan, Mississippi, New Hampshire, New Mexico, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Texas, Vermont, Virginia, West Virginia and Wisconsin. In December, Minnesota became the nineteenth state to report mercury contamination of fish (Anderson, 1970). In Minnesota, as Wisconsin, no fishing restrictions were imposed; however, consumers were advised to limit fish consumption to one meal per week from those waters where a mercury problem had been identified.

The announcement of the mercury problem resulted in an immediate reduction of fishing effort in waters in Wisconsin and other parts of the United States. Fishing license sales declined in some Wisconsin counties directly affected; however, statewide fishing license sales continued to grow in 1970. Total sales of all Wisconsin fishing licenses were 1,374,531 in 1968, 1,386,208 in 1969, and 1,431,409 in 1970.

A problem of mercury contamination of wildlife was reported in the prairie region of Canada. Alberta delayed the hunting season for pheasants and partridge in the fall of 1969 when elevated levels of mercury were detected (Fimreite, 1969). Fimreite, Fyfe, and Keith (1970) found that mercury contamination of prairie wildlife was widespread, and believed the source of contamination to be the use of mercury dressings on grain seed. Wildlife monitoring studies reported by the states of Colorado, Idaho, Michigan, Montana, Oregon, and Washington (Fed. Water Quality Administration, 1970) indicate mercury levels in most wildlife are well below .5 ppm.

In September 1971, the Canadian Wildlife Service announced that hunters in northwestern Ontario should avoid eating common goldeneye, blue-winged teal and mallard from the Wabigoon River system west of Dryden. These goldeneye, blue-winged teal, and mallard averaged 7.4, 5.9 and 4.8 ppm mercury respectively(Canadian Wildlife Service, 1971). The Wabigoon River system is a contaminated waterway where fish also contain high mercury levels. Earlier the Canadian Wildlife Service had carried out a general survey of 1,400 waterfowl shot during the fall hunting season of 1970 in 20 areas of Canada, which showed waterfowl levels averaged below .5 ppm mercury even in areas of suspected mercury contamination. The occurrence of high mercury levels in waterfowl is believed to be localized in the Wabigoon River system.

Research in Sweden has shown that mercury contamination of fish is a long-term phenomenon even when surface water pollution sources are eliminated. Three methods for restoring mercury-polluted sediments are now being investigated in Sweden (Landner, 1970). The three methods include: (1) Introducing inorganic materials with a high reactivity, having very strong adsorptive capacities in order to fix the mercury in nonmethylable form; (2) covering mercury-polluted sediments with unpolluted sediments to prevent mercury release to waters; (3) removing mercury-polluted sediments by dredging or pumping. Although these methods are possible, Swedish researchers have reported no significant successes in restoring waters in Sweden. In Wisconsin, mercury concentrations in sediments are dispersed over large sections of stream bottoms, totaling many hundreds of acres. Be-

cause of the large areas of stream bottom involved, neither covering or removing mercury-polluted sediments appear to be practical or feasible.

Physical removal of mercury from waters can result from natural processes. One river in Sweden had been polluted with mercury by a small cardboard mill. Phenyl mercury from the mill was found on cellulose fibers on the stream bottom. Within three years a significant decrease in mercury content of fish and bottom organisms was reported and was believed due to the fact that important amounts of mercury-contaminated fiber moved from the river to the sea during this period (Landner, 1970).

The Department of Natural Resources will continue to monitor fish in the Wisconsin, Chippewa, and Flambeau Rivers to see if certain species or stretches of the river can be exempted from consumption warnings. There are no present plans to continue monitoring wildlife for mercury.

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TABLE 7. Mercury Levels in Fish Fillets from Various Wisconsin Waters.

Fish Collection Description						ppm Mercury		
County	Water		Site	Date	Species Sampled	Low	Avg.	High
BRULE RIVER DRAINAGE								
Douglas	Brule River	1.	T49N, R10W, S10	7/21/70	4S, R, 6W, 4BR, 2RT	.04	.16	.36
CHIPPEWA-FLAMBEAU RIVER DRAINAGE								
Vilas	Escanaba Lake	2.	Escanaba Lake	4/30/70	YP, W	.03	.08	.12
Vilas	Trout Lake	3.	Trout Lake	7/21-23/70	S, R, BB, 2SMB, 4B, 4P, 4RB, 2NP, M, 3YP, 5W, LW, LT	.05	.11	.39
Iron	Flambeau River	4.	Flambeau Flowage	7/29/70	2R, BB, P, 4RB, 5NP, 5YP, 6W	.14	.38	.60
Price	Flambeau River	5.	In Park Falls	5/15 & 8/20/70	10S, R, 2M, 5NP, YP, W	.06	.26	.46
Price	Flambeau River	6.	Below Park Falls	8/31/70	5S, 2CR, P, BU, YP, W	.15	.39	.60
Price	Flambeau River	7.	Crowley Flowage	9/9/70	CR, 3P, 2BU, 2YP	.33	.44	.69
Rusk	Flambeau River	8.	Big Falls Flowage	9/9/70	4S, 6R, 2CR, RB, 2NP, 2BU, 2W	.11	.63	1.12
			Big Falls Flowage	5/24/71	5R, M, 3NP, 2BU, 2W	.25	.84	1.39
Rusk	Flambeau River	9.	Above Ladysmith	8/17/70	3S, 7BU, 10W	.55	.97	1.57
Rusk	Flambeau River	10.	Below Ladysmith	7/29/70	3S, 3R, 3BU, W	.58	1.28	2.03
			Below Ladysmith	5/24/71	2S, 2RB, 2M, NP, 4BU, YP, 4W	.31	.82	1.39
Sawyer	Chippewa River	11.	Chippewa Flowage	8/3/70	5S, 8W	.11	.14	.26
Chippewa	Chippewa River	12.	Holcombe Flowage	9/10/70	10S, 3C, B, 9CR, 4NP, 5W	.18	.55	1.00
			Holcombe Flowage	5/--/71	3S, 3R, 3LMB, B, 3CR, P, RB, 3NP, 3W	.12	.48	1.03
Chippewa	Chippewa River	13.	Below Cornell	8/3/70	7S, NP, 2CC	.25	1.06	4.89
Chippewa	Chippewa River	14.	Lake Wissota	9/10/70	9S, 4CR, 2RB, 5NP, 3W	.23	.66	1.33
			Lake Wissota	5/13/71	3S, 2R, 3LMB, 3SMB, CR, 3NP, BU, CC, 3W, ST	.37	.89	2.57
Chippewa	Chippewa River	15.	Below Lake Wissota	8/3/70	5NP	.43	1.09	2.12
Eau Claire	Chippewa River	16.	Below Eau Claire	8/4/70	8S, R, 4C, 3CC	.11	.43	.75
Pepin	Chippewa River	17.	Below Durand	9/11/70	5S, 8C, 4MO, SMB, CR, 5W, CC	.11	.32	.69
Sawyer	Pickerel Lake	18.	Pickerel Lake	10/5/70	2S, 3M, 3YP, 3W	.04	.24	.49
Rusk	Murphy Flowage	19.	Murphy Flowage	4/30/70	B, NP	.11	.36	.60
DOOR DRAINAGE								
Door	Kangaroo Lake	20.	Kangaroo Lake	6/10/70	B, YP, W	.09	.15	.28

TABLE 7 (cont.)

