GREAT LAKES INDIAN FISH & WILDLIFE COMMISSION

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• MEMBER TRIBES •

MICHIGAN
Bay Mills Community
Keweenaw Bay Community
Lac Vieux Desert Band

WISCONSIN
Bad River Band
Lac Courte Oreilles Band
Lac du Flambeau Band
Red Cliff Band
St. Croix Chippewa
Sokaogon Chippewa

MINNESOTA
Fond du Lac Band
Mille Lacs Band

To: Ann McCammon-Soltis, Policy Analyst

From: Matt Hudson, Environmental Biologist

Date: December 30, 2005

Re: Reporting Results for U.S. EPA Grant Number: EQ-98538501

Attached are results for U.S. EPA Grant Number: EQ-98538501. Also included are brief descriptions of the fish processing and analytical methods used to produce the data.

The objectives of this study as stated in the EPA-approved Quality Assurance Project Plan (QAPP) entitled "Lake Whitefish Collection, Compositing, and Environmental Chemical Contaminant Analysis Quality Assurance Project Plan" were to:

1. Determine the wet weight of each fillet's skin, lipid dense trimmings, and muscle tissue collected from lake whitefish captured in management unit MI-3.

2. Determine the concentration of chemicals listed in Table 1 in 16 composite muscle samples; lipid and moisture content in 16 composite muscle, 16 lipid-dense, and 16 skin samples; and archive these 48 composite samples from management unit MI-3.

3. Based on tissue wet weights and lipid and chemical content, mathematically estimate the chemical concentration in skin-on trimmed fillets and skin-on untrimmed fillets.

4. Compare the mean chemical composite values of the skin-off trimmed raw fillet, skin-on trimmed fillets and skin-on untrimmed fillets to the U.S. Food and Drug Administration's environmental chemical concentration limits for the sale of fish.

Other Study Objectives

Other study objectives in the project grant proposal that were addressed, are: 1) compare whitefish consumption advice used by each state (Michigan, Minnesota, and Wisconsin) for Lake Superior, 2) compare whitefish data collected in this study to that collected by Michigan, Minnesota, and Wisconsin for fish advisory purposes, and 3) compare GLIFWC whitefish data to advisory trigger levels used to set fish consumption advice by Michigan, Minnesota, and Wisconsin.

Methods

Whitefish Collection and Storage

Lake whitefish (*Coregonus clupeaformis*), hereafter referred to as whitefish, were collected on November 10, 2004 using gillnets at Eagle River shoal (47°25 N, 88°17 W) in Lake Superior lake trout fisheries management unit MI-3 (Figure 1). Four length ranges of whitefish were collected: 43-46, 48-51, 53-56, and 58-61 centimeters (cm). The length ranges selected span the length range of whitefish commonly harvested by tribal commercial fishermen (Figure 2). Samples were handled in a similar manner to commercially harvested fish and placed on ice within hours of collection. Samples were frozen intact within 24 hours of collection and remained frozen (at temperatures at or below -10°C) until processing at the analytical laboratory. The date, time, and conditions of collection and storage were documented on chain-of-custody forms.

Whitefish Processing into Composites

Total length, round weight, and aging material (scales) were collected from each fish prior to freezing. The Great Lakes Indian Fish and Wildlife Commission's (GLIFWC) Great Lakes Fisheries Section aged the fish to the nearest year. Fish were selected for each composite group based on length and age. Whitefish were processed into composites at the Lake Superior Research Institute (LSRI), University of Wisconsin-Superior in January and February of 2005 (Table 2).

Fish were thawed before processing. Laboratory personnel were trained by an experienced tribal fisherman during a previous GLIFWC study on the technique used to trim the fillets. Individual whitefish were filleted using a stainless steel knife. Fillets were segmented into skin, dorsal/ventral fatty tissue (fat), and muscle tissue. Each individual fillet component (i.e. skin, fat, muscle) was weighed separately, ground, and an equal weight of ground tissue used to form a composite. On each processing day, a can of commercial chunk light tuna (*Thunnus sp*.) was divided in half. One half was processed in the same manner as the whitefish composites and the other half was transferred directly to an amber sample jar. These samples were used as procedural blanks to check for contamination that may have been introduced during processing. All lab utensils and glassware were critically cleaned between each composite. Moisture analyses were conducted on the composites. Remaining composite tissues were

transferred to critically cleaned amber glass jars with Teflon lids and archived in a freezer at temperatures at or below -10°C.

Chemical Extraction and Analysis

Each of the 16 muscle tissue composite samples was analyzed for 37 chemicals (Table 1). Mercury was analyzed by LSRI according to LSRI SOP SA/13, *Cold Vapor Mercury Analysis in Biota*, based on EPA Method 245.6. Percent moisture was determined by LSRI using LSRI SOP NT/15 *Procedures for Determining Percent Moisture in Tissue Samples.*

Organic chemicals were analyzed by Pace Analytical, Inc. located in Kimberly, WI. Note that Pace was known as En Chem, Inc. at the beginning of this project. This name change resulted in the titles of the lab's standard operating procedures (SOPs) being changed, but the methods essentially remained the same as described in the project QAPP. The organic chemicals were extracted according to Pace SOP KM-O-001 (based on EPA SW846 Method 3540C). Percent lipid was determined by Pace SOP KM-L-003, based on Standard Methods for the Examination of Water and Wastewater # 5520, 1992. Lipids were removed from the sample extracts using gel permeation chromatography (Pace SOP KM-O-004, based on EPA SW846 Method 3640A). Following removal of lipids, the samples were filtered through a silica gel column to separate the chlorinated pesticides from the PCBs (Pace SOP KM-O-012, based on EPA SW846 Method 3630C). The final extracts were analyzed for PCBs according to Pace SOP KM-O-002 (based on EPA Method 8082) and chlorinated pesticides according to Pace SOP KM-O-014 (based on EPA Method 8081A).

A more complete description of the methods can be found in the QAPP for this project entitled "Lake Whitefish Collection, Compositing, and Environmental Chemical Contaminant Analysis Quality Assurance Project Plan".

Results

Quality Control

Results from quality control (QC) analyses used to monitor data quality for the organic chemical analyses can be found in Tables 3 - 7. QC results from the total mercury analyses can be found in Tables 8 - 11.

Objective #1 - Determine the wet weight of each fillet's skin, lipid dense trimmings, and muscle tissue collected from lake whitefish captured in management unit MI-3.

Table 12 lists descriptive data including tag number, sex, age, and length, along with the weight of muscle, skin, and fat tissues for the 64 whitefish that were sorted into composite samples. An equal weight of tissue from each fish was used to form a composite and this weight is not reported in Table 12.

Objective #2 - Determine the concentration of chemicals listed in Table 1 in 16 composite muscle samples; lipid and moisture content in 16 composite muscle, 16 lipid-dense, and 16 skin samples; and archive these 48 composite samples from management unit MI-3.

Objective #3 - Based on tissue wet weights and lipid and chemical content, mathematically estimate the chemical concentration in skin-on trimmed (SOT) fillets and skin-on untrimmed (SOUT) fillets.

Table 13 provides skin and fat tissue composite mean ± one standard deviation percent moisture and percent lipid measurements. Table 14 provides the whitefish data by composite and by chemical. Table 14 also includes mean ± one standard deviation of muscle composite chemical concentrations for each size group and estimated mean ± one standard deviation of chemical concentrations in SOT and SOUT fillets. These estimates were calculated using the assumption that organic, PBT contaminants partition primarily to the lipid tissue of organisms (Mackay 1982) and were based on tissue weights recorded during fish tissue processing, and percent lipid measured in each tissue. Regression statistics for five representative organic contaminants plotted against percent lipid in whitefish muscle tissue are provided as a test of the lipid assumptions used (Table 15).

All tissue composites have been archived at LSRI in critically cleaned amber glass jars with Teflon lids, frozen at temperatures at or below -10°C.

Objective #4 - Compare the mean chemical composite values of the skin-off trimmed raw fillet, skin-on trimmed fillets and skin-on untrimmed fillets to the U.S. Food and Drug Administration's environmental chemical concentration limits for the sale of fish.

The United States Food and Drug Administration (FDA) regulates the sale of fish based on concentrations of various chemicals measured in fish fillets that are to be sold commercially. Table 16 compares Lake Superior whitefish muscle tissue concentrations of chemicals and chemical groups to FDA concentration limits for those chemicals/groups. All whitefish muscle tissue concentrations, along with SOT and SOUT fillet estimated concentrations, were below current FDA fish tissue concentration limits.

GLIFWC conducted a study of PBT contaminants in Lake Superior fish (including whitefish) in 1999. Table 17 compares concentrations of three chemicals measured in whitefish muscle tissue composites in 1999 to those measured in the current study (2004).

Other Study Objectives Addressed

1) Compare whitefish consumption advice issued by each state (Michigan, Minnesota, and Wisconsin) for Lake Superior.

Table 18 provides current fish consumption advisory trigger level and "do not eat" concentrations used by jurisdictions around Lake Superior. Table 19 describes the chemicals currently driving whitefish consumption advice for Lake Superior, along with

the number and general location of whitefish samples collected for fish advisory purposes by each jurisdiction. Figures 3A and 3B show the current Lake Superior whitefish consumption advice issued by Michigan, Minnesota, and Wisconsin.

2) Compare whitefish data collected in this study to that collected by Michigan, Minnesota, and Wisconsin for fish advisory purposes.

Table 20 summarizes Lake Superior whitefish fillet data collected by Michigan, Minnesota, Wisconsin, and GLIFWC by year of data collection.

GLIFWC has also conducted similar studies to the current whitefish study described in this memo across common, tribally harvested size ranges of siscowet trout (*Salvelinus namaycush siscowet*, 1999) and lake trout (*Salvelinus namaycush namaycush*, 2003). Comparisons between siscowet trout, lake trout, and whitefish are shown for total mercury in Figure 4 and for total PCBs in Figure 5.

3) Compare GLIFWC whitefish data to advisory trigger levels used to set fish consumption advice by Michigan, Minnesota, and Wisconsin.

Figures 6-9 compare GLIFWC whitefish data to current fish advisory trigger and "do not eat" levels for total PCBs, mercury, total chlordane, and toxaphene that are used by Michigan, Minnesota, and Wisconsin to set fish consumption advice. The values are meant to be used as benchmarks for comparison and not to describe how a jurisdiction would interpret the data or set fish consumption advice based on these data.

References

Mackay, D. Correlation of bioconcentration factors. Environmental Science and Technology. 1982. 16: 274-278.

Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory. 1993. Great Lakes Sport Fish Advisory Task Force.

United States Food and Drug Administration. 2001. Fish and Fisheries Products Hazards and Control Guidance. Third Edition.

cc Neil Kmiecik, Biological Services Director
John Coleman, Environmental Section Leader
James Thannum, Planning Director

TABLES

Table 1. Chemical and non-chemical analyses conducted on muscle tissue (e.g. trimmed, skin-off fillets) composite samples of Lake Superior whitefish (*Coregonus clupeaformis*).

No	Chemical Analyses	Lab Conducting Analysis	No	Chemical Analyses	Lab Conducting Analysis
1	**Total Chlordane**	Calculated by GLIFWC	22	Toxaphene	Pace
2	Cis-Chlordane	Pace	23	Aldrin	Pace
3	Trans-Chlordane	Pace	24	Dieldrin	Pace
4	Cis-nonachlor	Pace	25	Heptachlor	Pace
5	Trans-nonachlor	Pace	26	Heptachlor epoxide	Pace
6	Oxychlordane	Pace	27	Endrin Ketone	Pace
7	**Total PCBs**	Pace	28	Methoxychlor	Pace
8	1016	Pace	29	Hexachlorobenzene	Pace
9	1221	Pace	30	Mirex	Pace
10	1232	Pace	31	Pentachloroanisole	Pace
11	1242	Pace	32	Endosulfan	Pace
12	1248	Pace	33	Endrin	Pace
13	1254	Pace	34	Endosulfan sulfate	Pace
14	1260	Pace	35	Endrin aldehyde	Pace
15	**Total DDT**	Calculated by GLIFWC	36	α-benzene hexachloride	Pace
16	4,4'-DDT	Pace	37	β-benzene hexachloride	Pace
17	4,4'-DDE	Pace	38	δ-benzene hexachloride	Pace
18	4,4'-DDD	Pace	39	γ-benzene hexachloride	Pace
19	2,4'-DDT	Pace	40	Total mercury	LSRI
20	2,4'-DDE	Pace	41	Lipid Determination	Pace
21	2,4'-DDD	Pace	42	Moisture Determination	LSRI

Table 2. Mean length and age (± one standard deviation) for the four composites within each Lake Superior whitefish (*Coregonus clupeaformis*) size group.

