2011, 2012, 2013, 2015
Fish Toxics Monitoring
Public Request Surveys

Massachusetts Department of Environmental Protection
Divisions of Watershed Management
and
Environmental Analysis

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Introduction

Public Request Surveys (Interagency Committee on Freshwater Fish Toxics Monitoring and Assessment)

Due in part to an increasing public demand for fish toxics data, a formal protocol for the public to request fish toxics monitoring surveys of the Commonwealth's waterbodies was initiated in 1993/94. While public requests for fish testing had been fulfilled prior to this time, increased requests beyond the scope of the resources available made formal prioritization necessary. The following protocol is the result of a collaborative effort between the Massachusetts Department of Environmental Protection (MassDEP), the Massachusetts Department of Public Health (MDPH), and the Massachusetts Department of Fish and Game (MDFG). It consists of a Memorandum of Understanding (MOU) (Appendix B), a form for requesting fish testing (Appendix C), and the criteria used for ranking testing requests (Appendix D).

The process is as follows: completed request forms are sent to the MassDEP Division of Watershed Management (DWM) in Worcester. Representatives of the aforementioned agencies make up the Interagency Committee on Freshwater Fish Toxics Monitoring and Assessment (Interagency Committee). The Interagency Committee meets each year in February to prioritize all requests received between February 1st of the previous year and February 1st of the current year. Criteria used to prioritize requests include fishing pressure (determined by Division of Fisheries and Wildlife (DFW) and the requester) and the presence of known or potential point and non-point sources of pollution (determined by MassDEP, DFW, and the requester) The number of requests fulfilled during any given year is determined by the amount of field and laboratory resources available in that year. All requesters are notified regarding the status of their request. If a request is denied, re-application in following years is allowed. Request forms are available through each of the agencies involved in the MOU, at the following locations and online at http://www.mass.gov/eea/docs/dep/toxics/stypes/fishform.pdf .

Massachusetts Department of Environmental Protection

Division of Watershed Management 8 New Bond Street Worcester, MA 01606 (508) 792-7470	Division of Environmental Analysis Senator William X. Wall Experiment Station 37 Shattuck Street Lawrence, MA 01843 (978) 682-5237
Office of Research and Standards One Winter Street Boston, MA 02108 (617) 292-5510	

Massachusetts Department of Public Health
Bureau of Environmental Health Assessment
250 Washington Street, 7th Floor
Boston, MA 02108-4619
(617) 624-5757

Massachusetts Department of Fish and Game
Division of Fisheries and Wildlife (DFW)
Field Headquarters
One Rabbit Hill Road
Westborough, MA 01581
(508) 389-6300

Objective and Scope

The objective of Public Request Surveys is to screen edible fillets of fishes for potential contaminants (i.e. mercury and/or other metals, polychlorinated biphenyls (Aroclors), and organochlorine pesticides). The list of contaminants for which tissue samples are analyzed is determined on a case-by-case basis. All data are sent to the MDPH and the MassDEP Office of Research and Standards (ORS) for assessment and advisory issuance if appropriate.

PCB Arochlors analyzed for include, Arochlors 1232, 1242, 1248, 1254, and 1260. Organochlorine pesticides analyzed for include, Chlordane, Toxaphene, a-BHC, b-BHC, d-BHC, Lindane, Hexachlorocyclopentadiene, Trifluralin, Hexachlorobenzene, Heptachlor, Heptachlor Epoxide, Methoxychlor, DDD, DDE, DDT, Aldrin, Endrin, and Endosulfan I. All organics analyses include lipid determination. Mercury is the only metal which is currently being routinely analyzed for. All analyses for variables listed above are performed at the Senator William X. Wall Experiment Station (WES). Additional analytes are addressed on a site-specific basis.

In order to assess the level of contamination present in fish of different trophic guilds and habitat types, fish species targeted include at a minimum; largemouth bass, *Micropterus salmoides,* and/or chain pickerel, *Esox niger,* (predators); yellow perch, *Perca flavescens,* and/or white perch, *Morone americana,* (water column invertivores/omnivores); and bullhead, *Ameiurus* sp. and/or common carp, *Cyprinus carpio,* (bottom feeding omnivores). Average-sized fish (above legal length limit when applicable) are analyzed as composite samples. Additional species or substitute species are chosen on a site-by-site basis.

During 2011-2015, (no fish were collected in 2014), a total of twelve waterbodies were sampled as a result of recommendations from the Interagency Committee. A list of the sampling sites with pertinent locational information is presented in the following table.

Waterbody	Year	Watershed	Town
Copicut Reservoir PALIS#[1] 95175	2011	Buzzards Bay	Dartmouth/ Fall River
Browning Pond PALIS#[1] 36025	2011	Chicopee River	Oakham/ Spencer
Horn Pond PALIS#[1] 71019	2011	Mystic River	Woburn
Springfield Reservoir PALIS#[1] 36145	2012	Chicopee River	Ludlow
Sargent Pond PALIS#[1] 42049	2012	French River	Leicester
Forest Lake PALIS#[1] 84014	2013	Merrimack River	Methuen
Stevens Pond/Spickett River PALIS#[1]/SARIS#[2] 84065/8450800	2015	Merrimack River	Lawrence
Big Alum Pond PALIS#[1] 41001	2015	Quinebaug River	Sturbridge
Sargent Pond PALIS#[1] 42049	2015	French River	Leicester
Lake Waban PALIS#[1] 72125	2015	Charles River	Wellesley
Richmond Pond PALIS#[1] 21088	2015	Housatonic River	Pittsfield/ Richmond
Farrar Pond PALIS#[1] 82036	2015	Sudbury River	Lincoln