Fish Collection Description						ppm Mercury		
County	Water		Site	Date	Species Sampled	Low	Avg.	High
FOX-WOLF RIVER DRAINAGE								
Fond du Lac	Fond du Lac R.	21.	River Mouth	4/27/70	S	-	.20	-
Shawano	Wolf River	22.	Above Shawano	8/6/70	2R, B, CR	.16	.27	.47
Shawano	Wolf River	23.	Below Shawano	8/6/70	2R, 2D	.44	.64	.89
Winnebago	Lake Winnebago	24.	Asylum Bay	4/23/70	5D, 6CR, 2NP	.01	.17	.37
Brown	Fox River	25.	River Mouth	5/6/70	S, D, 3C, 2W, 2WB	.11	.36	1.92
Brown	Fox River	26.	River Mouth	4/27/70	YP	-	.26	-
FOX (ILLINOIS) RIVER DRAINAGE								
Waukesha	Pewaukee Lake	27.	Pewaukee Lake	4/15/70	S, B, NP, YP	.01	.13	.20
Walworth	Lake Geneva	28.	Lake Geneva	8/12/70	4S, 2C, SH, SMB, 5LMB, B, RB, 2NP, YP, 3W, 2BR	.04	.37	1.11
			Lake Geneva	10/13/70	3S, 2C, 7LMB, 6SMB, 2NP, 13W	.06	.45	.94
			Lake Geneva	2-3/-/71	2B, P, 3YP, 3CI	.11	.22	.39
Racine	Fox River	29.	Below Burlington	8/5/70	4S, R, 2C, 3SMB, 3CR, RB, NP, 4CC, YP, WB	.05	.29	.95
GALENA RIVER DRAINAGE								
Lafayette	Galena River	30.	T2N, R1E, S27	8/6/70	2S, 3SMB	.04	.06	.08
GREEN BAY								
Brown	Green Bay	31.	East of Fox River Mouth	8/5/70	8C, NP, BU, YP, W	.06	.21	.37
Door	Green Bay	32.	N. of Sturgeon Bay Canal	6/5/70	S, BF, A, 4CI, 3LT	.19	.30	.45
Oconto	Green Bay	33.	East of Oconto	6/12/70	5S, SMB, B, CR, 2NP, 2BU, YP, 2W, 2BR	.09	.36	.75
			East of Oconto	10/15/70	3S, 3C, 2SMB, 3CR, 2P, 4NP, 2BU, 3BR, 3LT, 3CS, 2WB	.05	.26	.46
Marinette	Green Bay	34.	East of Marinette	10/26/70	4S, 3C, 4NP, 2BU, 4BR, 3RT, 3LT, 3CS, 2WB, 2L	.01	.26	.56
KEWAUNEE RIVER DRAINAGE								
	Kewaunee River	35.	River Salmon Traps	10/19/70	4BR	.09	.15	.23
LAKE MICHIGAN								
Door	Lake Michigan	36.	East of Algoma	5/6/70	2BR, 2RT, CS	.05	.08	.12
			East of Algoma	4/29/70	2BR, 2RT	.05	.09	.16
Kewaunee	Lake Michigan	37.	East of Kewaunee	6/1/70	A, BT, 3BR, RT, CS	.06	.21	.70

TABLE 7 (cont.)

Fish Collection Description						ppm Mercury		
County	Water		Site	Date	Species Sampled	Low	Avg.	High
LAKE SUPERIOR								
Douglas	Lake Superior	38.	Off Amaicon R. Mouth	8/12/70	3W	.38	.74	1.17
Bayfield	Lake Superior	39.	Apostle Islands	8/12/70	3S, 2LW, 2BR, 2LT	.09	.30	.60
Bayfield	Lake Superior	40.	Off Boyd Creek	6/19/70	5S, 5W	.21	.44	.72
Ashland	Lake Superior	41.	Lower Chequamegon Bay	6/10/70	5S, 2YP	.05	.09	.13
Ashland	Lake Superior	42.	Oak Point	6/22/70	5SMB, 5W	.22	.44	.84
Ashland	Lake Superior	43.	Kakagon Sloughs	8/12/70	2C, SMB, RB, BU, YP	.18	.30	.66
MENOMINEE-BRULE RIVER DRAINAGE								
Florence	Brule River	44.	Above & Below Junction with the Iron River	6/16/71	3S, CR, YP, 3BT, 3BR, 2RT	.06	.16	.37
Marinette	Menominee River	45.	Below Highway 8 Bridge	6/2-3/71	3S, 4R, 2C, 2LMB, SMB, P, RB, NP, YP, 2W	.22	.48	1.72
Marinette	Menominee River	46.	Below Highway K Br.	6/4/71	3S, 3R, SMB, 4NP	.31	.54	1.22
Marinette	Menominee River	47.	Above Marinette	6/15/70	R, NP, 2YP	.27	.53	.66
		48.	In Marinette	6/15/70	R, 2SMB, 3RB, 2NP, YP	.30	.44	.69
		49.	River Mouth	5/20 & 6/15/70	2S, 2C, 2BF, A, 3LMB, 5P, 2NP, 4BU, 3YP, 8W	.15	.44	1.30
MILWAUKEE RIVER DRAINAGE								
Ozaukee	Milwaukee River	50.	At Thiensville	7/8/70	2S, R, 3C, P, 3NP, 2BU	.11	.22	.35
Milwaukee	Milwaukee River	51.	Above North Avenue	7/9/70	3C, GF	.11	.15	.18
Milwaukee	Milwaukee River	52.	Milwaukee Harbor	5/20-25/70	S, 2C, CC, CS	.05	.11	.22
MISSISSIPPI RIVER								
Pierce	Mississippi R.	53.	Bay City	5/27/70	2C, 2W	.20	.25	.32
Pepin	Mississippi R.	54.	Lake Pepin	6/15/70	5S, C, 4LMB, 2B, 6CR, 3NP, BU, 9CC, YP, 5W	.07	.33	.78
Pepin	Mississippi R.	55.	Pepin	5/21/70	3C, LMB, NP, 4W, WB	.06	.18	.39
Buffalo	Mississippi R.	56.	Wabasha, Minnesota	5/22/70	2C, SMB, CC, 5A, 2W, WB	.09	.19	.28
Buffalo	Mississippi R.	57.	Alma	5/21/70	2C, 3SMB, 2SA, 3W, WB	.12	.19	.26
Buffalo	Mississippi R.	58.	Fountain City	5/28/70	W	-	.24	-
Buffalo	Mississippi R.		Fountain City, River Mile 731-733	5/28/70	W, SA	.12	.14	.17
Trempealeau	Mississippi R.	59.	Trempealeau R. Mouth	5/26/70	2C, LMB, CC	.15	.26	.38
Trempealeau	Mississippi R.	60.	Trempealeau Lake	5/25/70	2C, 2LMB, NP, 2CC, W, WB	.13	.17	.23
La Crosse	Mississippi R.	61.	Below La Crosse	5/18/70	B	-	.08	-
Vernon	Mississippi R.	62.	Stoddard	6/2/70	C, 3LMB, SMB, NP	.15	.36	.66