Size Group (cm)	Mean Length (cm)	Mean Age
43-46	44.9 ± 0.6	7.4 ± 0.5
48-51	48.9 ± 0.5	8.0 ± 0.5
53-56	54.3 ± 0.7	9.3 ± 0.9
58-61	58.7 ± 0.4	10.4 ± 1.0

Table 3. Relative percent agreement (RPA*) of lipid concentration in duplicate Lake Superior whitefish (*Coregonus clupeaformis*) samples analyzed by Pace, Inc.

Date of Analysis	Composite No.	Sample 1	Sample 2	RPA	QC Limit RPA
3/23/2005	CC1718TF4	2.68	2.84	94.2	>65
3/23/2005	CC2122TF4	5.00	5.40	92.3	>65
3/28/2005	CC1920S4	17.0	16.7	98.2	>65
3/28/2005	CC2324S1	28.8	27.0	93.5	>65
3/28/2005	CC2122L4	30.2	27.4	90.3	>65
3/28/2005	CC2324L1	39.3	37.9	96.4	>65

*RPA is: 1 – (absolute value of the difference between the two samples/mean of the two samples)

Table 4. Relative percent agreement (RPA*) of PCB and pesticide concentrations in duplicate Lake Superior whitefish (*Coregonus clupeaformis*) samples analyzed by Pace, Inc.

Compound	CC1718 TF4	CC1718 TF4 DUP	RPA	CC2122 TF4	CC2122 TF4 DUP	RPA	QC Limit RPA**
Arochlor 1016	ND	ND	.	ND	ND	.	
Arochlor 1221	ND	ND	.	ND	ND	.	
Arochlor 1232	ND	ND	.	ND	ND	.	
Arochlor 1242	ND	ND	.	ND	ND	.	
Arochlor 1248	ND	ND	.	ND	ND	.	
Arochlor 1254	ND	ND	.	ND	ND	.	
Arochlor 1260	19	19	100	44	48	91.3	>65
Total PCBs	19	19	100	44	48	91.3	>65
2,4'-DDD	ND	ND	.	ND	ND	.	
2,4'-DDE	ND	ND	.	ND	ND	.	
2,4'-DDT	ND	ND	.	ND	ND	.	
4,4'-DDD	ND	ND	.	ND	ND	.	
4,4'-DDE	12	12	100	24	32	71.4	
4,4'-DDT	2.1	1.8	84.6	6.4	7.0	91.0	
Aldrin	ND	ND	.	ND	ND	.	
alpha-BHC	ND	ND	.	1.7	1.7	100	
alpha-Chlordane	0.89	0.93	95.6	3.1	3.4	90.8	
beta-BHC	ND	ND		ND	ND	.	
cis-nonachlor	5.2	5.4	96.2	13	14	92.6	
delta-BHC	ND	ND	.	ND	ND	.	
Dieldrin	5.7	6.3	90.0	12	17	65.5	
Endosulfan I	ND	ND	.	ND	ND	.	
Endosulfan II	ND	ND	.	ND	ND	.	
Endosulfan Sulfate	ND	ND	.	ND	ND	.	
Endrin	ND	ND	.	1.9	2.3	81.0	
Endrin Aldehyde	1.8	2.2	80.0	6.5	7.4	87.1	
Endrin Ketone	ND	ND	.	ND	ND	.	
gamma-BHC (Lindane)	ND	ND	.	ND	ND	.	
gamma-Chlordane	ND	ND	.	1.9	1.9	100	
Heptachlor	ND	ND	.	ND	ND	.	
Heptachlor Epoxide	2.3	2.6	87.8	5.9	7.0	82.9	
Hexachlorobenzene	1.9	1.7	88.9	3.3	4.6	67.1	
Methoxychlor	ND	ND	.	ND	ND	.	
Mirex	ND	ND	.	ND	ND	.	
Oxychlordane	1.5	1.6	93.5	3.3	3.5	94.1	
Pentachloroanisole	ND	ND	.	ND	ND	.	
Toxaphene	ND	ND	.	130	150	85.7	
Trans-nonachlor	6.3	6.6	95.3	16	18	88.2	

ND - Not Detectable - sample was below detection limit.

*RPA is: 1 – (absolute value of the difference between the two samples/mean of the two samples)

**QC limits were only available for PCB Aroclor analyses

Table 5. Spike recovery of PCBs and pesticides in two Lake Superior whitefish (*Coregonus clupeaformis*) samples analyzed by Pace, Inc.

Compound	Sample 1 CC1718TF4	Sample 2 CC2122TF4	QC Limits
Arochlor 1254	124	144*	43-130
alpha-BHC	105	102	69-123
beta-BHC	90	105	35-128
delta-BHC	80	100	57-126
gamma-BHC (Lindane)	95	110	52-126
Aldrin	90	95	52-122
Heptachlor	105	90	50-128
Heptachlor epoxide	94	100	51-130
Endosulfan I	70	90	45-140
Dieldrin	63	100	42-135
4,4'-DDE	108	105	46-152
Endrin	68	100	43-136
Endosulfan II	25*	100	46-147
4,4'-DDD	105	108	48-160
Endosulfan sulfate	18*	105	54-132
4,4'-DDT	120	116	49-148
Methoxychlor	5*	85	36-159
Endrin ketone	14*	105	61-139
Endrin aldehyde	8	46	6-96
alpha-Chlordane	110	105	52-139
gamma-Chlordane	85	86	55-136

* Spiked sample recovery not within control limits.

Table 6. Spike recovery of PCBs and pesticides in lab control spikes (LCS) and spike duplicates (LCS dup) analyzed by Pace, Inc.

Compound	BBLK096 LCS	BBLK096 LCS dup	RPD**	BBLK097 LCS	BBLK097 LCS dup	RPD	SVK1079-097 LCS	SVK1079-097 LCS dup	RPD	SVK1079-096F2MB LCS	SVK1079-096F2MB LCS dup	RPD	QC Limits % Recovery	QC Limits % RPD
Arochlor 1254							100	88	13	96	104	8	40-128	20
alpha-BHC	100	90	10	100	90	10							65-117	40
beta-BHC	85	60	34	100	75	28							58-115	40
delta-BHC	95	55*	53*	105	85	21							63-117	40
gamma-BHC (Lindane)	95	75	24	100	90	10							65-115	40
Aldrin	100	105	5	110	100	10							60-115	40
Heptachlor	85	95	11	95	90	5							58-118	40
Heptachlor epoxide	100	60*	50*	110	95	15							63-118	40
Endosulfan I	85	35*	83*	90	80	12							54-129	40
Dieldrin	95	32*	98*	98	88	11							63-117	40
4,4'-DDE	115	125	8	130	118	10							60-150	40
Endrin	92	30*	102*	95	88	8							55-116	40
Endosulfan II	82	8*	163*	90	80	12							57-120	40
4,4'-DDD	98	85	14	105	92	13							63-128	40
Endosulfan sulfate	78	0*	200*	92	80	14							61-123	40
4,4'-DDT	135*	62	73*	118	105	11							62-127	40
Methoxychlor	75	0*	200*	80	75	6							33-141	40
Endrin ketone	90	3*	186*	95	85	11							64-132	40
Endrin aldehyde	55	0*	200*	65	52	21							16-115	40
alpha-Chlordane	105	100	5	100	95	5							58-125	40
gamma-Chlordane	80	80	0	80	80	0							64-120	40
2,4'-DDD	130			132*									70-130	
2,4'-DDE	115			118									70-130	
2,4'-DDT	165*			122									70-130	
cis-Nonachlor	178*			182*									70-130	
trans-Nonachlor	122			122									70-130	
Oxychlordane	100			100									70-130	
Hexachlorobenzene	90			90									70-130	
Pentachloroanisole	100			100									70-130	
Mirex	128			142*									70-130	
Toxaphene	75			75									60-140	

* Spiked sample recovery not within control limits.

** RPD = Relative percent difference as calculated by Pace (absolute value of the difference between the two samples/mean of the two samples).

Table 7. Results of Standard Reference Material (SRM) analysis. SRM-1946 was the Certified Standard Reference Material used. SRM 096 and 097 refer to the SRM 1946 samples analyzed by Pace, Inc. Results are compared to Quality Control (QC) ranges issued for SRM 1946 and to Pace's QC ranges for the same analytes.

Compound Name	SRM 1946 Conc. µg/Kg	SRM 1946 Uncertainty	SRM QC Range (ug/kg)		SRM 096	SRM 097	Pace Lab Control Spike QC limits	Pace QC Range (ug/kg)		SRM 096	SRM 097
Alpha-BHC	5.72	±0.65	6.37	5.07	6.8*	7.0*	65-117	3.7	6.7	6.8*	7.0*
Gamma-BHC	1.14	±0.18	1.32	0.960	1.4*	1.4*	65-115	0.7	1.31	1.4*	1.4*
Heptachlor epoxide	5.50	±0.23	5.73	5.27	8.2*	7.4*	63-118	3.5	6.5	8.2*	7.4*
Dieldrin	32.5	±3.5	36.0	29.0	40*	38*	63-117	20.5	38.0	40*	38
4,4'-DDE	373	±48	421	325	380	380	60-150	223.8	559.5	380	380
4,4'-DDD	17.7	±2.8	20.5	14.9	13*	13*	60-150	10.6	26.6	13	13
4,4'-DDT	37.2	±3.5	40.7	33.7	46*	45*	62-127	23.1	47.2	46	45
Alpha-chlordane	32.5	±1.8	33.3	30.7	38*	36*	58-125	18.9	40.6	38	36
Gamma-chlordane	8.36	±0.91	9.27	7.45	10*	10*	55-136	4.6	11.4	10	10
2,4'-DDD	2.20	±0.25	2.45	1.95	0*	0*	60-150	1.3	3.3	0*	0*
2,4'-DDE	1.04	±0.29	1.33	0.75	14*	13*	40-160	0.4	1.7	14*	13*
2,4'-DDT	22.3	±3.2	25.5	19.1	15*	14*	40-160	8.9	35.7	15	14
Cis-nonachlor	59.1	±3.6	62.7	55.5	84*	87*	60-150	35.5	88.7	84	87
Trans-nonachlor	99.6	±7.6	107	92.0	130*	130*	60-150	59.8	149.4	130	130
Oxychlordane	18.9	±1.5	20.4	17.4	20	19	60-150	11.3	28.4	20	19
Hexachlorobenzene	7.25	±0.83	8.08	6.42	10*	9.7*	60-150	4.4	10.9	10	9.7
Mirex	6.47	±0.77	7.24	5.70	0*	0*	60-150	3.9	9.7	0*	0*
% Lipid	10.2	±0.48	10.7	9.72	10.5	10.7				10.5	10.7

* Analyte concentration was outside of given quality control (QC) range.

Table 8. Relative percent agreement (RPA*) of procedural blank samples [commercial tuna fish (*Thunnus sp*.) before and after grinding] for total mercury analysis by LSRI.