[1] Interim PALIS# = Pond and Lake Identification System number (Mar 16, 2000)
[2] SARIS # = Massachusetts Stream Classification Program Part I (July 1982)

Field Methods

Waterbodies were mostly sampled using an electrofishing boat with the following exceptions. Copicut Reservoir (2011) was sampled using rod and reel. Springfield Reservoir (2012) and Richmond Pond (2015) were primarily sampled by electrofishing, however, rod and reel sampling was utilized to catch two and three largemouth bass at these ponds respectively. Electrofishing was performed by maneuvering the boat through the littoral zone and shallow water habitat of a given waterbody, and collecting most fish shocked. Fish collected by electrofishing were stored in a live well until the completion of sampling. Fish collected using rod and reel were dispatched and immediately stored on ice. Live fish to be included in the sample were dispatched, stored on ice, and all fish were then transported to the Massachusetts Department of Environmental Protection (MassDEP) Division of Watershed Management (DWM) laboratory in Worcester where they were prepared (filleted and composited) and then frozen. In all cases, live fish that were not included as part of the sample, were released.

Field Results

The collection dates, species retained for analysis, and other species observed can be found in the following table.

Waterbody	Sampling Date	Collection Method(s)	Species Retained[1]	Other species observed[1]
Copicut Reservoir	6/10/2011	rod and reel	LMB, CP	no data
Browning Pond	6/21/2011	boat electrofishing	LMB, BC, YP, B, BB	no data
Horn Pond	6/28/2011	boat electrofishing	C, LMB, WS, BB, BC, B, YP	no data
Springfield Reservoir	5/30/2012	boat electrofishing	BB, P, AE, RB, YP, LMB	no data
Sargent Pond	6/27/2012	boat electrofishing	WS, YP, B, BC, LMB	no data
Forest Lake	6/11/2013	boat electrofishing	C, LMB, B, YP, AE	P, YB
Stevens Pond/Spickett River	5/14/2015	boat electrofishing	LMB, C, P, WS, BB	YP, B, AE
Big Alum Pond	5/21/2015	boat electrofishing	LMB, B, YB	P, YP
Sargent Pond	5/26/2015	boat electrofishing	LMB, BC, YP, P, YB	CP, B, SMB
Lake Waban	6/3/2015	boat electrofishing	LMB, CP, YP, WP, P, BB, WS	AE, C, B
Richmond Pond	6/4/2015	boat electrofishing, (rod and reel fishing)	RB, YP,P, BB (LMB)	B, CP
Farrar Pond	6/9/2015	boat electrofishing	LMB, CP, BC, YP, P, WP,BB	AE, GS, B

[1]Species codes are defined in Table 1 of Appendix A

Laboratory Methods

Fish transported to the MassDEP DWM laboratory in Worcester were processed using protocols designed to assure accuracy and prevent cross-contamination of samples. Specimen lengths and weights were recorded along with notes on tumors, lesions, or other anomalies noticed during an external visual inspection. Scales and/or spines were obtained for use in age determination. Species, length, and weight data can be found in Appendix A Table 1. Fish were filleted (skin off) on glass cutting boards and prepared for freezing. All equipment used in the filleting process was rinsed in tap water and then rinsed twice in de-ionized water before and after each sample. All samples for metals were placed in VWR high density polyethylene (HDPE) cups with covers. Samples to be analyzed for organics were wrapped in aluminum foil. Composite samples were composed of portions of fillets from two or three like-sized individuals of the same species (occasionally the same genus). Samples prepared at DWM in Worcester were tagged and frozen for subsequent delivery to the Department's Wall Experiment Station (WES).

Methods used at WES for metals analysis include the following: Mercury was analyzed by Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry using EPA method 7473. (Batdorf 2009). Arsenic, cadmium, chromium, lead, and selenium were analyzed by inductively coupled plasma optical emission spectroscopy following EPA method 200.7 (Batdorf 2016). PCB Aroclor, and organochlorine pesticide analyses were performed on a gas chromatograph equipped with an electron capture detector "according to the modified AOAC 983.21 procedure for the analysis of PCB Aroclors, and Organochlorine Pesticides."(MassDEP 2002). Additional information on analytical techniques used at WES is available from the laboratory.

Laboratory Results

Sixty four samples were delivered to WES for analysis. All fish tissue data passed WES QC acceptance limits, however, six of the mercury results were reported with "qualification" (See Quality Control Section). Mercury (MDL 0.002 mg/kg) was detected in all sixty-four samples analyzed. Concentrations ranged from 0.011 mg/kg to 1.9 mg/kg. Mercury concentrations varied greatly between waterbodies and species. Waterbody mean mercury concentrations and ranges are detailed below. Complete results of the mercury analysis can be found in Appendix A Table 1.