TABLE 7 (cont.)

Fish Collection Description						ppm Mercury		
County	Water		Site	Date	Species Sampled	Low	Avg.	High
MISSISSIPPI RIVER (CONT.)								
Vernon	Mississippi R.	63.	Below Stoddard	5/18/70	S, C, LMB, B, CR, BU, CC, NP, W	.15	.30	.55
Vernon	Mississippi R.	64.	Genoa	6/3/70	NP, 2W, 2WB	.16	.21	.34
Crawford	Mississippi R.	65.	Ferryville	6/4/70	2C, NP, 2W, WB	.07	.11	.15
Crawford	Mississippi R.	66.	Lynxville	6/5/70	3C, LMB, CC, SA, WB	.07	.22	.35
Crawford	Mississippi R.	67.	River Mile 636-638	6/15/70	LMB, 4NP, CC, WB	.08	.21	.40
Crawford	Mississippi R.	68.	Prairie du Chien	6/8/70	3C, BF, LMB, WB	.13	.20	.27
Grant	Mississippi R.	69.	River Mile 627-628	6/15/70	LMB, SMB, SA, WB	.20	.34	.41
Grant	Mississippi R.	70.	Cassville	6/10/70	2C, SMB, SA	.08	.16	.21
Grant	Mississippi R.	71.	Town of Waterloo	10/20/70	6CC	.08	.13	.21
Grant	Mississippi R.	72.	Dubuque, Iowa	6/9/70	C, 2LMB, 2CC, SA	.10	.23	.52
Grant	Mississippi R.	73.	River Mile 580.7-581.5	6/11/70	C, CC, 6W, 3WB	.08	.28	.93
OCONTO RIVER DRAINAGE								
Oconto	Oconto River	74.	Above Oconto Falls	6/17/70	S, B, CR, 2NP, BU, 2YP	.08	.12	.20
PESHTIGO RIVER DRAINAGE								
Marinette	Peshtigo River	75.	Above Peshtigo	6/16/70	S, R, SMB, 2RB, 4NP, BU, 3YP	.05	.29	.59
Marinette	Peshtigo River	76.	Below Peshtigo	6/16/70	S, C, A, NP, BU, YP	.14	.22	.30
ROCK RIVER DRAINAGE								
Washington	Rubicon River	77.	Below Hartford	5/27/70	3C	.07	.14	.18
Waukesha	Lake LaBelle	78.	Lake LaBelle	4/15/70	BF, C, B, CR, W	.04	.13	.18
Dodge	Rock River	79.	Lake Sinnissippi	8/4/70	5C, W	.01	.04	.12
Dodge	Rock River	80.	Horicon	5/15/70	C, 6NP	.07	.12	.16
Jefferson	Rock River	81.	Lake Koshkonong	7/16/70	4C, 3CC	.02	.08	.15
Dane	Nevin Hatchery	82.	Hatchery Ponds	9/17/70	10RT	.08	.10	.14
Dane	Lake Mendota	83.	Lake Mendota	7/23/70	4D, 4C, 3LMB, SMB, 5B, RB, 2NP, 3YP, 3W, 4WB	.03	.25	.75
			Lake Mendota	9/29/70	3D, 2C, LMB, 2CR, 2B, 2P, RB, 3NP, 2BU, 4CC, YP, 5W, 8WB, YB	.08	.24	1.13
Dane	Yahara River	84.	Below Lake Mendota	7/31/70	5D, 2C, 2LMB, B, 2RB, 2NP, 3W, WB	.04	.22	.69
Dane	Lake Monona	85.	Lake Monona	7/27/70	3D, 5C, 4LMB, B, P, RB, NP, 2W, 2YP, WB	.09	.22	.33
Dane	Yahara River	86.	Below Lake Monona	7/30 & 8/7/70	6D, 7C, 13LMB, 5B, 3P, 2NP, 3YP, 3W, 3WB	.05	.25	.53

TABLE 7 (cont.)