Date of Analysis	Grinding Date	Before Grinding	After Grinding	Mean	RPA	QC Limit RPA
3/17/2005	1/26/2005	0.086	0.093	0.090	92.2	>50
3/17/2005	2/10/2005	0.039	0.050	0.045	75.3	>50
3/17/2005	2/16/2005	0.035	0.030	0.033	84.6	>50
3/17/2005	2/18/2005	0.034	0.038	0.036	88.9	>50
3/17/2005	2/22/2005	0.042	0.037	0.040	87.3	>50
3/17/2005	2/23/2005	0.038	0.046	0.042	81.0	>50

*RPA is: 1 – (absolute value of the difference between the two samples/mean of the two samples)

Table 9. Mercury concentrations of dogfish tissue supplied by the National Research Council Canada (DORM-2) and analyzed by LSRI. The tissue has a certified mercury concentration of 4.64±0.26 μgHg/g tissue. The acceptable range of mercury concentration was 3.61-5.16 μgHg/g based upon DORM-2 analyses conducted from July 3, 2003 to August 12, 2003.

Date of Analysis	Sample 1	Sample 2	Mean	Std. Dev.	Percent of Expected
3/17/2005	4.49	5.15	4.82	0.47	104
3/17/2005	4.87	4.05	4.46	0.58	96.1

Table 10. Relative percent agreement (RPA*) between duplicate analysis for total mercury (wet weight) content in skinless fillet tissue of composited Lake Superior whitefish (*Coregonus clupeaformis*) analyzed by LSRI.

Date of Analysis	Sample ID	Sample 1	Sample 2	RPA	QC Limit RPA
3/17/2005	CC1920TF3	0.055	0.054	98.6	>83.7
3/17/2005	CC2324TF4	0.116	0.116	100	>83.7
3/17/2005	Tuna Before 2/23	0.043	0.033	73.7	>83.7

*RPA is: 1 – (absolute value of the difference between the two samples/mean of the two samples)

Table 11. Percent of total mercury Recovered from skinless fillet tissue of composited Lake Superior whitefish (*Coregonus clupeaformis*) spiked with a known quantity of mercury by LSRI.

Date of Analysis	Sample ID	Spike #1	Spike #2	Mean	Std. Dev.	QC Limits % Recovery
3/17/2005	CC1920TF3	99.0	98.0	98.5	0.68	54.4-114
3/17/2005	CC2324TF4	98.5	97.5	98.0	0.75	54.4-114
3/17/2005	Tuna Before 2/23	102.6	100.6	101.6	1.4	54.4-114

Table 12. Individual Lake Superior whitefish (*Coregonus clupeaformis*) descriptive data for fish contained in each composite. Tissue weights are wet weight values. These weights are not the weight of tissue used to form the composites.

Sample ID	Tag Num	Sex	Age	Length (in)	Length (cm)	Round Wt* (g)	Whole Fillet Wt (g)	Muscle Wt (g)	Fat Wt (g)	Skin Wt (g)
CC43-46-1	1902	M	7	17.4	44.2	700	193.5	171.3	4.3	15.1
CC43-46-1	1995	M	7	17.4	44.2	700	176.6	150.6	11.8	11.7
CC43-46-1	1984	M	7	17.4	44.2	700	208.5	174.8	14.7	15.8
CC43-46-1	1910	M	7	17.2	43.7	600	171	143.6	12.9	12.2
CC43-46-2	1983	M	7	17.6	44.7	800	195.5	172.6	6.3	12.1
CC43-46-2	1993	M	8	17.5	44.5	700	170	137.4	16.5	11.5
CC43-46-2	1904	M	7	17.6	44.7	700	192.6	165.5	11.4	12.3
CC43-46-2	1999	F	7	17.7	45.0	700	225.4	191.9	8.4	20.1
CC43-46-3	1994	M	8	17.8	45.2	700	203.7	174.3	11.6	13.6
CC43-46-3	1907	M	8	17.8	45.2	800	197.1	161.9	17.7	14.2
CC43-46-3	1921	M	8	17.8	45.2	700	203.8	158.2	24.9	16.5
CC43-46-3	1991	M	8	17.7	45.0	800	222.9	169.1	34.0	15.0
CC43-46-4	1901	M	7	18	45.7	900	249.4	214.8	11.6	18.7
CC43-46-4	1905	M	7	17.9	45.5	700	188.2	166.4	9.3	10.1
CC43-46-4	1982	M	8	17.9	45.5	800	195.2	170.5	7.3	15.6
CC43-46-4	2000	M	7	18	45.7	700	205.1	183.6	3.7	14.3
CC48-51-1	1848	F	8	19	48.3	900	222.1	194.8	7.3	19
CC48-51-1	1940	M	8	19.1	48.5	1000	273.4	231.4	17.8	22.9
CC48-51-1	1926	M	8	19	48.3	1000	266.3	222.6	21.7	17.3
CC48-51-1	1841	M	7	19.1	48.5	1000	270.4	224.5	21.9	21.0
CC48-51-2	1909	F	8	19.2	48.8	1000	211.2	178.0	13.8	15.5
CC48-51-2	1935	F	7	19.2	48.8	900	232.1	176.7	32.4	16.2
CC48-51-2	1914	M	8	19.2	48.8	1000	280.6	228.8	34.5	19.2
CC48-51-2	1913	M	8	19.2	48.8	1000	286.9	226.8	37.9	19.5
CC48-51-3	1985	M	9	19.3	49.0	1000	320.0	256.8	34.4	23.1
CC48-51-3	1988	M	8	19.4	49.3	1000	286.8	229.6	31.9	20.3
CC48-51-3	1918	F	8	19.3	49.0	1000	253.7	214.7	18.3	17.3
CC48-51-3	1850	M	8	19.2	48.8	900	247.4	217.0	14.2	14.0
CC48-51-4	1842	M	8	19.4	49.3	1000	302.1	263.1	16.4	18.7
CC48-51-4	1927	F	9	19.4	49.3	1000	245.8	203.1	15.0	20.3
CC48-51-4	1939	M	8	19.5	49.5	1000	293.4	240.2	20.5	24.9
CC48-51-4	1912	M	8	19.8	50.3	1000	315.0	255.6	31.6	22.3
CC53-56-1	1932	M	8	21	53.3	1200	338.4	290.8	23.7	19.9
CC53-56-1	1931	F	9	21.1	53.6	1300	413.5	333.2	47.1	25.3
CC53-56-1	1933	M	9	21.1	53.6	1500	392.2	320.6	39.2	27.5
CC53-56-1	1936	F	9	21.1	53.6	1200	308.6	260.2	18.3	26.1
CC53-56-2	1930	M	10	21.3	54.1	1500	287.1	233.7	26.1	22.7
CC53-56-2	1938	M	10	21.1	53.6	1400	402.0	328.8	45.9	23.4
CC53-56-2	1929	M	10	21.2	53.8	1400	381.8	328.3	25.0	23.4
CC53-56-2	1906	M	9	21.2	53.8	1500	414.9	355.5	24.8	28.1
CC53-56-3	1922	M	8	21.4	54.4	1500	454.7	356.8	59.1	27.3
CC53-56-3	1934	M	9	21.4	54.4	1400	398.7	314.1	44.9	29.1

Table 12 continued…

Sample ID	Tag Num	Sex	Age	Length (in)	Length (cm)	Round Wt* (g)	Whole Fillet Wt (g)	Muscle Wt (g)	Fat Wt (g)	Skin Wt (g)
CC53-56-3	1986	M	11	21.4	54.4	1400	383.4	320.4	28.6	26.7
CC53-56-3	1844	M	8	21.6	54.9	1400	368.0	293.6	47.5	21.9
CC53-56-4	1843	M	9	21.6	54.9	1300	347.2	291.6	27.5	23.2
CC53-56-4	1928	M	10	21.6	54.9	1300	351.5	290.2	34.5	22.4
CC53-56-4	1911	M	9	21.7	55.1	1500	409.3	347.8	29.5	27.6
CC53-56-4	1979	M	10	22	55.9	1400	400.9	335.9	35.0	23.8
CC58-61-1	1916	M	9	23	58.4	1500	468.5	362.7	36.2	39.0
CC58-61-1	1997	M	9	23.2	58.9	1900	511.2	407.6	41.0	50.1
CC58-61-1	1908	M	9	23.2	58.9	2000	603.9	483.4	37.4	45.8
CC58-61-1	1925	M	10	23	58.4	2000	518.3	435.6	40.3	35.4
CC58-61-2	1917	M	10	23.1	58.7	1800	519.2	418.4	48.4	39.8
CC58-61-2	1992	M	10	23.1	58.7	1700	472.8	380.8	45.2	36.8
CC58-61-2	1987	M	10	23	58.4	1700	489.2	406.3	36.0	35.5
CC58-61-2	1998	M	10	23.1	58.7	1600	511.1	408.4	47.4	40.4
CC58-61-3	1919	F	11	23	58.4	2000	457.1	346.5	69.5	34.1
CC58-61-3	1846	M	11	23	58.4	1800	481.3	401.1	39.1	31.5
CC58-61-3	1924	F	12	23	58.4	2000	436.1	347.5	49.2	33.1
CC58-61-3	1937	M	12	23	58.4	1800	466.3	391.9	30.2	35.1
CC58-61-4	1923	M	11	23.2	58.9	1800	510.3	425.0	42.3	33.2
CC58-61-4	1849	M	11	23.2	58.9	NA	595.8	483.3	68.9	33.7
CC58-61-4	1996	M	11	23.4	59.4	1800	495.8	399.8	50.9	36.0
CC58-61-4	1915	F	11	23.5	59.7	2000	469.7	377.0	49.7	35.1

* Round weight refers to the unprocessed weight of the fish in the field.
NA = Not Available

Table 13. Percent lipid and mean ± one standard deviation of percent moisture measured in fat and skin tissues from Lake Superior whitefish (*Coregonus clupeaformis*) fillets.

	Fat			Skin		
Sample ID	% Lipid	Mean % Moisture	STDEV	% Lipid	Mean % Moisture	STDEV
CC43-46-1	17.4	66.72	0.91	14.3	64.04	1.16
CC43-46-2	14.6	68.94	0.35	13.2	63.30	0.70
CC43-46-3	10.9	71.35	0.24	11.4	63.87	0.97
CC43-46-4	15.7	67.51	0.20	13.7	63.90	0.46
CC48-51-1	22.5	62.99	1.93	15.6	63.74	0.41
CC48-51-2	24.0	60.16	0.30	14.1	62.44	0.37
CC48-51-3	24.0	52.97	2.34	13.5	59.67	2.28
CC48-51-4	25.5	53.43	19.19	16.9*	60.01	0.05
CC53-56-1	24.7	59.80	0.83	12.1	65.16	0.61
CC53-56-2	26.7	55.04	0.85	14.8	64.13	0.96
CC53-56-3	17.8	65.50	0.46	16.0	62.10	0.20
CC53-56-4	28.8*	56.37	0.65	14.5	61.48	0.67
CC58-61-1	38.6*	42.18	2.55	27.9*	49.62	0.18
CC58-61-2	29.7	53.63	0.41	20.6	56.35	0.25
CC58-61-3	22.1	61.12	0.79	11.5	65.30	0.06
CC58-61-4	29.0	52.48	5.58	20.5	57.56	0.76

* Value listed is the mean of duplicate samples.

Table 14. Individual Lake Superior whitefish (*Coregonus clupeaformis*) muscle tissue composite chemical concentrations. Concentrations listed for skin-on trimmed fillets (SOT) and skin-on untrimmed fillets (SOUT) are estimated values based on the wet weight of tissues in the composites and percent lipid in those tissues. "Percent Moisture" data for each composite are the average of three replicates. Values given for "Percent Moisture" and Percent Lipid" are percentages. All other data are wet weight concentrations in units of ug/kg. Significant figures are consistent with lab reported values.

