

Letter Health Consultation

Evaluation of PCB Contamination in Fish Sampled from Country Pond

OTTATI & GOSS AND GREAT LAKES CONTAINER
CORPORATION SITE

KINGSTON, NEW HAMPHIRE

Prepared by
New Hampshire Department of Environmental Services

AUGUST 21, 2012

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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LETTER HEALTH CONSULTATION

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STATE OF NEW HAMPSHIRE
Department of Environmental Services

Memorandum

Date: August 17, 2012

To: Andrew Hoffman, P.E., Waste Management Division, Hazardous Waste Remediation Bureau

From: David S. Gordon, Environmental Health Program

Re: Ottati & Goss/Great Lakes Container Corp. Site, Kingston, NH - Evaluation of PCB Contamination in Fish Sampled from Country Pond

Background and Statement of Issues

The Ottati & Goss and Great Lakes Container Corporation Site (Site), located in Kingston, NH on Route 125, was placed on the National Priorities List (NPL) in 1983 (1). Steel drum reconditioning operations conducted from the late 1950's through 1979 and the associated waste handling practices resulted in contaminated surface water, groundwater, soil and sediment (2). Two streams cross the Site, draining into wetlands. The wetlands discharge into Country Pond, which is approximately 300 acres in size and a known local fishing spot (3). Historical sampling of wetland sediments has detected levels of PCBs up to 300 mg/kg (2). As part of the Site clean-up activities, in 2001, PCB-contaminated sediments were excavated from the wetlands and disposed of off-site followed by wetland restoration (1). Because the wetlands discharge into Country Pond, fish in this waterbody may have bioaccumulated PCBs. The Record of Decision (ROD) for the Site, signed in 1987, included long-term monitoring of the Site and Country Pond (1).

It is the responsibility of the Department of Environmental Services, Environmental Health Program (EHP) to maintain and update the State fish consumption advisories to ensure that those who consume fish from New Hampshire waterbodies do not jeopardize their health. This responsibility includes evaluating the most current data on contaminants detected in locally caught fish. In 2009, the U.S. Environmental Protection Agency (EPA) collected largemouth bass (LMB) and yellow perch (YP) from Country Pond and from Great Pond, a reference waterbody because it is considered to be located upgradient of contaminant migration from the Site. Samples were analyzed for total PCB congeners. The Department of Environmental Services, Environmental Health Program (EHP) has evaluated the fish data to determine whether the fish consumption recommendations currently in place for methylmercury in all NH inland waterbodies are also protective against potential adverse health effects caused by exposure to PCBs. State of NH fish consumption guidelines recommend that sensitive populations (young children through age six, women of child-bearing age, defined as between 18 to 45 years) and all "Others" consume no more than 1 and 4 fish meals per month, respectively (4). Meal sizes are 0.111 kilograms (kg) for young children and 0.227 kg for everyone else. Additionally, for certain fish species, which include LMB and YP, fish greater than 12 inches in length should not be consumed (4).

Discussion and Public Health Implications

PCBs are a group of 209 potential congeners, which were once sold as various congener mixtures under the trade name “Aroclor.” The mode of action that results in adverse health effects for a small group of PCB congeners is similar to that of the chlorinated dibenzo-p-dioxin (dioxins) class of compounds (5). There are currently 12 dioxin-like PCB (DL-PCB) congeners that are evaluated using protocols developed to assess the toxicity of dioxins (5). PCBs as total summed congeners (tPCBs) and DL-PCBs were analyzed for and evaluated as separate contaminants.

For this analysis of PCBs in fish tissue, skin-off filet portions from several fish were mixed together to form composites. For Country Pond, a sample was taken for analysis from 10 separate composites and one duplicate sample for a total of 11 samples each for LMB and YP. For Great Pond, only 2 filet composite samples of LMB and one of YP were analyzed.