Fish Collection Description						ppm Mercury		
County	Water		Site	Date	Species Sampled	Low	Avg.	High
ROCK RIVER DRAINAGE (CONT.)								
Dane	Lake Kegonsa	87.	Lake Kegonsa	7/29/70	3D, 4C, 2IMB, B, CR, P, NP, YP, 2W, 3WB, 4YB	.05	.16	.29
Dane	Starkweather Creek	88.	Creek Mouth	7/27/70	3D, 3C, B, CR, P, YP, 4W, WB, YB	.06	.17	.53
Dane	Lake Waubesa	89.	Lake Waubesa	7/28/70	D, 2C, 6IMB, B, CR, P, 2NP, W, 2YP, WB, 4YB	.13	.38	.80
Dane	Lake Wingra	90.	Lake Wingra	7/24-27/70	5C, BF, 5IMB, B, 2CR, P, NP, YP, YB	.03	.20	.58
Rock	Rock River	91.	Below Janesville	7/16/70	R, 2C, 2CR, NP, CC, 2YB	.05	.11	.20
Rock	Spaulding Pond	92.	Spaulding Pond	8/20/70	LMB, NP	.06	.07	.08
SHEBOYGAN RIVER DRAINAGE								
Sheboygan	Sheboygan R.	93.	Salmon River Traps	10/23/70	3CS	.07	.20	.27
ST. CROIX RIVER DRAINAGE								
Douglas	Gordon & St. Croix Flowages	94.	Gordon & St. Croix Flowages	10/20/70	4S, R, 9IMB, 2CR, 2B, 2P, 8NP, 2BU	.04	.28	.69
Polk	St. Croix River	95.	Below St. Croix Falls	8/5/70	BF, 6S, 5D, 4C, 6SMB, 2CR, NP, 2CC, 2SA, W, WB	.18	.43	1.40
Sawyer	Nelson Lake	96.	Nelson Lake	9/21-22/70	3S, 3IMB, 2B, 2P, 3NP, 2YP, 3W	.04	.12	.32
ST. LOUIS RIVER DRAINAGE								
Douglas	St. Louis River	97.	River Mouth	5/5 & 8/11/70	6S, BU, 2YP, 3W	.10	.62	.97
TWIN RIVER DRAINAGE								
Manitowoc	Twin River	98.	River Salmon Trap	10/23/70	3NP, 3CS	.25	.34	.51
WISCONSIN RIVER DRAINAGE								
Vilas	Wisconsin R.	99.	Lac Vieux Desert	6/30/70	S, NP, 3YP, 5W	.06	.12	.19
Oneida	Wisconsin R.	100.	Rainbow Flowage	7/1/70	R, CR, RB, NP, BU, YP, 3W	.17	.29	.67
Oneida	Wisconsin R.	101.	Above McNaughton	6/29/70	RB, NP, BU, 4YP	.08	.24	.38
Oneida	Wisconsin R.	102.	Below McNaughton	6/29/70	2S, M	.28	.35	.41
Oneida	Wisconsin R.	103.	Boom Lake	5/19/70	S, B, CR, NP, BU, YP, W	.10	.28	.50
Lincoln	Wisconsin R.	104.	Lake Alice	5/19/70	S, LMB, B, CR, BU, W	.17	.92	1.85
			Lake Alice	10/12/70	S, 2B, NP, 3YP	.22	.37	.50
			Lake Alice	5/27/71	5IMB, 2B, 4NP	.32	.75	1.28
Lincoln	Wisconsin R.	105.	Lake Mohawksin	5/19/70	S, B, CR, NP, BU, YP, W	.65	.97	1.72
			Lake Mohawksin	5/27/71	3IMB, 2B, 5NP	.35	.65	1.25

TABLE 7 (cont.)

Fish Collection Description						ppm Mercury		
County	Water		Site	Date	Species Sampled	Low	Avg.	High
WISCONSIN RIVER DRAINAGE (CONT.)								
Marathon	Wisconsin R.	106.	Lake Wausau	5/16/70	S, C, LMB, B, NP, YP, W	.16	.62	.95
			Lake Wausau	10/13/70	3S, C, 2B, CR, 2P, 3NP, 2YP	.17	.33	.86
			Lake Wausau	6/2/71	3C, P, 3NP, 2YP, W	.21	.39	.58
Marathon	Wisconsin R.	107.	Below Mosinee Dam	5/16/70	S, C, W	.10	.36	.65
Marathon	Wisconsin R.	108.	Lake DuBay	5/16/70	S, NP, BU, YP	.12	.28	.40
			Lake DuBay	6/2/71	5S, 3C, 3NP, W	.15	.30	.58
Wood	Wisconsin R.	109.	Above Biron Dam	5/3/70	S, C, B, NP, W	.32	.42	.49
Wood	Wisconsin R.	110.	Below Biron Dam	5/12/70	S, 2C, NP	.38	.50	.58
Wood	Wisconsin R.	111.	Above Centralia Dam	6/5/70	C	-	.56	-
			Above Centralia Dam	10/21/70	2S, 4C, W	.09	.26	.45
Wood	Wisconsin R.	112.	Above Wyandotte Chemical	6/5/70	S, C, NP, W	.37	.54	.78
Wood	Wisconsin R.	113.	Below Wyandotte Chemical	6/5/70	S, C, W	.46	.58	.73
Wood	Wisconsin R.	114.	Moccasin Cr. Mouth	4/24/70	2S, C	.38	.50	.58
Wood	Wisconsin R.	115.	Highway 73 Bridge	6/5/70	S, C	.60	.61	.61
Wood	Wisconsin R.	116.	Below Nekoosa Dam	6/5/70	S, Q, W	.44	1.62	2.98
Adams-Juneau	Wisconsin R.	117.	Upper Petenwell Flowage	5/11/70	3C, B, 2CR, 2NP, 4W	.68	2.36	4.62
			Upper Petenwell Flowage	10/21/70	5S, 3C, B, 2NP, YP, W	.61	1.03	1.90
			Upper Petenwell Flowage	5/11/71	3S, 4C, 3NP, W	.68	1.24	2.82
Adams-Juneau	Wisconsin R.	118.	Petenwell Flowage	5/3/70	C, B, NP, YP	.61	.94	1.25
Adams-Juneau	Wisconsin R.	119.	Below Petenwell Dam	5/3/70	C, CR, NP, YP, SH	.80	1.14	1.50
			Below Petenwell Dam	10/21/70	S, 2BU, W	.64	1.52	3.81
Adams-Juneau	Wisconsin R.	120.	Buckhorn Bridge	5/14/70	2S, C, LMB, B, CR, WB	.21	.38	.64
			Buckhorn Bridge	10/21/70	2S, 2R, 3LMB, 2NP, 3W	.07	.40	.83
			Buckhorn Bridge	5/10/71	2S, 2C, 2LMB, 3CR, 2B, 2NP, 2W	.20	.59	1.24
Adams-Juneau	Wisconsin R.	121.	Castle Rock Flowage	6/5/70	C, W	1.10	2.22	3.34
			Castle Rock Flowage	5/10/71	4C, B, 2CR, 3NP, 3W	.86	1.77	3.53
Adams-Juneau	Wisconsin R.	122.	Below Castle Rock Dam	5/14/70	2C, NP, 2W	.17	.38	.55
Adams-Juneau	Wisconsin R.	123.	Above Dells Dam	6/23/70	S, C, CR, W	.93	1.23	1.35

TABLE 7 (cont.)