Chemical Parameter	Method Detection Limit	Estimated Quantitation Limit	Length Group*	Composite Number				Replicate**		Length Group Average***	Length Group STDEV	Skin-on Trimmed (SOT) Fillet Average	Skin-on Trimmed (SOT) Fillet STDEV	Skin-on Untrimmed (SOUT) Fillet Average	Skin-on Untrimmed (SOUT) Fillet STDEV
				1	2	3	4	1	2						
Percent Moisture			43 to 46 cm	77.0	77.3	78.7	77.1	.	.	77.5	0.8	.	.	.	.
			48 to 51 cm	77.2	77.0	76.3	76.2			76.7	0.5	.	.	.	.
			53 to 56 cm	77.0	75.9	76.3	74.6	.	.	76.0	1.0	.	.	.	.
			58 to 61 cm	72.6	73.8	75.7	73.8			74.0	1.3	.	.	.	.
Percent Moisture Standard Deviation			43 to 46 cm	0.3	0.2	0.0	0.8	.	.	0.3	0.3	.	.	.	.
			48 to 51 cm	0.4	0.2	0.5	0.0			0.3	0.2	.	.	.	.
			53 to 56 cm	0.3	0.2	0.2	0.3	.	.	0.3	0.1	.	.	.	.
			58 to 61 cm	0.1	0.3	0.1	0.5			0.3	0.2	.	.	.	.
Percent Lipids			43 to 46 cm	2.42	2.92	2.52	2.76	2.68	2.84	2.66	0.23	.	.	.	.
			48 to 51 cm	3.74	2.89	3.89	4.16			3.67	0.55	.	.	.	.
			53 to 56 cm	3.50	4.57	4.01	5.20	5.00	5.40	4.32	0.73	.	.	.	.
			58 to 61 cm	7.76	6.24	4.70	6.31			6.25	1.25	.	.	.	.
2,4'-DDD	0.82	5.0	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
2,4'-DDE	1.2	5.0	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
2,4'-DDT	1.1	5.0	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	1.2	ND	1.6	ND			1.4	0.3	1.6	0.2	2.0	0.4

Table 14 continued…

Chemical Parameter	Method Detection Limit	Estimated Quantitation Limit	Length Group*	Composite Number 1	2	3	4	Replicate** 1	2	Length Group Average***	Length Group STDEV	Skin-on Trimmed (SOT) Fillet Average	Skin-on Trimmed (SOT) Fillet STDEV	Skin-on Untrimmed (SOUT) Fillet Average	Skin-on Untrimmed (SOUT) Fillet STDEV
4,4'-DDD	1.0	5.0	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	1.1			1.1	.	1.4	.	1.7	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
4,4'-DDE	0.74	5.0	43 to 46 cm	11	11	11	12	12	12	11	1	15	1	17	1
			48 to 51 cm	15	13	20	16			16	3	20	3	27	4
			53 to 56 cm	28	30	35	28	24	32	30	3	36	5	47	5
			58 to 61 cm	36	44	35	26			35	7	42	9	52	11
4,4'-DDT	1.1	5.0	43 to 46 cm	2.1	2.1	2.3	2.0	2.1	1.8	2.1	0.1	2.8	0.2	3.3	0.4
			48 to 51 cm	3.2	2.6	4.3	3.8			3.5	0.7	4.3	0.8	5.9	0.8
			53 to 56 cm	5.8	5.7	5.4	6.7	6.4	7.0	5.9	0.6	6.9	0.4	9.2	0.8
			58 to 61 cm	9.9	11	6.8	4.5			8.1	3.0	9.6	3.8	12	4
Aldrin	0.42	2.5	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
Alpha-BHC	0.86	2.5	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	0.89	ND	0.98	ND			0.94	0.06	1.1	0.0	1.5	0.1
			53 to 56 cm	1.2	1.3	1.0	1.7	1.7	1.7	1.3	0.3	1.5	0.3	2.0	0.4
			58 to 61 cm	3.6	1.8	1.2	2.3			2.2	1.0	2.7	1.3	3.3	1.5
Alpha-Chlordane	0.42	2.5	43 to 46 cm	1.5	1.3	1.1	0.91	0.89	0.93	1.2	0.3	1.6	0.4	1.9	0.5
			48 to 51 cm	2.1	2.2	2.4	1.9			2.2	0.2	2.7	0.2	3.7	0.7
			53 to 56 cm	2.9	2.2	1.9	3.3	3.1	3.4	2.6	0.6	3.0	0.7	4.0	1.0
			58 to 61 cm	4.3	4.8	6.0	2.9			4.5	1.3	5.3	1.4	6.6	1.8
Aroclor 1016	12	50	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.

Table 14 continued…

Chemical Parameter	Method Detection Limit	Estimated Quantitation Limit	Length Group*	Composite Number 1	2	3	4	Replicate** 1	2	Length Group Average***	Length Group STDEV	Skin-on Trimmed (SOT) Fillet Average	Skin-on Trimmed (SOT) Fillet STDEV	Skin-on Untrimmed (SOUT) Fillet Average	Skin-on Untrimmed (SOUT) Fillet STDEV
Aroclor 1221	12	50	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
Aroclor 1232	12	50	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
Aroclor 1242	12	50	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
Aroclor 1248	12	50	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
Aroclor 1254	12	50	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
Aroclor 1260	12	50	43 to 46 cm	21	17	19	19	19	19	19	2	25	3	29	5
			48 to 51 cm	25	23	35	28			28	5	35	5	47	7
			53 to 56 cm	53	50	43	46	44	48	48	4	56	5	75	10
			58 to 61 cm	58	65	68	41			58	12	68	14	86	17
Beta-BHC	1.1	2.5	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.

Table 14 continued…

Chemical Parameter	Method Detection Limit	Estimated Quantitation Limit	Length Group*	Composite Number 1	2	3	4	Replicate** 1	2	Length Group Average***	Length Group STDEV	Skin-on Trimmed (SOT) Fillet Average	Skin-on Trimmed (SOT) Fillet STDEV	Skin-on Untrimmed (SOUT) Fillet Average	Skin-on Untrimmed (SOUT) Fillet STDEV
Cis-nonachlor	1.0	5.0	43 to 46 cm	6.0	5.6	5.5	5.3	5.2	5.4	5.6	0.3	7.3	0.7	8.7	1.1
			48 to 51 cm	8.4	7.2	10	8.5			8.5	1.1	11	1	14	1
			53 to 56 cm	13	12	12	14	13	14	13	1	15	1	20	2
			58 to 61 cm	18	21	16	13			17	3	20	4	25	5
Delta-BHC	0.68	2.5	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
Dieldrin	1.1	5.0	43 to 46 cm	7.4	7.6	5.8	6.0	5.7	6.3	6.7	0.9	8.8	1.4	10	2
			48 to 51 cm	11	12	10	12			11	1	14	2	19	4
			53 to 56 cm	13	15	10	15	12	17	13	2	15	2	20	3
			58 to 61 cm	24	24	20	21			22	2	26	3	33	3
Endosulfan I	0.43	2.5	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
Endosulfan II	0.80	5.0	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND		ND		ND	
			48 to 51 cm	0.89	0.88	0.86	ND			0.88	0.02	1.1	0.1	1.5	0.3
			53 to 56 cm	0.94	ND	ND	1.4	ND	1.4	1.2	0.3	1.3	0.3	1.8	0.3
			58 to 61 cm	2.0	1.9	4.0	1.6			2.4	1.1	2.8	1.2	3.5	1.6
Endosulfan Sulfate	2.0	5.0	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
Endrin	0.84	5.0	43 to 46 cm	0.93	1.0	ND	ND	ND	ND	1.0	0.0	1.3	0.0	1.5	0.1
			48 to 51 cm	1.3	1.6	1.6	1.4			1.5	0.2	1.8	0.2	2.6	0.6
			53 to 56 cm	2.0	1.9	1.3	2.1	1.9	2.3	1.8	0.4	2.1	0.4	2.9	0.6
			58 to 61 cm	3.2	3.0	2.5	2.6			2.8	0.3	3.3	0.5	4.2	0.5

Table 14 continued…

Chemical Parameter	Method Detection Limit	Estimated Quantitation Limit	Length Group*	Composite Number 1	2	3	4	Replicate** 1	2	Length Group Average***	Length Group STDEV	Skin-on Trimmed (SOT) Fillet Average	Skin-on Trimmed (SOT) Fillet STDEV	Skin-on Untrimmed (SOUT) Fillet Average	Skin-on Untrimmed (SOUT) Fillet STDEV
Endrin Aldehyde	1.0	5.0	43 to 46 cm	3.2	3.1	3.0	2.0	1.8	2.2	2.8	0.6	3.7	0.8	4.4	1.1
			48 to 51 cm	3.5	3.6	5.0	4.6			4.2	0.7	5.2	0.7	7.1	1.1
			53 to 56 cm	6.3	6.3	5.0	7.0	6.5	7.4	6.1	0.8	7.2	0.7	9.6	1.3
			58 to 61 cm	8.9	10	8.3	6.6			8.5	1.4	10	2	12	2
Endrin Ketone	0.90	5.0	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
Gamma-BHC (Lindane)	0.48	2.5	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	0.51	ND	ND	ND	ND	0.51	.	0.59	.	0.78	.
			58 to 61 cm	0.87	ND	ND	0.62			0.75	0.18	0.90	0.25	1.1	0.2
Gamma-Chlordane	1.6	2.5	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	1.8	2.3	2.1	1.9	1.9	1.9	2.0	0.2	2.4	0.3	3.2	0.3
			58 to 61 cm	5.2	5.7	2.7	1.7			3.8	1.9	4.6	2.4	5.6	2.8
Heptachlor	0.72	2.5	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
Heptachlor Epoxide	0.66	2.5	43 to 46 cm	2.7	2.9	2.7	2.5	2.3	2.6	2.7	0.2	3.5	0.3	4.2	0.5
			48 to 51 cm	4.0	4.0	4.0	5.2			4.3	0.6	5.4	0.8	7.3	1.1
			53 to 56 cm	5.5	6.7	4.1	6.5	5.9	7.0	5.7	1.2	6.7	1.2	8.9	1.7
			58 to 61 cm	10	9.6	7.6	9.0			9.1	1.1	11	2	13	2
Hexachlorobenzene	0.45	2.5	43 to 46 cm	2.4	2.3	2.0	1.8	1.9	1.7	2.1	0.3	2.8	0.4	3.3	0.6
			48 to 51 cm	2.6	2.6	3.1	2.6			2.7	0.3	3.4	0.2	4.7	0.7
			53 to 56 cm	3.0	3.6	2.6	4.0	3.3	4.6	3.3	0.6	3.8	0.6	5.1	0.8
			58 to 61 cm	4.5	4.8	3.6	3.2			4.0	0.8	4.8	1.0	5.9	1.1

Table 14 continued…

Chemical Parameter	Method Detection Limit	Estimated Quantitation Limit	Length Group*	Composite Number 1	2	3	4	Replicate** 1	2	Length Group Average***	Length Group STDEV	Skin-on Trimmed (SOT) Fillet Average	Skin-on Trimmed (SOT) Fillet STDEV	Skin-on Untrimmed (SOUT) Fillet Average	Skin-on Untrimmed (SOUT) Fillet STDEV
Methoxychlor	2.8	25	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
Mirex	0.99	5.0	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
Oxychlordane	0.72	5.0	43 to 46 cm	1.4	1.6	1.7	1.6	1.5	1.6	1.6	0.1	2.0	0.1	2.4	0.2
			48 to 51 cm	2.0	1.4	2.1	2.3			2.0	0.4	2.4	0.4	3.3	0.3
			53 to 56 cm	3.6	3.6	3.4	3.4	3.3	3.5	3.5	0.1	4.1	0.2	5.5	0.4
			58 to 61 cm	4.9	5.9	4.3	4.8			5.0	0.7	5.9	0.9	7.4	1.0
Pentachloroanisole	0.36	2.5	43 to 46 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			48 to 51 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
			53 to 56 cm	ND	ND	ND	ND	ND	ND	ND	.	ND	.	ND	.
			58 to 61 cm	ND	ND	ND	ND			ND	.	ND	.	ND	.
Total Chlordane	sum of - cis-chlordane, trans-chlordane, cis-nonachlor, trans nonachlor, oxychlordane		43 to 46 cm	16	15	15	15	14	15	15	1	20	2	23	3
			48 to 51 cm	22	19	27	23			23	3	28	3	39	4
			53 to 56 cm	38	36	36	39	37	41	37	2	44	1	58	4
			58 to 61 cm	55	65	48	38			52	11	61	15	76	17
Total DDT	sum of - 2,4'-DDD, 2,4'-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, 4,4'DDT		43 to 46 cm	13	13	13	14	14	14	13	1	17	1	20	1
			48 to 51 cm	18	16	24	20			20	3	24	3	33	4
			53 to 56 cm	34	36	40	35	30	39	36	3	43	5	57	5
			58 to 61 cm	47	55	43	31			44	10	52	13	65	15
Total Mercury****	1.3		43 to 46 cm	50	60	56	58			56	4	.	.	.	.
			48 to 51 cm	59	60	55	70	55	54	61	7	.	.	.	.
			53 to 56 cm	85	98	99	76			90	11	.	.	.	.
			58 to 61 cm	82	92	100	120	120	120	98	14	.	.	.	.