Waterbody (year)	Mean Total Hg (mg/kg wet weight)	Total Hg Range (mg/kg (min-max))
Copicut Reservoir (2011)	1.32 (n=3)	0.47 - 1.9
Browning Pond (2011)	0.43 (n=6)	0.15 – 0.64
Horn Pond (2011)	0.07 (n=7)	0.026 – 0.18
Springfield Reservoir (2012)	0.14 (n=6)	0.043 – 0.25
Sargent Pond (2012)	0.48 (n=5)	0.20 – 1.0
Forest Lake (2013)	0,21 (n=5)	0.052 – 0.33
Stevens Pond/Spickett River (2015)	0.24 (n=5)	0.065 – 0.58
Big Alum Pond (2015)	0.14 (n=3)	0.067 – 0.25
Sargent Pond (2015)	0.41 (n=5)	0.20 – 0.74
Lake Waban(2015)	0.11 (n=7)	0.011 – 0.23
Richmond Pond (2015)	0.22 (n=5)	0.079 – 0.30
Farrar Pond (2015)	0.38 (n=7)	0.087 – 0.68

In addition, samples from Spicket River/Stevens Pond and Lake Waban were also be analyzed for As, Cd, Cr, Pb, and Se. Draft data for all metals other than mercury are reported as <MDL. Draft results of the metals analysis can be found in Table 2. It should be noted that although the results are considered draft, this is due to problems with the LIMS reporting software at the lab at the time of publication, and ultimately the "final" results will remain < MDL.

Samples from Spicket River/ Stevens Pond were also analyzed for PCB Aroclors, and organochlorine pesticides. PCB Aroclors, and DDT (and/or its metabolites DDE or DDD) were detected in two of the five

samples analyzed. Complete results for PCB Aroclors and organochlorine pesticides analysis can be found in Appendix A Table 1.

Quality Control

Nine percent of the mercury data were reported with "qualification". The qualification in all cases involved "EPA holding time" exceedances. Mercury was analyzed after the U.S. Environmental Protection Agency (EPA) recommended holding time of 28 days and samples were qualified by WES with the statement "Holding time not met but previous studies by WES show that frozen fish samples are stable for mercury for at least one year."

Mercury quality control sample recoveries were within the acceptable range of 70-130% recovery. Lab fortified blank recoveries for mercury were within the acceptable range of 85-115% recovery. Lab blanks were all acceptable at ND (analyzed for, but not detected above MDL). Complete quality control data for mercury are available upon request from WES or DWM.

PCB Aroclor and organochlorine pesticide results which were "qualified" as being greater than the Method Detection Limit but less than the Minimum Reporting Limit (>MDL but< MRL) were flagged by WES and appear so designated in the data tables (See Appendix A, Table 1).

All laboratory blanks for organics resulted in non-detectable concentrations. Duplicate samples analyzed for PCB Aroclors, and organochlorine pesticides in all cases had resultant RPDs within the acceptance criteria range of 0-35%. The laboratory fortified blank sample recoveries for PCB Aroclors and laboratory fortified matrix sample recoveries for organochlorine pesticides were within the acceptance criteria range of 60-140% recovery. All surrogate PCNB analyses resulted in percent recoveries within the acceptance criteria of 60-140% recovery. Complete quality control data for PCB Aroclors, and organochlorine pesticides are available upon request from WES or DWM.

Discussion

Edible tissue total mercury continues to be both widespread and detectable at concentrations that at times can exceed the USEPA water quality criterion (0.3 μg/g methyl mercury), the MDPH trigger level (0.5 μg/g total mercury) and on rare occasions the USFDA Action level (1.0 μg/g methyl mercury). (USEPA 2005 and USFDA 2009).

PCB Aroclors and organochlorine pesticides are occasionally found in freshwater fishes from Massachusetts. They are usually found in fishes from waterbodies that have received historical discharges or are associated with known waste sites. As such, they are mostly found in rivers, although their presence in fishes from lakes and ponds can't be entirely ruled out. Current USFDA Action Levels (for fish, edible portion) include chlordane, and mirex, (0.3 μg/g for each individually), aldrin and dieldrin (0.3 μg/g combined) and for DDT and its metabolites DDE and DDD (5.0 μg/g combined) (USFDA 2009). Historic USFDA "Action Levels" were also available for PCBs (2.0 μg/g), however these were not listed in the current reference document. In addition, the MDPH has "trigger levels" for PCBs (1.0 μg/g total Aroclors) and DDT (and/or its metabolites, 0.06 μg/g combined). PCB Aroclors were below levels of concern in Spickett River/Stevens Pond (the only waterbody which was sampled for these contaminants). DDT and its metabolites were detected in two samples from Spicket River/Stevens Pond. Concentrations exceeded the MDPH trigger levels in both samples.

MDPH has assessed the 2011-2013 data and is currently assessing the 2015 data with regard to the need for waterbody specific advisory issuance.

Conclusions

While mercury concentrations were mostly below the MDPH trigger level, the 2011–2015 Public Request Surveys data set supports previous findings that bioaccumulation of mercury is a widespread problem. Although individual ponds or regions may be at higher risk, it remains primarily a problem in predatory or piscivorous species, especially in larger (older) individuals.