Fish Collection Description						ppm Mercury		
County	County		Site	Date	Species Sampled	Low	Avg.	High
WISCONSIN RIVER DRAINAGE (CONT.)								
Sauk	Wisconsin R.	124.	Below Dells Dam	5/21 & 6/23/70	3S, R, Q, B, 3W	.55	1.09	2.00
			Below Dells Dam	10/-/70	S, 3R, BF, D, 6C, B, 3CR, NP, CC, 2SA, 4W, 7WB	.24	1.41	2.97
Sauk	Wisconsin R.	125.	Below Dells Creek	6/23/70	S, R, Q, 2C, W	1.00	1.83	3.02
Columbia	Wisconsin R.	126.	Below I-94 Bridge	5/15/70	S, 3C, LMB, NP	.45	.53	.75
Columbia-Sauk	Wisconsin R.	127.	At Merrimac	5/20/70	D, YP, W	.80	.83	.90
			At Merrimac	5/20-27/71	5S, 3Q, D, C, 3LMB, 3CR, 2NP, 6SA, 4W	.12	.79	1.85
Dane-Sauk	Wisconsin R.	128.	Below Prairie du Sac Dam	5/15/70	BF, D, 2C, SMB, LMB, W, WB	.20	.48	1.00
Iowa-Sauk	Wisconsin R.	129.	Spring Green	5/18 & 6/29/70	S, 3Q, C, NP, SA, 2W	.20	1.01	2.64
			Spring Green	5/17/71	4R, 5C, B, RB, 4CC, 3SA, 2W	.28	.76	1.64
Grant-Crawford	Wisconsin R.	130.	Boscobel	6/29/70	2R, 5Q, 4D, LMB, YP	.56	1.07	2.91
			Boscobel	10/9/70	3C, 2SMB, 4CC, 2SA, W	.09	.61	1.24
			Boscobel	5/13/71	5R, 5Q, 3NP, 4CC, 5SA	.08	.50	1.21
Grant-Crawford	Wisconsin R.	131.	Bridgeport	6/29/70	4R, 3C, 2W, WB	.57	.84	1.34
Vilas	Stormy Lake	132.	Stormy Lake	10/22/69	5CS	.10	.16	.27
Langlade	E. Eau Claire River	133.	Ackley Township	7/10/70	S, BT	.09	.13	.17
Langlade	Spring Brook	134.	Antigo	7/10/70	S, 3BT	.18	.32	.38
Marathon	Big Rib River	135.	Big Rib River	10/13/70	3C, LMB, B, 2NP, 2W	.14	.38	1.08
Portage	Little Plover River	136.	Plover Township	7/7/70	5BT	.09	.14	.22
Portage	Lower Tomorrow River	137.	Amherst Township	7/6/70	S, 3C	.16	.22	.33
Juneau	Yellow River	138.	Above Bullhorn Bridge	4/5/70	W	-	.25	-
Wood	Nepco Lake	139.	Nepco Lake	10/13/70	S, 4R, 2C, LMB, 2B, CR, 3NP, YP	.03	.08	.18

TABLE 8. Mercury Levels in Wisconsin Wildlife.

Species	Maturity & Sex	Sample Information: County	Site	Date	ppm Mercury: Muscle	Liver
White-tailed Deer	Mature Female	Dane	T6N, R9E, S8	7/22/70	.01	.01
" " "	-	Grant	S. Lancaster Twp.	8/15/70	.01	.01
" " "	-	Juneau	Kingston Twp.	8/6/70	T	.01
" " "	-	Juneau	T20N, R2E, S11	8/24/70	.01	.01
" " "	Mature Male	Kenosha	Wheatland Twp.	5/13/70	.01	.01
" " "	" "	Kenosha	Somers Twp.	6/4/70	.01	.01
" " "	-	La Crosse	Bangor Twp.	7/24/70	.01	.01
" " "	Mature Male	Marathon	T28N, R7E, S27	7/27/70	.01	.01
" " "	Mature Female	Marinette	T32N, R20E, S13	7/19/70	T	T
" " "	" "	Portage	Alban Twp.	5/29/70	.01	.01
" " "	-	Portage	Buena Vista Twp.	5/29/70	T	.01
" " "	-	Pierce	Maiden Rock Twp.	7/26/70	.01	.01
" " "	-	Polk	T33N, R15W, S12	5/10/70	.01	.01
" " "	Mature Female	Sawyer	Round Lake Twp.	7/26/70	.01	.01
" " "	" "	Vilas	St. Germain Twp.	7/-/70	.01	.02
" " "	" "	Wood	T21N, R6E, S26	7/24/70	.01	.01
" " "	" "	Wood	T22N, R5E, S30	8/11/70	.01	.01
" " "	Mature Male	Wood	T21N, R5E, S8	9/1/70	.01	.02
" " "	Mature Female	Wood	Port Edwards Twp.	10/5/70	.01	.02
				Ave.	.01	.01
Cottontail Rabbit	-	Dane	-	8/13/70	T	-
" "	-	Dane	Albion Twp.	8/14/70	T	.01
" "	-	Dane	Fitchburg Twp.	3/12/70	.01	T
" "	-	Grant	Ellenboro Twp.	8/10/70	T	.01
" "	-	Grant	Ellenboro Twp.	8/10/70	T	.01
" "	-	Jefferson	Waterloo Wildlife Area	8/2/70	.01	.04
" "	-	Jefferson	Waterloo Wildlife Area	5/5/70	.01	-
" "	-	Juneau	T19N, R2E, S32	-/-/70	T	-
" "	-	Juneau	T16N, R3E, S36	8/30/70	T	.01
" "	-	Juneau	T20N, R3E	10/1/70	T	.03
" "	-	Kenosha	Pleasant Prairie Twp.	5/17/70	T	T
" "	-	La Crosse	Farmington Twp.	8/4/70	.01	.03
" "	-	La Crosse	-	8/6/70	T	.01
" "	-	Marathon	T27N, R6E, S31	7/26/70	T	.01
" "	-	Marathon	T27N, R5E, S25	7/29/70	T	-
" "	-	Marinette	T29N, R23E, S13	7/20/70	T	.01
" "	-	Pierce	Oak Grove Twp.	8/1/70	.01	.02
" "	-	Pierce	Oak Grove Twp.	8/1/70	.01	.02
" "	-	Polk	Balsam Lake Twp.	5/30/70	T	.03
" "	-	Portage	T21N, R9E, S7	5/12/70	.01	.01
" "	-	Portage	T21N, R9E, S7	5/12/70	T	.03
" "	-	Portage	Almond Twp.	8/4/70	T	.01
" "	-	Sawyer	City of Hayward	7/27/70	T	.01
" "	-	Sawyer	City of Hayward	7/27/70	.01	.02
" "	-	Vilas	T40N, R7E, S31	7/-/70	T	.01
Snowshoe Rabbit	-	Sawyer	Round Lake Twp.	5/15/70	T	.04
				Ave.	.01	.01
Gray Squirrel	-	Wood	Town of Port Edwards	2/7/71	.07	-
" "	-	Wood	Town of Port Edwards	2/10/71	.03	-
" "	-	Wood	Town of Port Edwards	2/11/71	.03	-
" "	-	Wood	Town of Port Edwards	2/12/71	.22	-
" "	-	Wood	Town of Port Edwards	2/23/71	.02	-
" "	-	Wood	Town of Port Edwards	2/23/71	.01	-
Red Squirrel	-	Wood	Town of Port Edwards	2/24/71	.14	-
				Ave.	.09	
Ruffed Grouse	-	Juneau	-	7/20/70	.01	-
" "	-	Juneau	-	8/5/70	.03	-
" "	-	Juneau	-	8/5/70	.01	.03
" "	Mature Male	Langlade	-	6/22/70	.01	.02
" "	-	Marathon	T30N, R6E, S2	7/21/70	.01	-
" "	-	Marathon	T26N, R2E, S29	7/28/70	.01	.05