Table 14 continued…

Chemical Parameter	Method Detection Limit	Estimated Quantitation Limit	Length Group*	Composite Number 1	2	3	4	Replicate** 1	2	Length Group Average***	Length Group STDEV	Skin-on Trimmed (SOT) Fillet Average	Skin-on Trimmed (SOT) Fillet STDEV	Skin-on Untrimmed (SOUT) Fillet Average	Skin-on Untrimmed (SOUT) Fillet STDEV
Total PCBs	12	50	43 to 46 cm	21	17	19	19	19	19	19	2	25	3	29	5
			48 to 51 cm	25	23	35	28			28	5	35	5	47	7
			53 to 56 cm	53	50	43	46	44	48	48	4	56	5	75	10
			58 to 61 cm	58	65	68	41			58	12	68	14	86	17
Toxaphene	46	250	43 to 46 cm	65	ND	49	ND	ND	ND	57	11	77	19	94	23
			48 to 51 cm	90	93	110	100			98	9	120	10	170	20
			53 to 56 cm	140	120	100	140	130	150	130	20	150	20	200	30
			58 to 61 cm	210	230	180	130			190	40	220	60	280	60
Trans-Nonachlor	0.80	5.0	43 to 46 cm	6.8	6.6	6.6	6.5	6.3	6.6	6.6	0.1	8.7	0.5	10	1
			48 to 51 cm	9.9	8.4	12	9.9			10	1	13	1	17	2
			53 to 56 cm	17	16	17	17	16	18	17	1	20	1	26	2
			58 to 61 cm	23	28	19	16			22	5	26	7	32	8

ND = Not detected

* Length groups in centimeters correspond to inches as follows: 43 to 46 cm = 17 to 18 inches; 48 to 51 cm = 19 to 20 inches; 53 to 56 cm = 21 to 22 inches; and 58 to 61 cm = 23 to 24 inches.

** For the 43 to 46 cm and 53 to 56 cm length groups, the values for composite 4 represent the average of two replicates.

*** "ND" values were treated as "0" and were not included in length group average calculations.

**** Duplicate measurements for total mercury analysis were run on composite 3 of the 48 to 51 cm length group and composite 4 of the 58 to 61 cm length group. Total mercury concentrations are listed as reported by the Lake Superior Research Institute. Total mercury concentrations were not calculated for SOT and SOUT fillets because mercury binds to muscle tissue and is not reduced by trimming fillets.

Table 15. Statistics for five representative organic contaminants regressed against percent lipid in muscle tissue to test lipid partitioning assumptions used in estimating chemical concentrations in SOT and SOUT fillets.

Chemical or Chemical group	Number of samples	r-squared	p-value	slope
Total PCBs	16	0.54	0.0011	8.3
Total Chlordane	16	0.73	<0.0001	8.6
Total DDT	16	0.65	0.0002	7.2
Toxaphene	14	0.69	0.0002	28
Dieldrin	16	0.85	<0.0001	3.6

Table 16. Lake Superior whitefish (*Coregonus clupeaformis*) mean, standard deviation, and range of chemical concentrations (ug/kg) in muscle tissue, skin-on trimmed fillets (SOT) and skin-on, untrimmed fillets (SOUT) for each composite size group. Results for SOT and SOUT fillets are estimated values based on the wet weight of tissues in the composites and percent lipid in those tissues. United States Food and Drug Administration (FDA) fish tissue concentration levels regulating the commercial sale of fish are given for each chemical or chemical group.

Chemical Parameter	Tissue***	Whitefish Size Group (cm)	Mean Conc. (ug/kg)	St. Dev. (ug/kg)	Range (ug/kg)	FDA Level (ug/kg)
Total Mercury**	M	43-46*	56	4	50-60	1000****
	M	48-51	61	6	55-70	
	M	53-56*	90	11	76-99	
	M	58-61	98	14	82-116	
Total PCBs	M	43-46*	19	2	17-21	2000
	M	48-51	28	5	23-35	
	M	53-56*	48	4	43-53	
	M	58-61	58	12	41-68	
	SOT	43-46*	25	3	22-29	
	SOT	48-51	35	5	30-42	
	SOT	53-56*	56	5	52-63	
	SOT	58-61	68	14	48-78	
	SOUT	43-46*	29	5	25-36	
	SOUT	48-51	47	7	39-56	
	SOUT	53-56*	75	10	67-89	
	SOUT	58-61	86	17	61-100	
Total Chlordane	M	43-46*	15	1	15-16	300
	M	48-51	23	3	19-27	
	M	53-56*	37	2	36-39	
	M	58-61	52	11	38-65	
	SOT	43-46*	20	2	19-22	
	SOT	48-51	28	3	25-32	
	SOT	53-56*	44	1	42-45	
	SOT	58-61	61	15	44-78	
	SOUT	43-46*	23	3	21-27	
	SOUT	48-51	39	4	35-44	
	SOUT	53-56*	58	4	55-64	
	SOUT	58-61	76	17	57-97	
Total DDT	M	43-46*	13	1	13-14	5000
	M	48-51	20	3	16-24	
	M	53-56*	36	3	34-40	
	M	58-61	44	10	31-55	
	SOT	43-46*	17	1	17-18	
	SOT	48-51	24	3	21-28	
	SOT	53-56*	43	5	39-49	
	SOT	58-61	52	13	36-66	
	SOUT	43-46*	20	1	19-22	
	SOUT	48-51	33	4	28-39	
	SOUT	53-56*	57	5	51-62	
	SOUT	58-61	65	15	46-82	
Aldrin/Dieldrin	M	43-46*	6.7	0.9	5.8-7.6	300
	M	48-51	11	1	10-12	
	M	53-56*	13	2	10-15	
	M	58-61	22	2	20-24	
	SOT	43-46*	8.8	1.4	7.5-10	
	SOT	48-51	14	2	12-16	
	SOT	53-56*	15	2	12-17	
	SOT	58-61	26	3	22-30	
	SOUT	43-46*	10	2	8.7-13	
	SOUT	48-51	19	4	16-25	
	SOUT	53-56*	20	3	16-23	
	SOUT	58-61	33	3	29-36	

Table 16 Continued…

Chemical Parameter	Tissue***	Whitefish Size Group (cm)	Mean Conc. (ug/kg)	St. Dev. (ug/kg)	Range (ug/kg)	FDA Level (ug/kg)
Heptachlor/Heptachlor Epoxide	M	43-46*	2.7	0.2	3.5-4.2	300
	M	48-51	4.3	0.6	4-5.2	
	M	53-56*	5.7	1.2	5.5-6.7	
	M	58-61	9.1	1.1	7.6-10	
	SOT	43-46*	3.5	0.3	3.2-3.7	
	SOT	48-51	5.4	0.8	5.1-6.5	
	SOT	53-56*	6.7	1.2	5.0-7.8	
	SOT	58-61	11	2	8.5-12	
	SOUT	43-46*	4.2	0.5	3.5-4.6	
	SOUT	48-51	7.3	1.1	6.3-8.5	
	SOUT	53-56*	8.9	1.7	6.4-10	
	SOUT	58-61	13	2	11-15	
Mirex	M	43-46*	ND	.	ND	100
	M	48-51	ND	.	ND	
	M	53-56*	ND	.	ND	
	M	58-61	ND	.	ND	
	SOT	43-46*	ND	.	ND	
	SOT	48-51	ND	.	ND	
	SOT	53-56*	ND	.	ND	
	SOT	58-61	ND	.	ND	
	SOUT	43-46*	ND	.	ND	
	SOUT	48-51	ND	.	ND	
	SOUT	53-56*	ND	.	ND	
	SOUT	58-61	ND	.	ND	

ND = Not Detected

* These ranges include the mean of duplicate samples, i.e. duplicates were not treated as separate samples for inclusion in the concentration ranges.

** Because mercury binds to muscle tissue, trimming the fillet will not reduce mercury concentrations. Therefore, mercury concentrations were not calculated for SOT and SOUT fillets.

*** M = trimmed, skin-off muscle tissue; SOT = skin-on, trimmed fillet; SOUT = skin-on, untrimmed fillet.

**** The FDA action level for mercury is for methylmercury. Generally >95% of mercury in top predator fish such as lake trout is methylmercury (GLIFWC data, unpublished).

Table 17. Comparison of Lake Superior whitefish (*Coregonus clupeaformis*) muscle tissue contaminant data collected by the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) in 1999 and 2003. Whitefish composite size group (cm), mean chemical concentration (ug/kg), and concentration range (ug/kg) are given for three chemicals/chemical groups.

	2003 Data			1999 Data		
Chemical Parameter	**Whitefish Size Group**	**Mean Conc.**	**Range**	**Whitefish Size Group**	**Mean Conc.**	**Range**
Total Mercury	43-46*	56	50-60			
	48-51	61	55-70			
	53-56*	90	76-99			
	58-61	98	82-116	56-61	65	60-70
Total PCBs	43-46*	19	17-21			
	48-51	28	23-35			
	53-56*	48	43-53			
	58-61	58	41-68	56-61	32	20-45
Total Chlordane	43-46*	15	15-16			
	48-51	23	19-27			
	53-56*	37	36-39			
	58-61	52	38-65	56-61	14	11-17

* These ranges include the mean of duplicate samples, i.e. duplicates were not treated as separate samples for inclusion in the concentration ranges

Table 18. Current (as of 2005) trigger and "do not eat" (DNE) fish tissue concentrations (in ug/kg wet weight) used by jurisdictions on the United States side of Lake Superior to set sport fish consumption advisories. More specific advice (such as a concentration defining one meal per week or per month) for some contaminants are available, but are not listed here. The listed contaminants are responsible for the majority of advisories on the U.S. side of Lake Superior*. Concentrations are wet weight in micrograms of contaminant per kilogram of fish tissue (parts per billion) unless noted.

Jurisdiction	Mercury		Total PCBs*****		Toxaphene		Total Chlordane	
	Trigger	DNE	Trigger	DNE	Trigger	DNE	Trigger	DNE
Sensitive Populations**								
Wisconsin	50	>1000	50	>1900	-	-	-	>5620
Minnesota	50	>1000	50	>1900	-	-	-	-
Michigan****	500	>1500	50	>1900	5000	-	300	-
General Population***								
Wisconsin	160	-	50	>1900	-	-	-	-
Minnesota	160	>2800	50	>1900	-	-	-	-
Michigan****	500	>1500	2000	-	5000	-	300	-

* In Ontario, 65% of Lake Superior advisories based on their 2005 guidance are caused by dioxins/furans and dioxin-like PCBs.

** The sensitive population is defined as women of childbearing age and children under the age of 15.

*** The general population is defined as men above age 15 and women beyond childbearing years or above age 15 and not planning to have children.

**** The Michigan Department of Community Health sets fish consumption advice for most contaminants including: total PCBs for the general population, toxaphene, dioxin TEQs, and total chlordane, based on the percentage of measured fish tissue concentrations that exceed the trigger level.

***** Total PCB advice for Wisconsin, Minnesota, and for sensitive populations in Michigan, is based on the Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory, developed by the Great Lakes Sport Fish Advisory Task Force, September 1993.

Table 19. Comparison of some current methods and total fillet samples used by states around Lake Superior to set whitefish (*Coregonus clupeaformis*) consumption advice.