Following both EPA and State of NH guidance documents for evaluating contaminants in fish (5,6), EHP calculated risk-based consumption limits (RBCLs) for carcinogenic and non-carcinogenic health effects of PCBs to determine allowable fish meals on a monthly basis. Appendix B contains an example of a spreadsheet for each Receptor with exposure parameter assumptions used in the RBCL calculations and for cancer and non-cancer effects. Table B-1 in Appendix B presents the toxicity values used to calculate RBCLs. RBCLs for non-cancer effects were calculated using ATSDR chronic Minimal Risk Levels (MRLs).

Because a statistical analysis of the PCB data with ProUCL software (7) indicated that the data was not an adequate fit for any of the distributions to which a fit was attempted, RBCLs were calculated for tPCBs and DL-PCBs with both average and maximum exposure point concentrations (EPCs). Validated EPC data are presented in Appendix C as wet weight concentrations.

EPA has classified PCBs as “probable human carcinogens” (Group B2) based on animal studies correlating increases in liver tumors with PCB exposure (8). There is evidence that the more environmentally persistent congeners that tend to bioaccumulate in organisms are among the most toxic of the PCBs (5). Therefore, EHP evaluated carcinogenic health effects of tPCB exposure in fish using the most protective cancer slope factor (CSF) developed by EPA. Carcinogenic effects of DL-PCBs were evaluated using a CSF that was developed for 2,3,7,8-tetrachlorodibenzodioxin by the California EPA, as cited in EPA Regional Screening Level Tables (9). RBCLs were calculated using an acceptable lifetime cancer risk (ALCR) of one-in-one-million.

RBCLs for tPCBs and DL-PCBs were first calculated separately for carcinogenic effects. Then RBCLs for carcinogenic effects were calculated using an equation that takes into account co-exposure to both substances (5). Cancers caused by each substance are considered to occur independently of each other and, therefore, risks are summed (10). Co-exposure to tPCBs and DL-PCBs were not evaluated for non-carcinogenic health effects because evidence exists that the toxic endpoints are not likely to act by the same mode of action (MoA) (11).

Non-cancer health effects were evaluated considering Sensitive Receptors (young children, women of child-bearing age) and an all “Others” Receptor, since fetuses and young children are potentially more susceptible to the effects of PCBs (11) and, for noncancer effects, the averaging time (AT) over which exposure is evaluated is usually considered to be equal to the exposure duration (ED). However, because of the limited EDs of 6 and 27 years for the Sensitive Receptors, they are not the most exposed Receptors when assessing carcinogenic risk. Therefore, only the “Others” Receptor was evaluated for carcinogenic effects assuming an ED of 70 years, equal to the 70 year AT used when evaluating cancer effects.

The composite fish samples used in this evaluation had a mean length ranging from 13.9 to 15.4 inches. Data on individual fish length used to make up the composite samples is presented in Appendix C. The mean fish lengths exceed the 12-inch consumption limit recommendations for YP and LMB. Since the fish used in this assessment are 115 to 128% of the length limit recommendation, RBCLs calculated using mean concentrations were judged to be the most appropriate to consider when making decisions on fish consumption limits. Although RBCLs were calculated using maximum concentrations from fish exceeding the length limit guideline, EHP considered that the combination of the two would produce unrealistically protective results.

RBCLs were not calculated for Great Pond because there were only two composite filet samples for LMB and one for YP. Because of the limited number of samples, conclusions cannot be drawn about allowable fish meals with any reasonable degree of certainty. Therefore, no recommendations on the consumption of fish from Great Pond due to PCB contamination will be made at this time. However, it is of concern to the EHP that the average concentration of tPCBs for the LMB samples from Great Pond was 89% of the average concentration of tPCBs in LMB from Country Pond.

Tables D-1 and D-2 in Appendix D summarize RBCLs calculated for noncancer and cancer endpoints, respectively, from exposure to tPCBs and DL-PCBs.

RBCLs calculated for noncancer health effects for both fish species are greater than the monthly meals recommendations established for methylmercury contamination. However, other than for DL-PCBs in YP, RBCLs derived for carcinogenic effects in both species were less than 4 meals/month. Mean PCB contamination in LMB is considerably higher than in YP for both tPCBs and DL-PCBs. This is not an unexpected result when comparing PCB concentrations in a top predator fish species to a species such as YP, whose diet consists mainly of insects, crustaceans, and fish eggs (12, 13).