TABLE 8 (cont.)

Species	Maturity & Sex	Sample Information: County	Site	Date	ppm Mercury: Muscle	Liver
Ruffed Grouse	-	Marinette	T30N, R22E, S14	7/13/70	.01	-
" "	-	Marinette	T36N, R18E, S18	8/18/70	.01	-
" "	-	Portage	T26N, R6E, S16	7/9/70	.01	-
" "	Immature	Sawyer	Round Lake Twp.	7/30/70	.01	-
" "	"	Sawyer	Round Lake Twp.	7/30/70	.01	.03
" "	"	Sawyer	Round Lake Twp.	7/30/70	.01	.02
" "	-	Wood	T14N, R3E, S15	7/21/70	.01	-
" "	-	Wood	T21N, R3E, S16	7/23/70	.01	.03
				Ave.	.01	.03
Ring-necked Pheasant	-	Dane	Blooming Grove Twp.	8/12/70	.01	.01
" "	Mature Female	Dane	East of Madison	5/19/70	.01	.02
" "	-	Grant	Platteville Twp.	8/12/70	.01	.01
" "	Mature Female	Jefferson	T8N, R14E, S3	8/6/70	T	T
" "	Mature Male	Jefferson	Waterloo Wildlife Area	-/-/70	T	.01
" "	" "	Kenosha	Randall Twp.	5/28/70	T	.01
" "	Immature Female	La Crosse	Farmington Twp.	7/6/70	.01	.01
" "	Immature Male	La Crosse	Farmington Twp.	7/6/70	.01	.01
" "	-	Pierce	Clifton Twp.	8/2/70	.01	.01
" "	Immature Male	Pierce	River Falls Twp.	8/2/70	.01	-
" "	Mature Male	Polk	-	5/20/70	.08	.28
				Ave.	.01	.04
Puddle Ducks						
Mallard	Immature Male	Bayfield	Totogatic Lake	9/28/70	.02	.14
Wood Duck	Mature Male	Bayfield	T45N, R7W	9/12/70	.01	.03
Blue-winged Teal	Immature Female	Brown	Atkinson Marsh	9/6/70	.52	1.62
Green-winged Teal	" "	Brown	Atkinson Marsh	9/6/70	.03	.01
" "	Immature Male	Brown	Atkinson Marsh	9/3/70	.08	.02
Mallard	" "	Brown	Atkinson Marsh	9/6/70	.14	.47
"	" "	Brown	Atkinson Marsh	9/6/70	.11	.47
"	Immature Female	Brown	Sensiba Wildlife Area	9/8/70	.08	.43
"	" "	Brown	Atkinson Marsh	9/16/70	.11	.06
Black Duck	Immature Male	Buffalo	Mississippi River	11/29/70	.13	.44
Blue-winged Teal	" "	Burnett	Crex Meadows Wildlife Area	8/12/70	.16	.44
" "	" "	Burnett	Crex Meadows Wildlife Area	8/14/70	.09	.21
Green-winged Teal	Immature Female	Burnett	Crex Meadows Wildlife Area	9/30/70	.08	.17
Wood Duck	Mature Male	Burnett	Crex Meadows Wildlife Area	9/24/70	.02	.06
Mallard	Immature Male	Burnett	T38N, R17W	?	.03	.12
American Widgeon	-	Crawford	Ferryville, Wis.	10/3/70	.01	.03
" "	-	Crawford	Ferryville, Wis.	10/3/70	.01	.02
Blue-winged Teal	-	Crawford	Ferryville, Wis.	10/4/70	.06	.20
Green-winged Teal	-	Crawford	Ferryville, Wis.	10/4/70	.02	.09
Wood Duck	Mature Male	Crawford	Mississippi River	8/12/70	.01	.05
" "	" "	Crawford	Mississippi River	8/12/70	.04	.06
Mallard	" "	Dane	Middleton, Wis.	5/21/70	.03	.14
American Widgeon	Immature Female	Dodge	Theresa W.L.A.	10/-/70	.01	.03
" "	Immature Male	Dodge	Theresa W.L.A.	10/-/70	.02	.08
Blue-winged Teal	" "	Dodge	Beaver Dam Lake	7/30/70	.10	.18
" "	" "	Dodge	Beaver Dam Lake	7/22/70	.18	.42
" "	" "	Dodge	Theresa W.L.A.	10/-/70	.06	.30
" "	Mature Female	Dodge	Theresa W.L.A.	10/-/70	.10	.58
Green-winged Teal	Adult Male	Dodge	Theresa W.L.A.	10/-/70	.04	.10
Mallard	Immature Male	Dodge	Beaver Dam Lake	7/29/70	.28	.67
"	" "	Dodge	Horicon Marsh	7/20/70	.02	.07
"	Mature Female	Dodge	Horicon Marsh	7/20/70	.04	.10
"	" "	Dodge	Horicon Marsh	10/5/70	.01	.03
"	Immature Male	Dodge	Theresa W.L.A.	10/-/70	.02	.04
"	Immature Female	Dodge	Theresa W.L.A.	10/-/70	.01	.01
Wood Duck	Mature Female	Dodge	Fox Lake	10/13/70	.02	.05
" "	Immature Male	Dodge	Fox Lake	10/13/70	.04	.12
" "	Immature Female	Douglas	T49N, R12W	9/19/70	.19	.35
Green-winged Teal	Immature Male	Dunn	Red Cedar Twp.	10/3/70	.05	.17
Mallard	Immature Female	Dunn	Elk Lake	10/3/70	.02	.03
Wood Duck	Mature Female	Dunn	Tiffany Wildlife Area	10/3/70	.03	.09
" "	Immature Male	Dunn	Red Cedar Twp.	10/3/70	.03	.07
" "	" "	Eau Claire	Cooky Lake	10/3/70	.01	.04