It is presumed that the mercury present in freshwater fish is due mainly to atmospheric deposition (near and far field emissions from incinerators and coal burning power plants) and possibly bedrock sources. A recent scientific paper co- authored by scientists at MassDEP titled *Temporal and Spatial Trends in Freshwater Fish Tissue Mercury Concentrations Associated with Mercury Emissions Reductions* includes the following abstract.(Hutcheson et.al. 2014)

"Mercury (Hg) concentrations were monitored from 1999 to 2011 in largemouth bass (LMB) and yellow perch (YP) in 23 lakes in Massachusetts USA during a period of significant local and regional Hg emissions reductions. Average LMB tissue Hg concentration decreases of 44% were seen in 13 of 16 lakes in a regional Hg "hotspot" area. YP in all lakes sampled in this area decreased 43% after the major emissions reductions. Comparative decreases throughout the remainder of the state were 13% and 19% for LMB and YP respectively. Annual tissue mercury concentration rate decreases were 0.029 (LMB) and 0.016 mg Hg/kg/yr (YP) in the hotspot. In lakes around the rest of the state, LMB showed no trend and YP Hg decreased 0.0068 mg Hg/kg/yr. Mercury emissions from major point sources in the hotspot area decreased 98%, and 93% in the rest of the state from the early 1990s to 2008. The significant declines in fish Hg concentrations in many lakes occurred over the second half of a two decade decrease in Hg emissions primarily from municipal solid waste combustors and, secondarily, from other combustion point sources. In addition to the substantial Hg emissions reductions achieved in Massachusetts, further regional, national and global emissions reductions are needed for fish Hg levels to decrease below fish consumption advisory levels."

Reducing direct human health risks associated with eating freshwater fish can further be accomplished through educating the public with regard to both fish bioaccumulation patterns as well as the implications of various levels of fish consumption.

It should be noted that although the fish toxics monitoring program addresses the human health risk associated with the consumption of freshwater fishes, mercury in fish tissue also poses ecological risks to piscivorous wildlife (Eisler 1987). Studies have shown that mercury poses a health risk to eagles, loons, and ospreys as well as many other species.

While PCBs remain essentially a problem in rivers or other waterbodies that have received historic PCB discharges, it appears that in light of the low MDPH trigger levels for DDT and its metrabolites (0.06 mg/Kg), certain species of fish from both rivers and ponds do bioaccumulate significant concentrations of DDT (and/or it's metabolites DDD and DDE). It is assumed that the source of these contaminants is related to historic use.

The DWM will continue to screen for contaminants in freshwater fishes as part of Public Request surveys, as resources allow. DWM will also continue to cooperate with other state and federal agencies in an effort to better understand not only the distribution of fish tissue contaminants, but also temporal changes that may be taking place with regard to fish tissue contaminant levels.

This report has been forwarded to the departments involved with the Interagency Committee, the individuals requesting work, and DEP's regional offices. Additional copies of this report are available from the MassDEP, Division of Watershed Management, 627 Main Street 2nd Floor, Worcester, MA 01608. They will also eventually be available online at *http://www.mass.gov/dep/.*

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LIST OF APPENDICES

Appendix A: Data Tables

Table 1. Mercury, PCB and organochlorine pesticide **r**esults for 2011-2015 Fish Toxics Monitoring Public Request and Watershed Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).
Table 2. Selected metals for 2015 Fish Toxics Monitoring Public Request Surveys. Draft results reported in wet weight, are from composite samples of fish fillets (skin off).
Table 3. 2010 Fish Toxics Analytical Methods, Project Quantitation Limits, Method Detection and Reporting Detection Limits.

Appendix B:

Interagency Committee on Freshwater Fish Toxics Monitoring and Assessment Memorandum of Understanding April 1994

Appendix C: Form For Requesting Fish Testing

Appendix D: Criteria For Ranking Fish Toxics Testing Requests

APPENDIX A

Table 1. Mercury, PCB and organochlorine pesticide results for 2011-2015 Fish Toxics Monitoring Public Request Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (mm)	Weight (g)	Sample ID (laboratory sample #)	Total Hg (mg/kg)	% Lipids (%)	PCB Arochlors (µg/g)	Pesticides (µg/g)
Copicut Reservoir, Dartmouth/Fall River, Buzzards Bay Coastal Watershed									
2011113-001A	6/10/11	LMB	388	780	2011113-001	1.9	-	-	-
2011113-001B	6/10/11	LMB	402	860					
2011113-001C	6/10/11	LMB	390	760					
2011113-002A	6/10/11	B	223	240	2011113-002	0.47	-	-	-
2011113-002B	6/10/11	B	230	260					
2011113-002C	6/10/11	B	227	220					
2011113-003A	6/10/11	CP	531	690	2011113-003	1.6	-	-	-
2011113-003B	6/10/11	CP	485	660					
Browning Pond, Oakham/Spencer, Chicopee River Watershed									
2011111-001A	6/21/11	LMB	462	1400	2011111-001	0.61	-	-	-
2011111-001B	6/21/11	LMB	459	1200					
2011111-002A	6/21/11	LMB	297	340	2011111-002	0.48	-	-	-
2011111-002B	6/21/11	LMB	300	320					
2011111-002C	6/21/11	LMB	271	220					
2011111-003A	6/21/11	BC	270	300	2011111-003	0.29	-	-	-
2011111-003B	6/21/11	BC	271	280					
2011111-003C	6/21/11	BC	261	290					
2011111-004A	6/21/11	YP	261	190	2011111-004	0.64	-	-	-
2011111-004B	6/21/11	YP	250	170					
2011111-004C	6/21/11	YP	265	180					
2011111-005A	6/21/11	B	219	200	2011111-005	0.45	-	-	-
2011111-005B	6/21/11	B	209	180					
2011111-005C	6/21/11	B	214	200					
2011111-006A	6/21/11	BB	330	500	2011111-006	0.15	-	-	-
2011111-006B	6/21/11	BB	330	510					
2011111-006C	6/21/11	BB	320	420					