When RBCLs are calculated for carcinogenic effects from co-exposure to tPCBs and DL-PCBs, the RBCLs for LMB and YP are 0.47 and 1.7 meals/month, respectively. See Table D-3 in Appendix D. Because the LMB RBCL value falls below one-half of a meal/ month, per EPA guidance (5), EHP is recommending that LMB not be consumed. Smallmouth bass (SMB) is the only other top-predator fish species in Country Pond (3). Although the EHP has no data on PCB levels in SMB, because they are at the top of the food chain along with LMB, we also recommend that SMB not be consumed. For YP less than 12 inches long and the remaining fish species in Country Pond, EHP is recommending that up to 2 meals/month can be consumed by all receptors.

Anglers who fish on a regular basis possess the knowledge to distinguish LMB and SMB from YP and other fish species in Country Pond (14). The occasional fisherman or those on vacation who may not have the more extensive knowledge of a regular angler are not likely to have an elevated cancer risk from occasional or episodic consumption of fish contaminated with PCBs at the concentrations evaluated.

Conclusions and Recommendations

Fish are an excellent source of protein, minerals, and vitamins, and play an important role in maintaining a healthy, well-balanced diet. Fish are also a valuable source of omega-3 fatty acids, which are essential for proper fetal development (15). Conversely, the general population is commonly exposed to PCBs from eating fish tissue (11). Because of the bioaccumulation and biomagnification of contaminants such as PCBs, fish species that primarily consume other fish as a food source can build up PCB concentrations that are many times greater than levels found in the surrounding water (11).

Elevated concentrations of PCBs have been found in LMB and YP from Country Pond. There are no warning signs such as odor, taste, or visual changes that would allow an individual to determine if any individual fish caught from Country Pond has elevated levels of PCBs. Eating PCB-contaminated fish over many years can increase the risk of certain types of cancer.

EHP concludes that eating LMB and SMB caught from Country Pond in Kingston, NH could harm people's health. Eating more than two meals/month of YP or other non-bass fish species could also harm people's health. This is a public health hazard.

EHP is recommending that the following advisory be added to the current NH Fish Consumption Guidelines: "Both largemouth and smallmouth bass caught from Country Pond, located within Kingston and Newton, NH, should not be consumed due to potential PCB contamination. Consumption of other fish species from Country Pond, such as yellow perch, should be limited to no more than 2 meals/month, applicable to everyone."

In conjunction with the addition of the Country Pond Advisory to the State Fish Consumption Guidelines, to provide Community Health Education to the residents surrounding and those recreating in Country Pond, the EHP Health Educator has created the following Health Education Plan.

Community Health Education Plan for Country Pond Fish Advisory

- Conduct a site visit to Country Pond to determine:
 - Public access locations to install signage regarding fish consumption advisory.
 - Number of year round residents compared to seasonal camps.
- Contact local health officers for both Kingston and Newton to advise them of fish consumption issues.
- Contact full time and seasonal residents to educate them about the fish advisory.
- Update our state-wide fish consumption advisory to include Country Pond as a water body specific advisory.
- Contact the NH Fish and Game Department to notify them of the updated fish advisory.
- Post updated fish advisory, with explanatory text, on Kingston and Newton's town websites.
- Host a public meeting in conjunction with the NH Department of Environmental Services' Superfund Program to explain the proposed remedy for the site, site related contaminants and their locations, and the fish advisory for Country Pond. Be available to answer questions and clarify any misconceptions.

Should resources become available for additional fish tissue sampling, EHP recommends samples be collected from Great Pond to more fully assess PCB contamination levels. The data can be evaluated to determine if more restrictive fish consumption advisories should also be applied to this waterbody.