State	Chemical driving advice	Analytical Method	Total whitefish samples collected	Total whitefish samples used for setting advice**	Location of sample collections to date (lake trout mgmt unit)
Michigan	Total PCBs	Sum of individual congeners	46	46	MI-5
Wisconsin	Total PCBs	Sum of Aroclor mixtures	24	15	WI-2
Minnesota	Total PCBs	Sum of Aroclor mixtures	9*	15	MN-3

* Five of the Minnesota samples are fillets, two are composites of 5 fillets each, and two are fish tissue plugs rather than fillets.

** Wisconsin and Minnesota combine their data for setting Lake Superior whitefish consumption advice. The two states currently use data collected only within the past 10 years for setting the whitefish advisory. Michigan uses all whitefish data collected by looking for trends in the data over time to determine whether the advisory needs to be updated.

Table 20. Summary of Lake Superior whitefish total mercury and total PCB data collected by the Great Lakes Indian Fish & Wildlife Commission (GLIFWC), Minnesota Department of Natural Resources (MNDNR), Michigan Department of Environmental Quality (MI DEQ), and Wisconsin Department of Natural Resources (WDNR). Results from each jurisdiction are summarized by year. Only fillet data results are listed. Whole fish and other non-fillet data were not included in this summary. GLIFWC samples were composites while other samples were largely individual fish. Note that concentrations are listed in units of mg/kg or parts per million. Mean results are given along with ± one standard deviation.

Agency	Year	Mgmt Unit	No. Analyses/No. Fish**	Length Mean (cm)	Length Range (cm)	Mean total mercury (mg/kg wet wt)	Total mercury range (mg/kg wet wt)	Mean total PCBs (Aroclors, mg/kg wet wt)	Total PCB Range (mg/kg wet wt)
MNDNR	1987	MN-3	2/10	58.7±0.4	NA***	0.074±0.003	0.072-0.076	0.079±0.086	0.018-0.14
MNDNR	2000	MN-3	5/5	54.4±5.5	48.8-60.5	0.02±0.01	0.01-0.03	0.01±0	0.01-0.01
MI DEQ	1986	MI-5	10/10	52.5±2.1	48-55	<0.1	NA	0.108±0.016	0.083-0.134
MI DEQ	1992	MI-5	7/7	49.9±4.3	44-56	0.05±0.02	0.03-0.09	0.068±0.022	0.029-0.092
MI DEQ	1993	MI-5	5/5	53.6±5.9	47-62	0.04±0.01	0.03-0.06	0.062±0.040	0.026-0.125
MI DEQ	1996	MI-5	20/20	54.2±5.5	45.2-63.2	0.05±0.01	0.03-0.09	0.100±0.056	0.033-0.208
MI DEQ	2000	MI-5	15/15	54.7±5.3	48.4-62.3	0.06±0.02	0.04-0.1	0.049±0.026****	0.013-0.096
MI DEQ	2002	MI-5	11/11	58.4±10.4	46.6-75.8	0.08±0.02	0.05-0.13	0.060±0.037****	0.024±0.141
WDNR	1974	WI-2	2/2	32.4±15.3	21.6-43.2	NA	NA	0.2±0.1	0.1-0.3
WDNR	1976	WI-2	2/2	61.1±3.1	58.9-63.2	NA	NA	1.5±1.8	0.21-2.7
WDNR	1985	WI-2	2/2	44.6±0.9	43.9-45.2	NA	NA	0.2±0	0.20-0.20
WDNR	1986	WI-2	1/1	64.8	NA	NA	NA	0.21	NA
WDNR	1987	WI-2	3/3	65.7±3.8	63.0-70.1	NA	NA	0.45±0.42	0.20-0.93
WDNR	1988	WI-2	4/4	43.4±17.9	32.0-70.1	0.073±0.039	0.05-0.13	0.23±0.06	0.20-0.31
WDNR	2003	WI-2	10/10	47.4±2.2	45.0-52.1	0.051±0.015	0.028-0.083	0.27±0.17	0.11-0.52
GLIFWC	1999	MI-4	4/47	57.3±0.3	55.9-61.0	0.051±0.007	0.046-0.061	0.058±0.009	0.051-0.071
GLIFWC*	2004	MI-3	4/16	44.9±0.6	43.7-45.7	0.056±0.004	0.050-0.060	0.029±0.005	0.025-0.036
GLIFWC*	2004	MI-3	4/16	48.9±0.5	48.3-50.3	0.061±0.006	0.055-0.070	0.047±0.007	0.039-0.056
GLIFWC*	2004	MI-3	4/16	54.3±0.7	53.3-55.9	0.090±0.011	0.076-0.099	0.075±0.010	0.067-0.089
GLIFWC*	2004	MI-3	4/16	58.7±0.4	58.4-59.7	0.098±0.014	0.082-0.116	0.086±0.017	0.061-0.10

* GLIFWC segmented fillets into muscle, skin, and fat tissues. In 2004, chemical concentrations were only measured in trimmed, skin-off muscle tissue. PCB concentrations listed here are estimates for a skin-on, untrimmed fillet based on lipid normalized muscle concentrations and percent lipid in the skin and fat tissues. Total mercury concentrations for the GLIFWC 2004 samples are reported for muscle tissue only (i.e. the skin and fat have been removed unlike the other fillet samples listed in this table).

** No. Analyses/No. Fish = No. Analyses denotes the number of laboratory analyses the data represent. No. Fish denotes the number of fish represented in those analyses. When the two numbers are equal, individual fish were analyzed, when the numbers are not equal, composites were analyzed.

*** NA = Not Available

**** MI DEQ total PCB data from 2000 and 2002 are reported as the sum of individual PCB congeners as opposed to the sum of Aroclors.

FIGURES

Figure 1. Lake Superior lake trout (*Salvelinus namaycush namaycush*) management units (United States waters). Whitefish samples were collected from Eagle River Shoal (marked with an "X") in management unit MI-3.

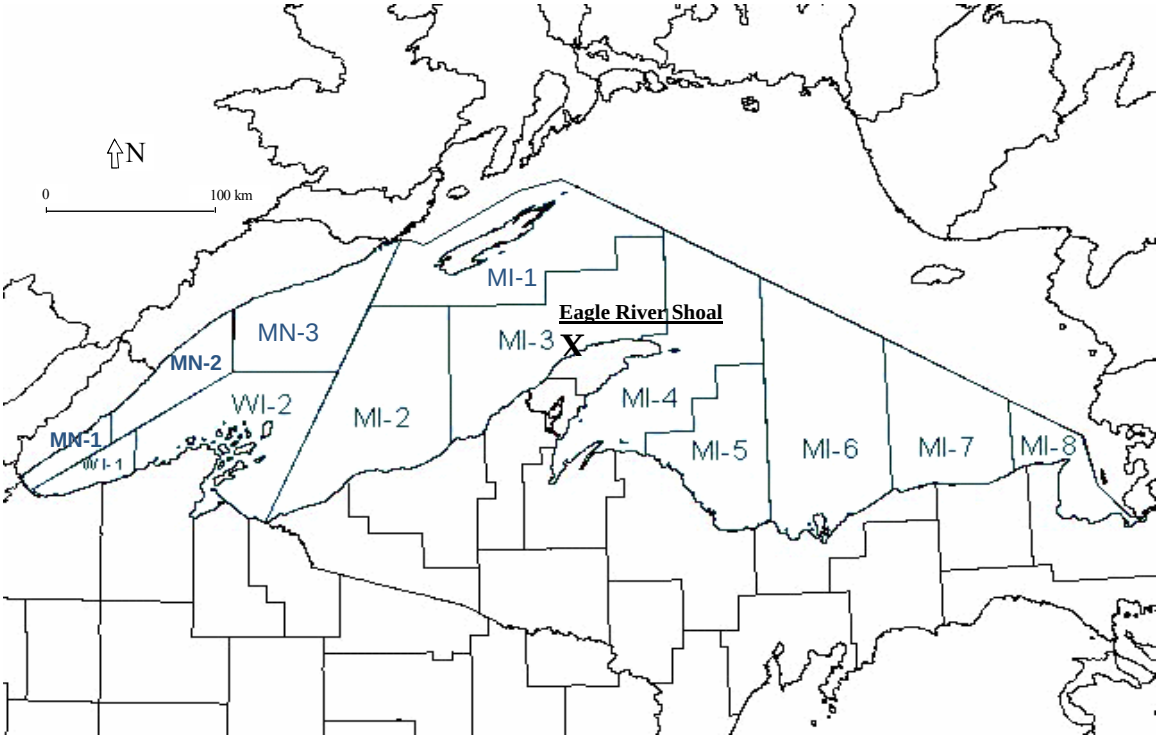
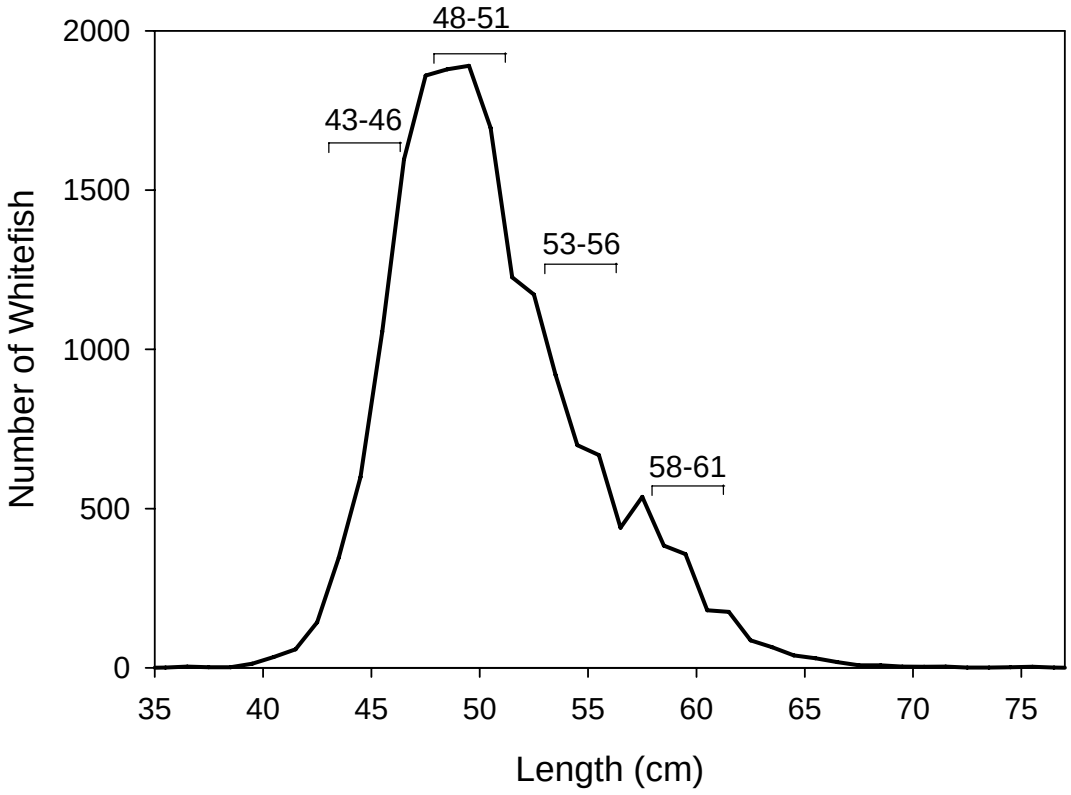


Figure 2. Great Lakes Indian Fish and Wildlife Commission (GLIFWC) whitefish (*Coregonus clupeaformis*) monitoring data from Lake Superior lake trout management unit MI-3 from the years 1985-2004. Numbered ranges indicate the size ranges of whitefish sampled.



Figures 3A and B. Comparison of Michigan, Minnesota and Wisconsin Lake Superior whitefish (*Coregonus clupeaformis*) consumption advice for sensitive populations (i.e. women of childbearing age and children under the age of 15, Figure A) and the general population (i.e. women beyond childbearing age and men above age 15, Figure B).