Table 1. Continued. Mercury, PCB and organochlorine pesticide results for 2011-2015 Fish Toxics Monitoring Public Request Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (mm)	Weight (g)	Sample ID (laboratory sample #)	Total Hg (mg/kg)	% Lipids (%)	PCB Arochlors (µg/g)	Pesticides (µg/g)
Horn Pond, Woburn, Mystic River Watershed									
2011112-001A	6/28/11	C	660	3500	2011112-001	0.086	-	-	-
2011112-001B	6/28/11	C	690	5000					
2011112-001C	6/28/11	C	650	3800					
2011112-002A	6/28/11	LMB	367	520	2011112-002	0.18	-	-	-
2011112-002B	6/28/11	LMB	348	560					
2011112-002C	6/28/11	LMB	388	680					
2011112-003A	6/28/11	WS	395	680	2011112-003	0.039	-	-	-
2011112-003B	6/28/11	WS	465	1240					
2011112-003C	6/28/11	WS	399	710					
2011112-004A	6/28/11	BB	300	400	2011112-004	0.026	-	-	-
2011112-004B	6/28/11	BB	279	220					
2011112-004C	6/28/11	BB	325	360					
2011112-005A	6/28/11	BC	201	100	2011112-005	0.053	-	-	-
2011112-005B	6/28/11	BC	215	120					
2011112-005C	6/28/11	BC	201	100					
2011112-006A	6/28/11	B	189	110	2011112-006	0.046	-	-	-
2011112-006B	6/28/11	B	180	100					
2011112-006C	6/28/11	B	178	100					
2011112-007A	6/28/11	YP	205	80	2011112-007	0.070	-	-	-
2011112-007B	6/28/11	YP	173	60					
2011112-007C	6/28/11	YP	200	80					
Springfield Reservoir, Ludlow, Chicopee River Watershed									
2012143-001A	5/30/12	BB	370	860	2012143-001	0.043	-	-	-
2012143-001B	5/30/12	BB	394	810					
2012143-001C	5/30/12	BB	352	660					
2012143-002A	5/30/12	P	205	210	2012143-002	0.088	-	-	-
2012143-002B	5/30/12	P	186	170					
2012143-002C	5/30/12	P	195	190					
2012143-003A	5/30/12	AE	642	680	2012143-003	0.065	-	-	-
2012143-003B	5/30/12	AE	669	640					
2012143-003C	5/30/12	AE	659	500					
2012143-004A	5/30/12	RB	200	140	2012143-004	0.19	-	-	-
2012143-004B	5/30/12	RB	222	230					
2012143-004C	5/30/12	RB	202	170					

Table 1. Continued. Mercury, PCB and organochlorine pesticide results for 2011-2015 Fish Toxics Monitoring Public Request Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (mm)	Weight (g)	Sample ID (laboratory sample #)	Total Hg (mg/kg)	% Lipids (%)	PCB Arochlors (µg/g)	Pesticides (µg/g)
Springfield Reservoir, Ludlow, Chicopee River Watershed (continued)									
2012143-005A	5/30/12	YP	300	280	2012143-005	0.21	-	-	-
2012143-005B	5/30/12	YP	255	190					
2012143-005C	5/30/12	YP	251	180					
2012143-006A	5/30/12	LMB	400	900	2012143-006	0.25	-	-	-
2012143-006B	6/20/12	LMB	381	790					
2012143-006C	6/20/12	LMB	395	780					
Sargent Pond, Leicester, French River Watershed									
2012144-001A	6/27/12	WS	413	800	2012144-001	0.30	-	-	-
2012144-001B	6/27/12	WS	404	760					
2012144-001C	6/27/12	WS	423	840					
2012144-002A	6/27/12	YP	236	130	2012144-002	0.59	-	-	-
2012144-002B	6/27/12	YP	246	160					
2012144-002C	6/27/12	YP	246	150					
2012144-003A	6/27/12	B	200	140	2012144-003	0.31	-	-	-
2012144-003B	6/27/12	B	183	130					
2012144-003C	6/27/12	B	181	120					
2012144-004A	6/27/12	BC	215	140	2012144-004	0.20	-	-	-
2012144-004B	6/27/12	BC	195	105					
2012144-005A	7/11/12	LMB	440	1400	2012144-005	1.0	-	-	-
2012144-005B	7/11/12	LMB	431	840					
Forest Lake, Methuen, Merrimack River Watershed									
2013262-001A	6/11/13	C	654	3600	2013262-001	0.18H	-	-	-
2013262-001B	6/11/13	C	670	3840					
2013262-001C	6/11/13	C	645	3440					
2013262-002A	6/11/13	LMB	322	440	2013262-002	0.33H	-	-	-
2013262-002B	6/11/13	LMB	289	320					
2013262-002C	6/11/13	LMB	294	270					
2013262-003A	6/11/13	B	197	180	2013262-003	0.052H	-	-	-
2013262-003B	6/11/13	B	194	160					
2013262-003C	6/11/13	B	198	160					
2013262-004A	6/11/13	YP	281	240	2013262-004	0.22H	-	-	-
2013262-004B	6/11/13	YP	252	200					
2013262-004C	6/11/13	YP	265	210					