TABLE 8 (cont.)

Species	Maturity & Sex	Sample Information			ppm Mercury	
		County	Site	Date	Muscle	Liver
Mallard	Female	Grant	Wyalusing Twp.	10/16/70	.07	.47
Wood Duck	-	Grant	Potosi Twp.	10/3/70	.01	.06
" "	-	Grant	Bloomington Twp.	10/3/70	.06	.21
Green-winged Teal	Immature Female	Green Lake	Grand River Wildlife Area	10/3/70	.05	.13
Mallard	Mature Male	Green Lake	Grand River Wildlife Area	10/6/70	.02	.10
Shoveler	Immature Male	Green Lake	Grand River Wildlife Area	11/19/70	.40	1.04
"	Immature Female	Green Lake	Grand River Marsh	11/19/70	.19	.48
Mallard	-	Iowa	Blackhawk Lake	10/15/70	.04	.10
Wood Duck	Immature Female	Kewaunee	T24N, R24E, S30	10/4/70	.21	.62
Mallard	Immature Male	La Crosse	Mississippi River Pool #7	10/14/70	.04	.10
Blue-winged Teal	-	Manitowoc	Rockland Twp.	6/10/70	.29	.85
Mallard	-	Manitowoc	Rockland Twp.	6/10/70	.10	.39
Mallard	Immature Female	Marquette	Grand River Wildlife Area	10/22/70	.05	.31
Blue-winged Teal	" "	Marathon	Mead Wildlife Area	7/29/70	.13	.28
" "	Immature Male	Marathon	Mead Wildlife Area	7/29/70	.19	.45
" "	Mature Male	Marathon	Mead Wildlife Area	7/29/70	.43	.84
" "	Immature Male	Marathon	Mead Wildlife Area	8/26/70	.07	.12
Mallard	" "	Marathon	Wausau City Park	8/19/70	.03	.11
"	" "	Marathon	Mead Wildlife Area	9/4/70	.14	.62
"	" "	Marathon	Mead Wildlife Area	8/27/70	.09	.18
"	Immature Female	Marathon	Wausau City Park	8/19/70	.04	.04
"	" "	Marathon	Wausau City Park	8/19/70	.05	.17
"	Immature Male	Marathon	Wausau City Park	8/19/70	.08	.15
Wood Duck	" "	Marathon	Mead Wildlife Area	9/4/70	.03	.05
" "	" "	Marathon	T20N, R6E, S12	8/21/70	.08	.11
" "	Mature Male	Marathon	Teal Flowage	7/30/70	.06	.14
" "	Immature Male	Marathon	Mead Wildlife Area	8/26/70	.07	.20
Mallard	" "	Rusk	Potato Creek	10/5/70	.04	.23
Wood Duck	Mature Male	Rusk	Beaver Pond	10/-/70	.02	.06
Shoveler	Immature Female	Taylor	Pershing Wildlife Area	10/17/70	.13	.41
Wood Duck	Mature Female	Trempealeau	Blacksmith Slough	10/14/70	.02	.04
Mallard	Immature Female	Winnebago	Rush Lake	7/24/70	.16	.37
Wood Duck	Immature Male	Winnebago	Oshkosh	-1-1-	.08	.05
				Ave.	.09	.23
Diving Ducks						
Bufflehead	Mature Male	Bayfield	Totogatic Lake	9/28/70	.12	.53
Canvasback	" "	Bayfield	Totogatic Lake	9/28/70	.01	.04
Lesser Scaup	Immature Female	Bayfield	Totogatic Lake	9/28/70	.12	.43
Greater Scaup	Mature Male	Brown	Longtail Point	10/23/70	.03	.09
Lesser Scaup	" "	Brown	Sensiba Wildlife Area	9/8/70	.11	.47
" "	" "	Brown	Longtail Point	Fall '70	.08	.63
Goldeneye	Immature Female	Buffalo	Mississippi River	11/19/70	.25	1.46
Redhead	" "	Buffalo	Mississippi River	11/19/70	.03	.12
Ringneck	" "	Buffalo	Mississippi River	11/14/70	.02	.03
"	" "	Burnett	Blomen Lake	10/16/70	.02	.09
Bufflehead	Mature Female	Dodge	Fox Lake	11/13/70	.18	.59
Lesser Scaup	" "	Dodge	Beaver Dam Lake	10/23/70	.10	.26
Ruddy Duck	Immature Male	Dodge	Theresa Wildlife Area	10/-/70	.02	.07
Goldeneye	Mature Female	Green Lake	Big Green Lake	11/25/70	.35	.84
Lesser Scaup	" "	Green Lake	Big Green Lake	11/25/70	.60	.20
Ringneck	Immature Female	Green Lake	Big Green Lake	11/26/70	.02	.01
"	" "	Green Lake	Grand River Wildlife Area	11/3/70	.03	.10
Lesser Scaup	Mature Female	La Crosse	Mississippi River Pool #7	10/19/70	.11	.29
" "	Mature Male	La Crosse	Mississippi River Pool #7	10/19/70	.05	.16
" "	" "	La Crosse	Mississippi River Pool #7	10/19/70	.06	.22
" "	" "	Marathon	Peshtigo Harbor, Green Bay	10/20/70	.07	.29
Bufflehead	Mature Female	Milwaukee	Lake Michigan	11/8/70	.16	.73
Goldeneye	Immature Female	Milwaukee	Lake Michigan	11/8/70	.13	.44
Lesser Scaup	Mature Male	Milwaukee	Lake Michigan	11/20/70	.31	1.01
Old Squaw	Immature Female	Milwaukee	Lake Michigan	11/8/70	.15	.78
Goldeneye	Mature Male	Oconto	White Potato Lake	11/1/70	.24	1.23
Lesser Scaup	Mature Female	Oconto	White Potato Lake	11/1/70	.08	.25
Greater Scaup	Immature Female	Sawyer	Chetac Lake	10/-/70	.13	.43
Bufflehead	Mature Male	Vernon	Stoddard, Wis.	10/31/70	.11	1.23
				Ave.	.12	.45

TABLE 8 (cont.)