Figure 3A – Sensitive population

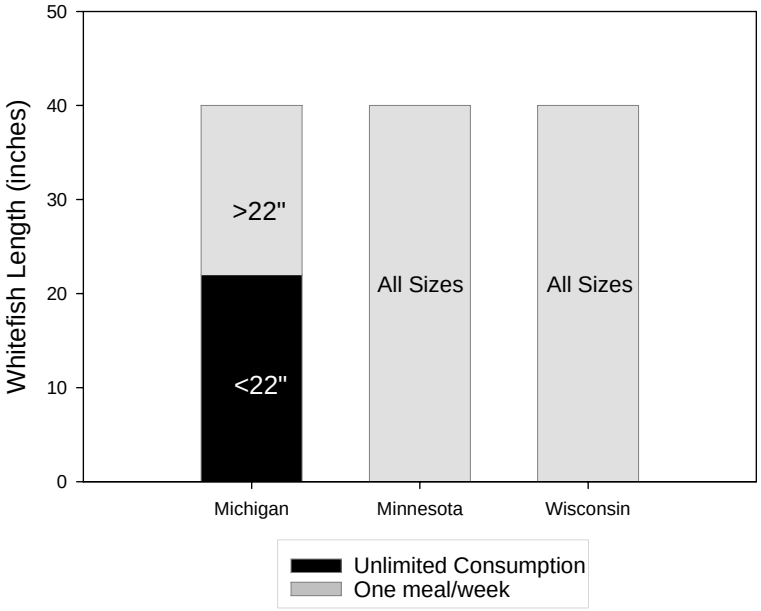


Figure 3B – General population

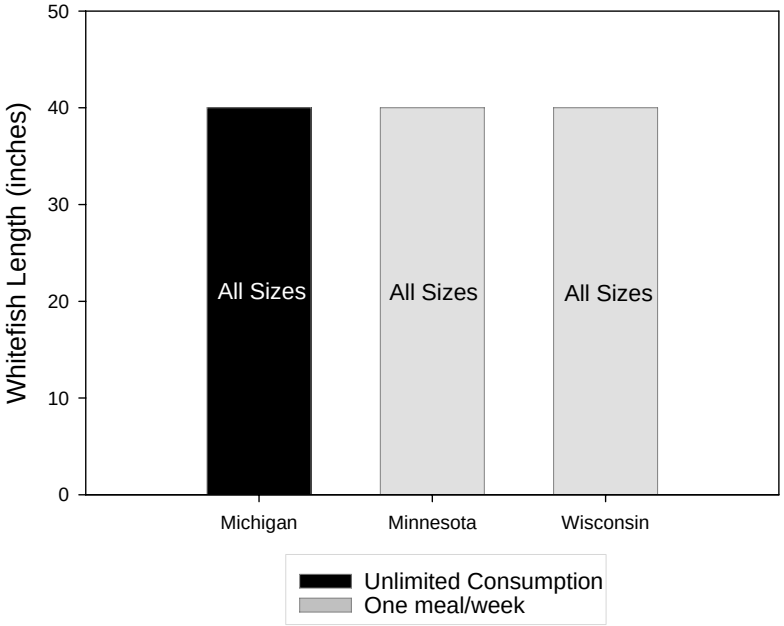


Figure 4. Total mercury concentrations (mean ± one standard deviation) for three species of Lake Superior fish. The sizes of fish span the length range of each species commonly harvested by tribal commercial fishermen. Data for siscowet trout (*Salvelinus namaycush siscowet*) and lake trout (*Salvelinus namaycush namaycush*) were previously reported by the Great Lakes Indian Fish and Wildlife Commission (GLIFWC).

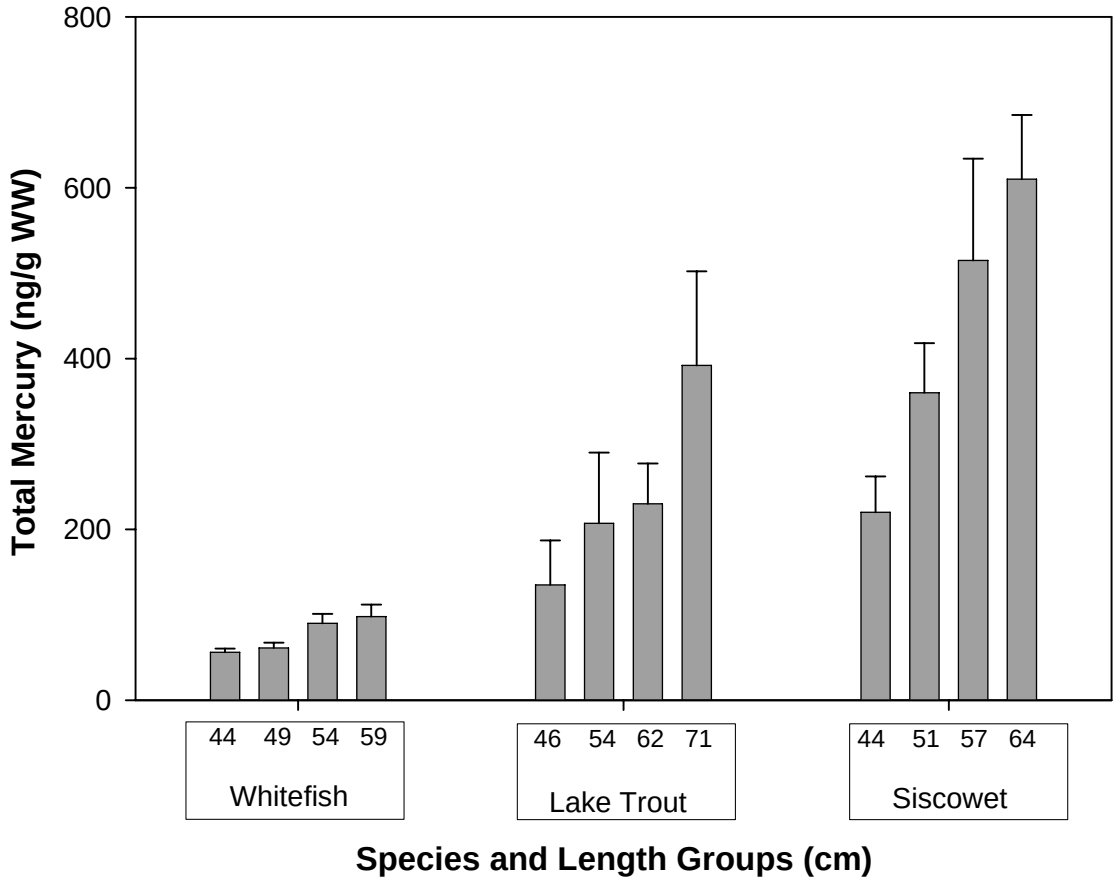
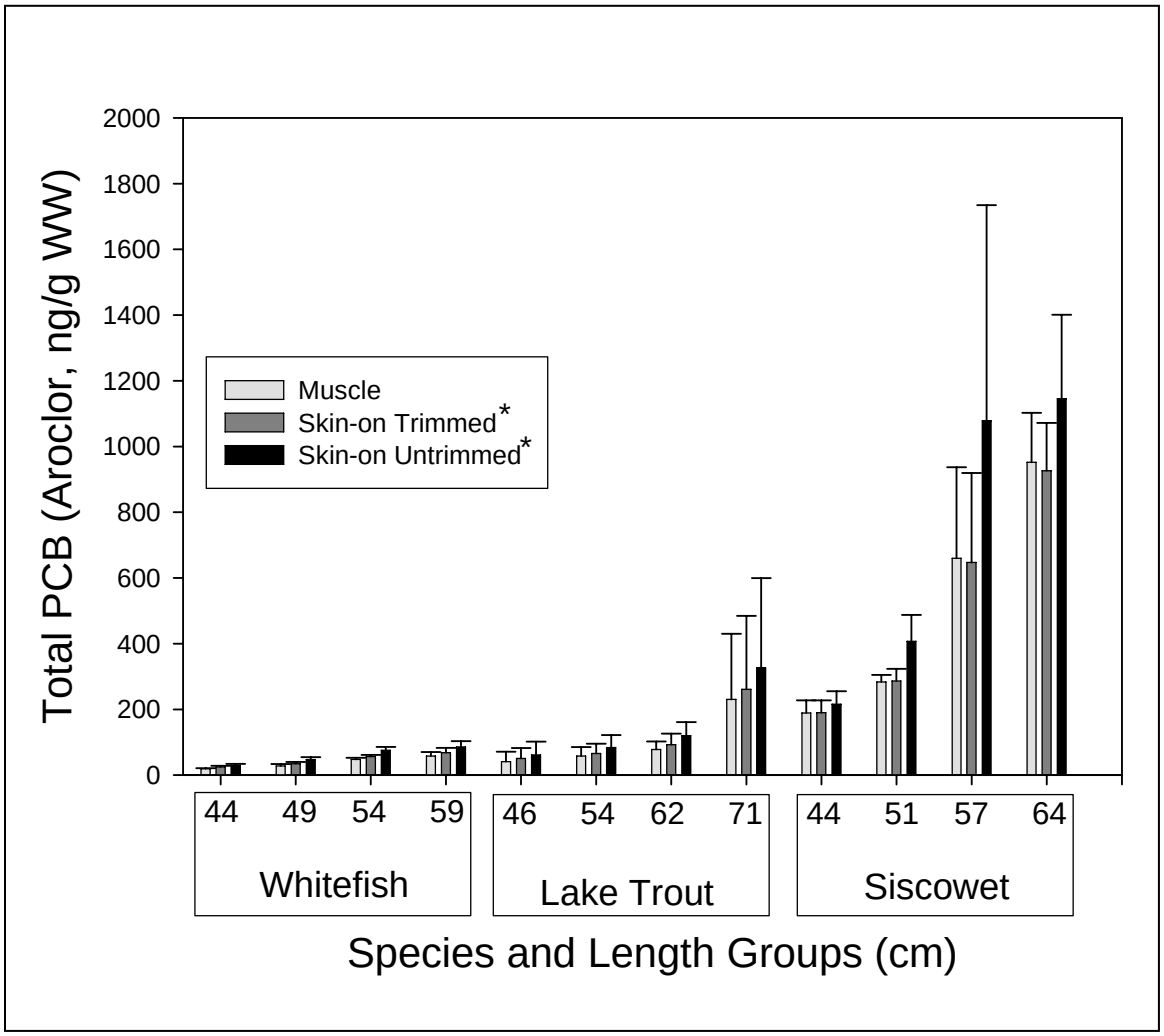


Figure 5. Total PCB concentrations (mean ± one standard deviation) for three species of Lake Superior fish. The sizes of fish span the length range of each species commonly harvested by tribal commercial fishermen. Data for siscowet trout (*Salvelinus namaycush siscowet*) and lake trout (*Salvelinus namaycush namaycush*) were previously reported by the Great Lakes Indian Fish and Wildlife Commission (GLIFWC).



* Concentrations in "skin-on trimmed" and "skin-on untrimmed" fillets were measured for siscowet trout and estimated for lake trout and whitefish based on lipid normalized muscle tissue concentrations and skin and fat tissue lipid content.

Figure 6. Total PCB concentrations (mean ± one standard deviation) in Lake Superior whitefish (*Coregonus clupeaformis*) muscle tissue composites. Concentrations in SOT and SOUT fillets are estimated based on muscle tissue concentrations and percent lipid in respective skin and fat tissues. SOT and SOUT refer to "skin on trimmed" and "skin on untrimmed" fillets. The trigger and "do not eat" fish tissue concentrations used by Michigan, Minnesota, and Wisconsin to set fish consumption advice are shown as lines. These states use values agreed upon in the "Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory" (Great Lakes Sport Fish Advisory Task Force, Sept. 1993).