Table 1. Continued. Mercury, PCB and organochlorine pesticide results for 2011-2015 Fish Toxics Monitoring Public Request Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (mm)	Weight (g)	Sample ID (laboratory sample #)	Total Hg (mg/kg)	% Lipids (%)	PCB Arochlors (µg/g)	Pesticides (µg/g)
Forest Lake, Methuen, Merrimack River Watershed (continued)									
2013262-005A 2013262-005B 2013262-005C	6/11/13 6/11/13 6/11/13	AE AE AE	640 690 541	600 780 320	2013262-005	0.29H	-	-	-
Stevens Pond/Spicket River, Lawrence, Merrimack River Watershed									
2015230-001A 2015230-001B 2015230-001C	5/14/15 5/14/15 5/14/15	C C C	667 661 647	4200 4540 3900	2015230-001	0.18	5.0	A1254 – 0.19 A1260 – 0.12	DDE – 0.075
2015230-002A 2015230-002B 2015230-002C	5/14/15 5/14/15 5/14/15	LMB LMB LMB	409 391 379	890 780 800	2015230-002	0.58	0.27	ND	ND
2015230-003A 2015230-003B 2015230-003C	5/14/15 5/14/15 5/14/15	WS WS WS	490 443 396	1430 1220 800	2015230-003	0.30	1.8	A1242 – 0.053M A1254 – 0.11 A1260 – 0.081M	DDE – 0.043 DDT – 0.029M
2015230-004A 2015230-004B 2015230-004C	5/14/15 5/14/15 5/14/15	P P P	161 152 172	100 100 130	2015230-004	0.12	0.20	ND	ND
2015230-005A 2015230-005B 2015230-005C	5/14/15 5/14/15 5/14/15	BB BB BB	317 317 291	450 550 360	2015230-005	0.065	0.68	ND	ND
Big Alum Pond, Sturbridge, Quinebaug River Watershed									
2015233-001A 2015233-001B 2015233-001C	5/21/2015 5/21/2015 5/21/2015	LMB LMB LMB	332 339 380	500 470 650	2015233-001	0.25	-	-	-
2015233-002A 2015233-002B 2015233-002C	5/21/2015 5/21/2015 5/21/2015	B B B	211 216 211	200 220 200	2015233-002	0.067	-	-	-
2015233-003A 2015233-003B 2015233-003C	5/21/2015 5/21/2015 5/21/2015	YB YB YB	252 230 276	240 200 300	2015233-003	0.11	-	-	-

Table 1. Continued. Mercury, PCB and organochlorine pesticide results for 2011-2015 Fish Toxics Monitoring Public Request Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (mm)	Weight (g)	Sample ID (laboratory sample #)	Total Hg (mg/kg)	% Lipids (%)	PCB Arochlors (µg/g)	Pesticides (µg/g)
Sargent Pond, Leicester, French River Watershed									
2015228-001A	5/26/2015	LMB	368	600	2015228-001	0.74	-	-	-
2015228-001B	5/26/2015	LMB	403	880					
2015228-001C	5/26/2015	LMB	336	450					
2015228-002A	5/26/2015	YP	244	190	2015228-002	0.33	-	-	-
2015228-002B	5/26/2015	YP	254	200					
2015228-002C	5/26/2015	YP	246	190					
2015228-003A	5/26/2015	P	181	180	2015228-003	0.20	-	-	-
2015228-003B	5/26/2015	P	205	180					
2015228-003C	5/26/2015	P	194	170					
2015228-004A	5/26/2015	YB	272	280	2015228-004	0.44	-	-	-
2015228-004B	5/26/2015	YB	292	380					
2015228-004C	5/26/2015	YB	279	280					
2015228-005A	5/26/2015	BC	240	200	2015228-005	0.35	-	-	-
2015228-005B	5/26/2015	BC	231	170					
Lake Waban, Wellesley, Charles River Watershed									
2015232-001A	6/3/15	LMB	352	550	2015232-001	0.15	-	-	-
2015232-001B	6/3/15	LMB	328	460					
2015232-001C	6/3/15	LMB	336	500					
2015232-002A	6/3/15	YP	260	200	2015232-002	0.077	-	-	-
2015232-002B	6/3/15	YP	255	180					
2015232-002C	6/3/15	YP	234	200					
2015232-003A	6/3/15	WP	257	220	2015232-003	0.23	-	-	-
2015232-003B	6/3/15	WP	256	210					
2015232-003C	6/3/15	WP	264	250					
2015232-004A	6/3/15	BB	330	520	2015232-004	0.011	-	-	-
2015232-004B	6/3/15	BB	368	640					
2015232-004C	6/3/15	BB	368	600					
2015232-005A	6/3/15	P	189	160	2015232-005	0.037	-	-	-
2015232-005B	6/3/15	P	197	180					
2015232-005C	6/3/15	P	195	170					