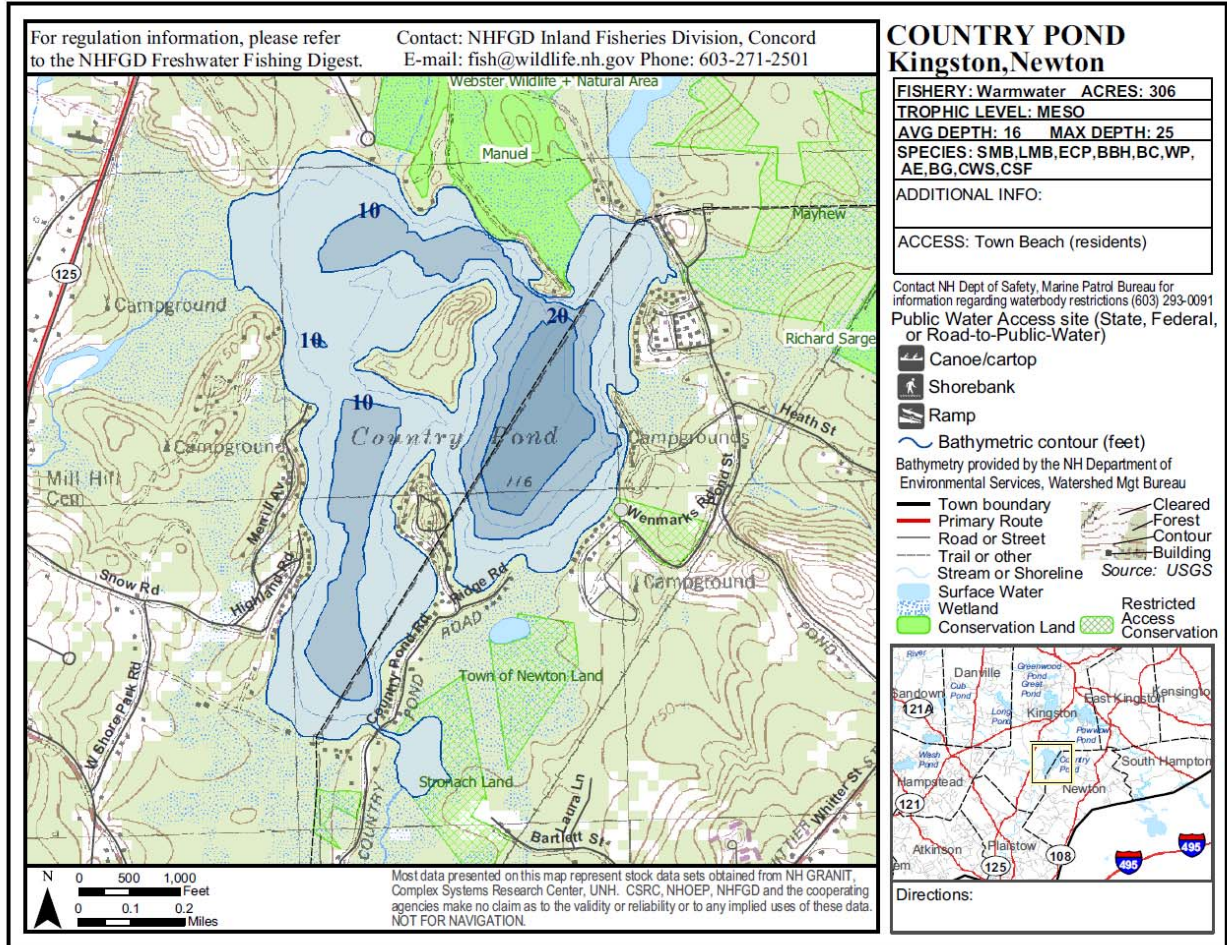
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Appendix A

NH Fish & Game Map of Country Pond



Appendix B

Table B-1: Toxicity Values Used to Evaluate PCB Exposure

Risk Based Calculation Limit (RBCL) Spreadsheets of Allowable Meals/Month:

Spreadsheet Example for Each Receptor, for Cancer and Non-Cancer
Effects, and for the Summation of Risk for Multiple Contaminant Exposure