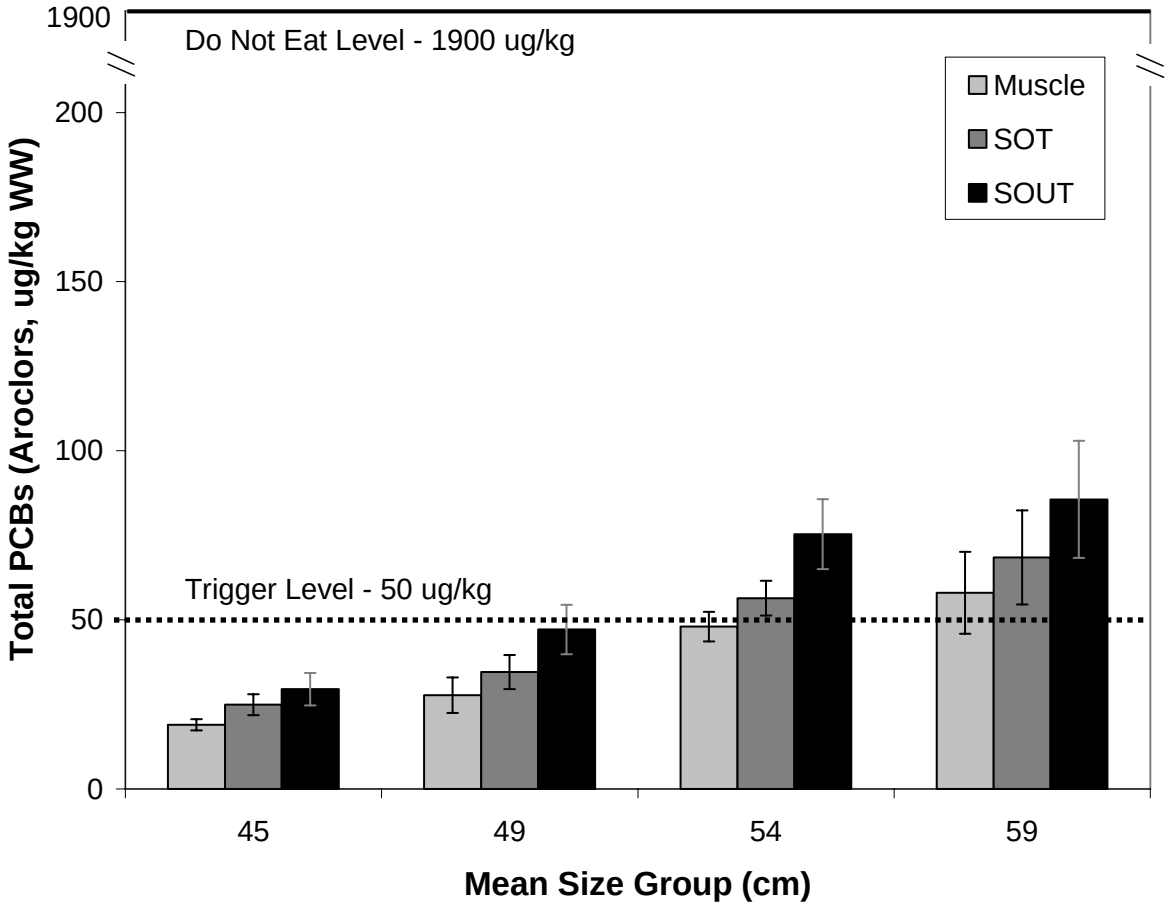


Figure 7. Total mercury concentrations (mean ± one standard deviation) in Lake Superior whitefish (*Coregonus clupeaformis*) muscle tissue (i.e. trimmed, skin-off fillet) composites. Estimates of mercury concentrations in skin on trimmed (SOT) and skin on untrimmed fillets (SOUT) were not calculated because mercury binds to muscle tissue and cannot be removed by trimming a fillet. The trigger and "do not eat" fish tissue concentrations used by Michigan, Minnesota, and Wisconsin to set fish consumption advice are shown as lines.

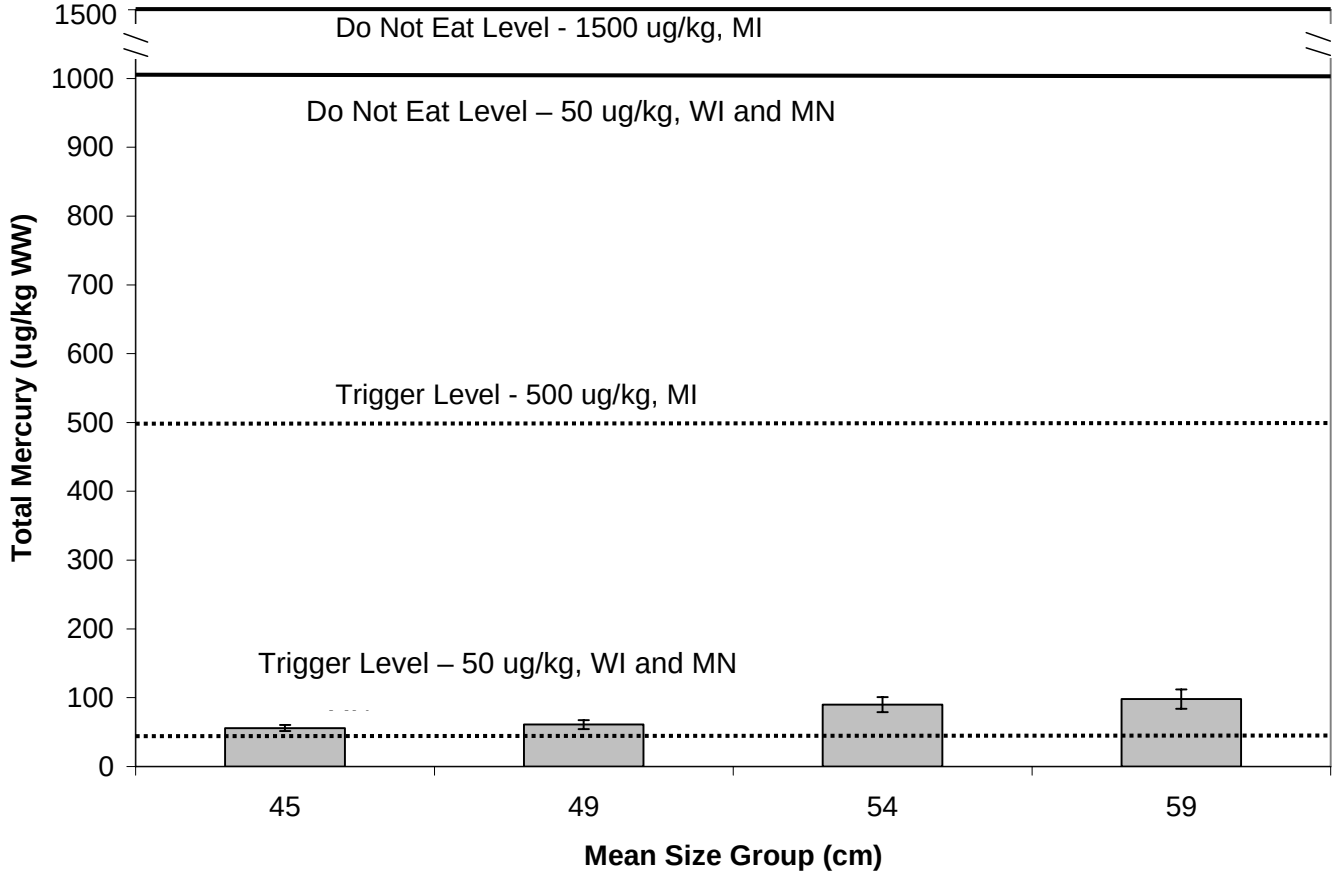


Figure 8. Total chlordane concentrations (mean ± one standard deviation) in Lake Superior whitefish (*Coregonus clupeaformis*) muscle tissue composites. Concentrations in SOT and SOUT fillets are estimated based on muscle tissue concentrations and percent lipid in respective skin and fat tissues. SOT and SOUT refer to "skin on trimmed" and "skin on untrimmed" fillets. The trigger and/or "do not eat" fish tissue concentrations used by Michigan and Wisconsin to set fish consumption advice are shown as lines.

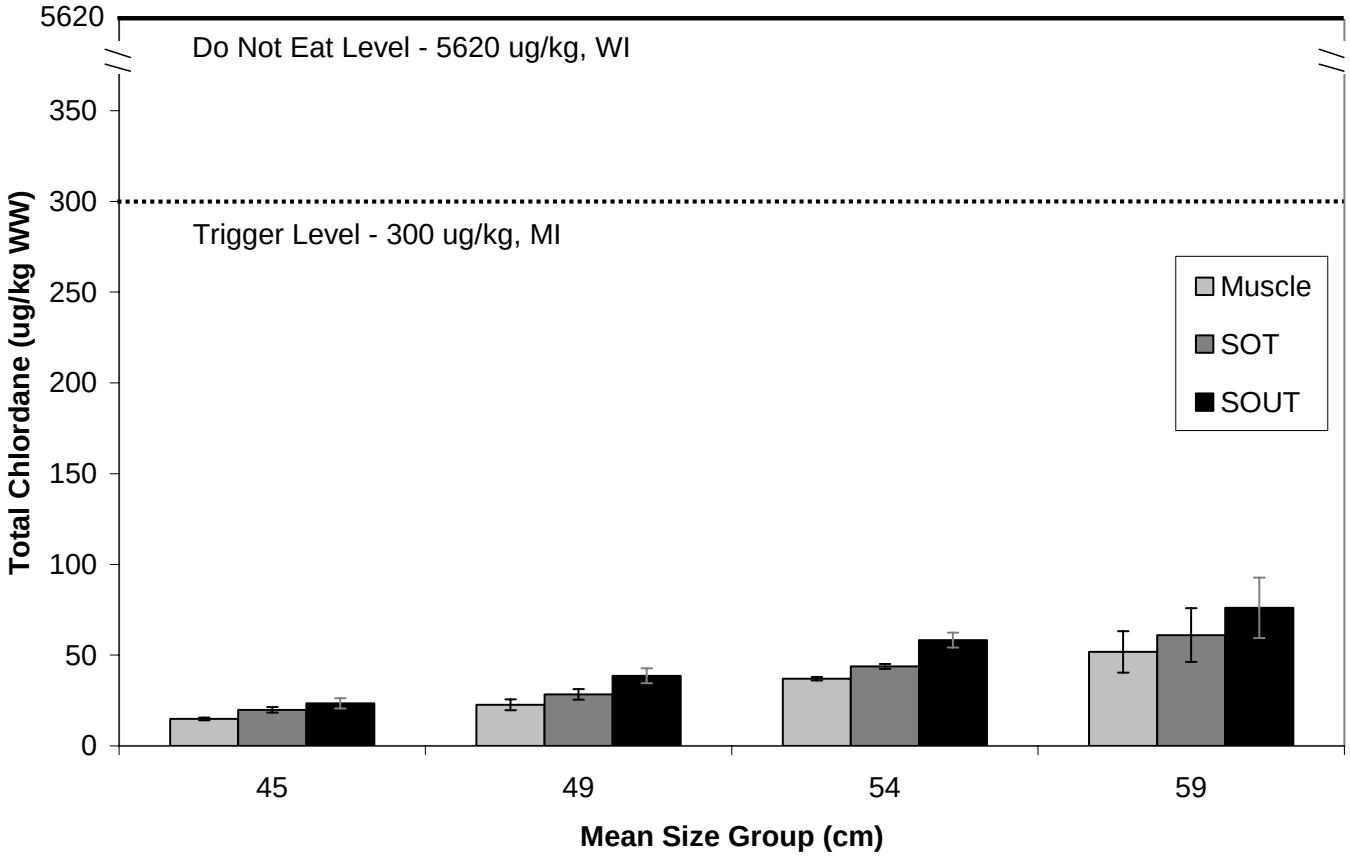


Figure 9. Toxaphene concentrations (mean ± one standard deviation) in Lake Superior whitefish (*Coregonus clupeaformis*) muscle tissue composites. Concentrations in SOT and SOUT fillets are estimated based on muscle tissue concentrations and percent lipid in respective skin and fat tissues. SOT and SOUT refer to "skin on trimmed" and "skin on untrimmed" fillets. The trigger fish tissue concentration used by Michigan to set fish consumption advice is shown as a line.