Table 1. Continued. Mercury, PCB and organochlorine pesticide results for 2011-2015 Fish Toxics Monitoring Public Request Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (mm)	Weight (g)	Sample ID (laboratory sample #)	Total Hg (mg/kg)	% Lipids (%)	PCB Arochlors (µg/g)	Pesticides (µg/g)
Lake Waban, Wellesley, Charles River Watershed (continued)									
2015232-006A	6/3/15	CP	432	440	2015232-006	0.13	-	-	-
2015232-006B	6/3/15	CP	394	310					
2015232-006C	6/3/15	CP	397	360					
2015232-007A	6/3/15	WS	463	1200	2015232-007	0.10	-	-	-
2015232-007B	6/3/15	WS	470	1280					
Richmond Pond, Pittsfield/Richmond, Housatonic River Watershed									
2015231-001A	6/4/2015	RB	210	210	2015231-001	0.29	--	-	-
2015231-001B	6/4/2015	RB	220	240					
2015231-001C	6/4/2015	RB	245	270					
2015231-002A	6/4/2015	YP	280	290	2015231-002	0.29	-	-	-
2015231-002B	6/4/2015	YP	270	250					
2015231-002C	6/4/2015	YP	290	310					
2015231-003A	6/4/2015	P	190	190	2015231-003	0.19	-	-	-
2015231-003B	6/4/2015	P	190	190					
2015231-003C	6/4/2015	P	205	220					
2015231-004A	6/4/2015	BB	280	370	2015231-004	0.079	-	-	-
2015231-004B	6/4/2015	BB	295	430					
2015231-004C	6/4/2015	BB	295	410					
2015354-001A	7/16/2015	LMB	333	550	2015354-001	0.30H	-	-	-
2015354-001B	7/16/2015	LMB	332	580					
2015354-001C	7/16/2015	LMB	319	520					
Farrar Pond, Lincoln, Concord (Sudbury) River Watershed									
2015229-001A	6/9/15	LMB	393	820	2015229-001	0.68	-	-	-
2015229-001B	6/9/15	LMB	361	700					
2015229-001C	6/9/15	LMB	411	820					
2015229-002A	6/9/15	CP	450	520	2015229-002	0.62	-	-	-
2015229-002B	6/9/15	CP	460	620					
2015229-002C	6/9/15	CP	444	430					
2015229-003A	6/9/15	BC	261	250	2015229-003	0.62	-	-	-
2015229-003B	6/9/15	BC	273	240					
2015229-003C	6/9/15	BC	254	220					
2015229-004A	6/9/15	YP	260	220	2015229-004	0.36	-	-	-
2015229-004B	6/9/15	YP	223	160					
2015229-004C	6/9/15	YP	207	110					

Table 1. Continued. Mercury, PCB and organochlorine pesticide results for 2011-2015 Fish Toxics Monitoring Public Request Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (mm)	Weight (g)	Sample ID (laboratory sample #)	Total Hg (mg/kg)	% Lipids (%)	PCB Arochlors (µg/g)	Pesticides (µg/g)
Farrar Pond, Lincoln, Concord (Sudbury) River Watershed (continued)									
2015229-005A 2015229-005B 2015229-005C	6/9/15 6/9/15 6/9/15	BB BB YB	360 349 280	570 520 300	2015229-005	0.087	-	-	-
2015229-006A 2015229-006B 2015229-006C	6/9/15 6/9/15 6/9/15	P P P	200 182 182	160 150 120	2015229-006	0.13	-	-	-
2015229-007A 2015229-007B 2015229-007C	6/9/15 6/9/15 6/9/15	WP WP	292 274	300 300	2015229-007	0.19	-	-	-

[1] Species Code	Common Name	*Scientific name*	Data Qualifiers as reported by WES
			H = USEPA holding time exceeded. Holding time not met but previous studies by WES show that frozen fish samples are stable for mercury for at least one year.
AE	American eel	*Anguilla rostrata*	M = analyte concentration greater than Method Detection Limit but less than Minimum Reporting Limit
B	bluegill	*Lepomis macrochirus*	ND = analyzed for, but not detected above Method Detection Level
BB	brown bullhead	*Ameiurus nebulosus*	- = not analyzed for
BC	black crappie	*Pomoxis nigromaculatus*	
C	common carp	*Cyprinus carpio*	
CP	chain pickerel	*Esox niger*	
LMB	largemouth bass	*Micropterus salmoides*	
P	pumpkinseed	*Lepomis gibbosus*	
RB	rock bass	*Ambloplites rupestris*	
WP	white perch	*Morone Americana*	
WS	white sucker	*Catostomus commersonii*	
YB	yellow bullhead	*Ameiurus natalis*	
YP	yellow perch	*Perca flavescens*	

Table 2. Selected metals for 2015 Fish Toxics Monitoring Public Request Surveys. Draft results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID (laboratory sample #)	Selected Metals mg/Kg				
	As,	Cd,	Cr	Pb	Se
Stevens Pond/Spicket River, Lawrence, Merrimack River Watershed					
2015230-001	<0.04	<0.04	<0.03	<0.03	<0.03
2015230-002	<0.04	<0.04	<0.03	<0.03	<0.03
2015230-003	<0.04	<0.04	<0.03	<0.03	<0.03
2015230-004	<0.04	<0.04	<0.03	<0.03	<0.03
2015230-004	<0.04	<0.04	<0.03	<0.03	<0.03
Lake Waban, Wellesley, Charles River Watershed					
2015232-001	<0.04	<0.04	<0.03	<0.03	<0.03
2015232-002	<0.04	<0.04	<0.03	<0.03	<0.03
2015232-003	<0.04	<0.04	<0.03	<0.03	<0.03
2015232-004	<0.04	<0.04	<0.03	<0.03	<0.03
2015232-005	<0.04	<0.04	<0.03	<0.03	<0.03
2015232-006	<0.04	<0.04	<0.03	<0.03	<0.03
2015232-007	<0.04	<0.04	<0.03	<0.03	<0.03

Note: All results for metals are draft results, due to problems with the LIMS reporting software at the lab at the time of publication. Ultimately the “final” results will remain < MDL.

Table 3. 2011- 2015 Fish Toxics Analytical Methods, Project Quantitation Limits, Method Detection and Reporting Detection Limits.