Table B-1: Toxicity Values Used to Evaluate PCB Exposure

Toxicity Value Type	Value (mg/kg/day)	Source
PCB Cancer Slope Factor	2.0E +0	IRIS (upperbound for food chain) (8)
DLC Cancer Slope factor	1.3E + 5	CAL EPA (cited by EPA) (9)
Aroclor 1254 Reference Dose	2.0E-5	IRIS (8) and equivalent to ATSDR chronic MRL (11)
DLC Reference Dose	1.0E-9	ATSDR chronic MRL (16)

DLC = dioxin-like PCBs

Adult Receptors: PCBs as Aroclors, Mean Concentrations, Carcinogenic Effects

Other Adults & Older Children

Parameter	Abbreviation	Value	Units	Source
Cancer Slope Factor	CSF	2.00E+00	mg/kg-day	upperbound value for food chain exposure (IRIS)
Acceptable Lifetime Cancer Risk	ALCR	1.00E-06	Unitless	professional judgment for single medium exposure
Body Weight	BW	70	Kg	USEPA
Portion Size	PS	0.227	Kg	(8 oz) - professional judgment
Concentration in Fish	C _{fish}	4.25E-03	mg/kg	mean concentration
Conversion Factor		30.42	days/month	
Maximum Allowable Consumption Rate	CR _(limit)	8.24E-03 0.25	kg/day kg/month	= ALCR * BW/(CSF * C _{fish})
<u># Meals/month (UCL)</u>	<u>1.10</u>			= CR _{limit} * (days/month) / PS

Sensitive Receptors: PCBs as Aroclors, Mean Concentrations, Non-Carcinogenic Effects

Young Children (ages 1-6)

Parameter	Abbreviation	Value	Units	Source
Toxicity Reference Dose	RfD	2.00E-05	mg/kg-day	USEPA
Body Weight	BW	16.6	kg	61 woman & 16.6 Child (1-6 yrs)
Portion Size	PS	0.111	kg	8 oz (0.227kg) woman & 3 oz (0.111kg) child of 1-6 yrs
Concentration in Fish	C _{fish}	4.25E-03	mg/kg	mean concentration
Conversion Factor			days/month	
Maximum Allowable Consumption Rate	CR _(limit)	0.078117647 2.376338824	kg/day kg/month	= RfD * BW / C _{fish}
<u># Meals/month</u>	<u>21.41</u>			= CR _{limit} * (days/month) / PS
	30.42			

Women (age 18-45)

Parameter	Abbreviation	Value	Units	Source
Toxicity Reference Dose	RfD	2.00E-05	mg/kg-day	USEPA
Body Weight	BW	61	kg	61 woman & 16.6 Child (1-6 yrs)
Portion Size	PS	0.227	kg	8 oz (0.227kg) woman & 3 oz (0.111kg) child of 1-6 yrs
Concentration in Fish	C _{fish}	4.25E-03	mg/kg	mean concentration
Conversion Factor			days/month	
Maximum Allowable Consumption Rate	CR _(limit)	0.287058824 8.732329412	kg/day kg/month	= RfD * BW / C _{fish}
<u># Meals/month</u>	<u>38.47</u>			= CR _{limit} * (days/month) / PS
	30.42			

Largemouth Bass
Sum of Carcinogenic Risks of PCBs as Aroclors and Dioxin-like PCBs
Mean
Concentrations

Other Adults & Older Children

Parameter	Abbreviation	Value	Units	Source
Cancer Slope Factor (Aroclors)	CSF-A	2.00E+00	mg/kg-day	upperbound value for food chain exposure (IRIS)
Cancer Slope Factor (Dioxin-like PCBs)	CSF-D	1.30E+05	mg/kg-day	Cal EPA as cited by EPA Regional Screening Level Table
Acceptable Lifetime Cancer Risk	ALCR	1.00E-06	unitless	professional judgment for single medium exposure
Body Weight	BW	70	kg	USEPA
Portion Size	PS	0.227	kg	(8 oz) - professional judgment
Concentration in Fish (Aroclor congeners)	C _{fish-A}	4.25E-03	mg/kg	mean concentration
Concentration in Fish (DL-PCBs)	C _{fish-D}	8.90E-08	mg/kg	mean concentration
Conversion Factor		30.42	days/month	
Maximum Allowable Consumption Rate	CR _(limit)	3.24E-03 0.10	kg/day kg/month	= ALCR * BW / ((CSF-A) * C _{fish-A}) + ((CSF-D) * (C _{fish-D}))
<u># Meals/month</u>	<u>0.47</u>			= CR _{limit} * (days/month) / PS