Species	Maturity & Sex	Sample Information: County	Site	Date	ppm Mercury: Muscle	Liver
American Coot	-	Brown	Sensiba Wildlife Area	10/8/70	.04	.29
" "	-	Brown	Atkinson Marsh	10/6/70	.06	.25
" "	-	Burnett	Yellow River	10/31/70	.03	.22
" "	-	Buffalo	Mississippi River	10/14/70	.05	.23
" "	-	Dunn	Elk Lake	Fall '70	.05	.28
" "	-	Grant	Mississippi River	10/17/70	.03	.14
" "	-	Green Lake	Grand River Wildlife Area	11/12/70	.04	.24
" "	-	Milwaukee	Lake Michigan	11/20/70	.08	.35
" "	-	Price	Flambeau River	Fall '70	.04	.16
" "	-	Rusk	Potato Creek	10/5/70	.07	.25
" "	-	Taylor	Chequamegon Forest Waters	10/3/70	.04	.19
				Ave.	.05	.24
Geese						
Canada	Mature Male	Dodge	Horicon Marsh	Fall '69	.01	.01
"	Mature Female	Dodge	Horicon Marsh	Fall '69	T	.01
"	" "	Dodge	Horicon Marsh	Fall '69	T	.02
"	Mature Male	Dodge	Horicon Marsh	Fall '70	.01	.02
"	Immature Female	Dodge	Horicon Marsh	Fall '70	.01	.01
"	" "	Dodge	Horicon Marsh	Fall '70	T	.01
"	Immature Male	Dodge	Horicon Marsh	Fall '70	.01	.01
"	Mature Female	Dodge	Horicon Marsh	Fall '70	T	.01
"	Mature Male	Dodge	Horicon Marsh	Fall '70	T	.01
"	Mature Female	Dodge	Horicon Marsh	Fall '70	T	.01
"	Immature Female	Dodge	Horicon Marsh	Fall '70	T	.01
"	Immature Male	Dodge	Horicon Marsh	Fall '70	T	.01
"	" "	Dodge	Horicon Marsh	Fall '70	T	.01
"	" "	Dodge	Horicon Marsh	Fall '70	.01	.02
"	Immature Female	Dodge	Horicon Marsh	Fall '70	.01	.01
"	Immature Male	Dodge	Horicon Marsh	Fall '70	.01	.02
"	Immature Female	Dodge	Horicon Marsh	Fall '70	.01	.05
"	Mature Female	Dodge	Horicon Marsh	Fall '70	T	.01
Blue	Immature Male	Dodge	Horicon Marsh	Fall '70	.01	.01
"	Immature -	Dodge	Horicon Marsh	Fall '70	.01	.01
"	Mature Female	Dodge	Horicon Marsh	Fall '70	.01	.01
Canada	Mature Male	Green Lake	Grand River Wildlife Area	Fall '70	.01	.01
Snow	" "	Green Lake	Grand River Wildlife Area	Fall '70	.01	.01
Canada	Immature Male	Marquette	Grand River Wildlife Area	Fall '70	.01	.02
Blue	Mature Female	Marquette	Grand River Wildlife Area	Fall '70	.02	.01
Canada	Immature Male	Winnebago	Lake Butte des Morts	Fall '70	.01	.03
"	-	Waukesha	Vernon Marsh	Mar. '70	.01	.02
				Ave.	.01	.01
Whistling Swan	Mature Female	Dodge	-	10/14/69	.13	.32
" "	Mature Male	Dodge	-	Fall '69	.04	.17
" "	Mature Female	Dodge	Beaver Dam Lake	11/3/69	.02	.01
				Ave.	.06	.16
Pied-bill Grebe	-	Green Lake	Grand River Wildlife Area	10/4/70	.49	1.54
" "	-	Green Lake	Grand River Wildlife Area	10/4/70	.46	1.85
				Ave.	.47	1.70
Great Blue Heron	Immature -	Wood	Port Edwards Twp.	Spring '70	.07	.39
" " "	" -	Wood	Port Edwards Twp.	Spring '70	.13	.41
" " "	" -	Wood	Port Edwards Twp.	Spring '70	.07	.22
" " "	" -	Wood	Port Edwards Twp.	Spring '70	.24	1.07
" " "	" -	Wood	Port Edwards Twp.	Spring '70	.17	.43
				Ave.	.14	.50
Hooded Merganser	Mature Female	Burnett	Amsterdam Slough	10/18/70	.54	1.94
" "	" "	Eau Claire	Augusta Wildlife Area	10/11/70	.83	3.39
" "	Immature Female	Sawyer	Chetac Lake	10/-/70	.49	2.13
				Ave.	.62	2.49

T indicates less than .005 ppm mercury present.

TECHNICAL BULLETINS
Currently Available from the Department of Natural Resources

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Harold A. Mathiak and Arlyn F. Linde

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Cyril Kabat, Frank M. Kozlik, Donald R. Thompson and Frederic H. Wagner

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Cyril Kabat, R. K. Meyer, Kenneth G. Flakas and Ruth L. Hine

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Ali Hussain and R. D. Shenefelt

The European Pine Shoot Moth and Its Relation to Pines in Wisconsin. (1959) Daniel M. Benjamin, Philip W. Smith and Ronald L. Bachman

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No. 22. The State Park Visitor: A Report of the Wisconsin Park and Forest Travel Study. (1961)
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Questions concerning the content of this report can be directed to S. J. Kleinert, Chief of the Surveillance Section, Bureau of Standards and Surveys. Questions concerning laboratory procedures can be directed to P. E. Degurse, Fish Pathologist and Director of the Nevin Laboratory, Bureau of Fish Management.

Edited by Ruth L. Hine

Cover:
Petenwell Dam and Flowage of the Wisconsin River. Most fish from these waters exceeded federal Food and Drug Administration standards of .5 ppm mercury.

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