Appendix C

Validated Fish Tissue PCB Concentration Data

Fish Length Data

Table 3. Ottati & Goss fish tissue validated data, September, 2009

	Total PCBs		Total TEQ	
	(ng/kg)		(ng/kg)	
Largemouth Bass Fillet Country Pond				
LMB1-FIL-CP	5630	J	0.127	J
LMB2-FIL-CP	15900	J	0.346	J
LMB3-FIL-CP	8920	J	0.208	J
LMB4-FIL-CP	924	J	0.00118	J
LMB5-FIL-CP	6610	J	0.163	J
LMB6-FIL-CP	4070	J	0.116	J
LMB7-FIL-CP	3640	J	0.0152	J
LMB8-FIL-CP	44.6	J	0.0001	J
LMB9-FIL-CP	42.3	J	0.00029	J
LMB10-FIL-CP	421	J	0.00084	J
LMB11-FIL-CP (dup)	590	J	0.00087	J
LMB11-FIL-CP				
Mean:	4254	J	0.08895	J
Great Pond				
LMB1-FIL-REF	3700	J	0.0205	J
LMB2-FIL-REF	3850	J	0.0910	J

Yellow Perch Fillet Country Pond	Total PCBs		Total TEQ	
	(ng/kg)		(ng/kg)	
YP1-FIL-CP	101	J	5.3E-05	J
YP2-FIL-CP	2040	J	0.00788	J
YP3-FIL-CP	1840	J	0.00604	J
YP4-FIL-CP	1730	J	0.00561	J
YP5-FIL-CP	1260	J	0.006	J
YP6-FIL-CP	2670	J	0.00912	J
YP7-FIL-CP	3960	J	0.018	J
YP8-FIL-CP	2780	J	0.00923	J
YP9-FIL-CP	528	J	0.00075	J
YP10-FIL-CP	4010	J	0.0167	J
YP11-FIL-CP(DUP)	3700	J	0.0121	J
Mean:	2238	J	0.00832	J
Great Pond				
YP2-FIL-REF	406	J	0.00632	J

Large Mouth Bass - Country Pond Health Evaluation

Collected 9/18/09 and 10/5/09 Processed 1/26/10 and 1/27/10

Sample ID	Length (cm)
LMB1-FIL-CP	
1	30.0
2	38.2
3	38.1
LMB2-FIL-CP	
1	31.7
2	38.7
3	35.6
LMB3-FIL-CP	
1	32.2
2	42.0
3	37.5
LMB4-FIL-CP	
1	33.2
2	34.1
3	39.0
LMB5-FIL-CP	
1	35.5
2	29.3
3	42.0
LMB6-FIL-CP	
1	36.0
2	32.5

Sample ID	Length (cm)
3	42.9
LMB7-FIL-CP	
1	29.9
2	40.3
3	36.8
LMB8-FIL-CP	
1	40.4
2	32.2
3	34.0
LMB9-FIL-CP	
1	29.0
2	39.9
3	37.0
LMB10-FIL-CP	
1	41.3
2	29.8
3	35.1
LMB11-FIL-CP DUP	
1	42.8
2	36.0
3	27.0

Yellow Perch - Country Pond Health Evaluation

Collected 9/18/09 and 10/5/09 Processed 1/26/10 and 1/27/10

Sample ID	Length (cm)
YP1-FIL-CP	
1	16.7
2	15.5
3	17.9
4	20.2
5	16.8
6	27.4
YP2-FIL-CP	
1	26.2
2	20.5
3	15.7
4	18.7
5	16.4
6	15.9
YP3-FIL-CP	
1	15.9
2	18.0
3	16.3
4	20.3
5	26.0
6	18.0
YP4-FIL-CP	
1	16.4
2	20.1
3	23.6
4	17.5
5	18.3
6	18.1
YP5-FIL-CP	
1	16.7
2	19.5
3	23.8
4	20.5
5	17.5
6	16.4
YP6-FIL-CP	
1	19.9
2	17.0
3	21.9

Sample ID	Length (cm)
4	17.9
5	23.3
6	15.8
YP7-FIL-CP	
1	16.6
2	19.6
3	21.8
4	18.8
5	16.2
6	22.2
YP8-FIL-CP	
1	17.0
2	19.1
3	17.5
4	16.4
5	21.7
6	22.2
YP9-FIL-CP	
1	17.9
2	15.8
3	20.6
4	16.7
5	21.1
6	23.3
YP10-FIL-CP	
1	18.5
2	17.6
3	18.3
4	16.5
5	23.5
6	21.7
YP11-FIL-CP DUP	
1	22.9
2	21.0
3	15.7
4	17.3
5	16.6
6	19.6

Appendix D: Risk-Based Concentration Limit (RBCL) Tables
(Meals/Month)

Table D-1: Non-Carcinogenic Effects, Mean and Maximum Concentrations,
Total PCBs (tPCBs) and Dioxin-like PCBs (DL-PCBs)

Table D-2: Carcinogenic Effects, Mean and Maximum Concentrations, Total
PCBs (tPCBs) and Dioxin-like PCBs (DL-PCBs)

Table D-3: Carcinogenic Effects, Mean Concentrations, Co-Exposure to
Total PCBs (tPCBs) and Dioxin-Like PCBs (DL-PCBs)

Table D-1: Risk-Based Concentration Limits (RBCLs) in Meals/Month – Non-Carcinogenic Effects, Mean and Maximum Concentrations, Total PCBs (tPCBs) and Dioxin-like PCBs (DL-PCBs)

Largemouth Bass				
Receptors	Total PCBs		Dioxin-like PCBs	
	Mean Concentration	Maximum Concentration	Mean Concentration	Maximum Concentration
Child, 1-6 yrs.	21	6	51	13
Woman-CBA	38	10	92	24
Others	44	12	105	27

Yellow Perch				
Receptors	Total PCBs		Dioxin-like PCBs	
	Mean Concentration	Maximum Concentration	Mean Concentration	Maximum Concentration
Child, 1-6 yrs.	41	23	547	253
Woman-CBA	73	41	983	454
Others	84	47	1127	521

CBA = child bearing age (18-45 years of age)

Child meal portion = 3.92 oz. = 111 g

Adult meal portion = 8 oz. = 227 g

Calculations assume Averaging Time (AT) = Exposure Duration (ED)

Table D-2: Risk-Based Concentration Limits (RBCLs) in Meals/Month - Carcinogenic Effects, Mean and Maximum Concentrations, Total PCBs (tPCBs) and Dioxin-like PCBs (DL-PCBs)

Largemouth Bass				
Receptor	Total PCBs		Dioxin-like PCBs	
	Mean Concentration	Maximum Concentration	Mean Concentration	Maximum Concentration
Others	1.10	0.29	0.81	0.21

Yellow Perch				
Receptor	Total PCBs		Dioxin-like PCBs	
	Mean Concentration	Maximum Concentration	Mean Concentration	Maximum Concentration
Others	2.1	1.2	8.7	4.0

Table D-3: Risk-Based Concentration Limits (RBCLs) in Meals/Month- Carcinogenic Effects, Mean Concentrations, Co-Exposure to Total PCBs (tPCBs) and Dioxin-like PCBs (DL-PCBs)

Receptor	RBCLs	
	Largemouth Bass	Yellow Perch
Others	0.47	1.7

Others Receptor is an adult with a 70 year exposure duration (ED).

An Acceptable Lifetime Cancer Risk (ALCR) of 1E-6 was used to calculate RBCLs.