Analyte/Compound	Units	Project Quantitation Limit (PQL)	Achievable Laboratory Method Detection Limit (MDL)	Laboratory Minimum Reporting Limit (MRL)	Method
Lipid Concentration	%	N/A	N/A	N/A	Modified AOAC 983.21
Mercury	ug/g wet	0.5*	0.002	0.006	EPA 7473
PCB Arochlor 1232	µg/g wet	1.0** (total)	0.019	0.057	Modified AOAC 983.21
PCB Arochlor 1242	µg/g wet	1.0** (total)	0.043	0.13	Modified AOAC 983.21
PCB Arochlor 1248	µg/g wet	1.0** (total)	0.038	0.11	Modified AOAC 983.21
PCB Arochlor 1254	µg/g wet	1.0** (total)	0.038	0.11	Modified AOAC 983.21
PCB Arochlor 1260	µg/g wet	1.0** (total)	0.031	0.093	Modified AOAC 983.21
Chlordane	µg/g wet	0.3***	0.11	0.33	Modified AOAC 983.21
Toxaphene	µg/g wet	Unknown	0.25	0.75	Modified AOAC 983.21
a-BHC	µg/g wet	Unknown	0.0060	0.018	Modified AOAC 983.21
b-BHC	µg/g wet	Unknown	0.010	0.030	Modified AOAC 983.21
Lindane	µg/g wet	Unknown	0.0060	0.018	Modified AOAC 983.21
d-BHC	µg/g wet	Unknown	0.028	0.084	Modified AOAC 983.21
Endrin	µg/g wet	Unknown	0.0036	0.011	Modified AOAC 983.21
Endosulfan I	µg/g wet	Unknown	0.021	0.063	Modified AOAC 983.21
Hexachlorocyclopentadiene	µg/g wet	Unknown	0.10	0.30	Modified AOAC 983.21
Hexachlorobenzene	µg/g wet	Unknown	0.084	0.25	Modified AOAC 983.21
Trifluralin	µg/g wet	Unknown	0.047	0.14	Modified AOAC 983.21
Heptachlor	µg/g wet	0.3***	0.0060	0.018	Modified AOAC 983.21
Heptachlor Epoxide	µg/g wet	Unknown	0.014	0.043	Modified AOAC 983.21
Methoxychlor	µg/g wet	Unknown	0.026	0.078	Modified AOAC 983.21
DDD	µg/g wet	0.06**(total)	0.0070	0.021	Modified AOAC 983.21
DDE	µg/g wet	0.06**(total)	0.010	0.030	Modified AOAC 983.21
DDT	µg/g wet	0.06**(total)	0.011	0.033	Modified AOAC 983.21
Aldrin	µg/g wet	5.0***	0.0080	0.024	Modified AOAC 983.21
PCNB	% recovery	NA	NA	NA	Modified AOAC 983.21
As	ug/g wet	Unknown	0.04	0.2	EPA 200.7
Cd	µg/g wet	Unknown	0.04	0.2	EPA 200.7
Cr	µg/g wet	Unknown	0.03	0.1	EPA 200.7
Pb	µg/g wet	Unknown	0.03	0.1	EPA 200.7
Se	µg/g wet	Unknown	0.03	0.1	EPA 200.7

Notes:
* MDPH trigger level
** MDPH trigger level for "total arochlors and/or total DDT and metabolites DDD and DDE
*** USFDA Action Level
1) "NA"= Not Applicable, no data provided
2) "Unknown" = no information available or no Data Quality Objective defined at this time.
3) Analyte MDL/RDL values are based on most recent analyses by WES (2004), and as all Detection Limit values, subject to change.
4) Methods -EPA 7473 – Mercury in Tissues by Cold Vapor

Table 3. 2011- 2015 Fish Toxics Analytical Methods, Project Quantitation Limits, Method Detection and Reporting Detection Limits.

-Modified AOAC 983.21 - Organochlorine Pesticide and Polychlorinated Biphenyl Residues in Fish, Gas Chromatographic Method, Method 983.21. In Association of Official Analytical Chemists (AOAC) Official Methods of Analysis, 15th ed., AOAC, Arlington, VA.

Appendix B

Interagency Committee on Freshwater Fish Toxics Monitoring and Assessment

MEMORANDUM OF UNDERSTANDING
April 1994

MEMBERSHIP: The Committee is comprised of representatives from the following Departments and programs:

- Department of Environmental Protection -
  - Office of Watershed Management (OWM)
  - Division of Water Pollution Control (DWPC)
  - Office of Research and Standards (ORS)
  - Division of Environmental Analysis (DEA)
- Department of Public Health
  - Environmental Toxicology Program (ETP)
  - Physician Education Unit (PEU)
  - Community Assessment Unit (CAU)
  - Environmental Laboratory (EL)
- Department of Fisheries, Wildlife and Environmental Law Enforcement
  - Division of Fisheries and Wildlife (DFW)

INTRODUCTION: The freshwater fish toxics testing efforts of Massachusetts are headed by the MA Department of Environmental Protection (DEP) in cooperation with the MA Department of Public Health (DPH), the Department of Fisheries, Wildlife and Environmental Law Enforcement (DFWELE). The DPH leads efforts to determine the public health impacts of consuming contaminated fish from various locations. These collaborative efforts ensure the state's ability to conduct limited testing and evaluation of contaminants in fish tissue for purposes of protecting public health and the environment. This Memorandum of Understanding (MOU) is limited to the freshwater environment.

PURPOSE: This Memorandum of Understanding is issued by the Interagency Committee to formalize and communicate its goals, objectives and responsibilities for monitoring and assessing toxic contaminants in fresh water fish in Massachusetts.

AUTHORITY: Specific legal mandates do not exist for testing freshwater fish for toxic contaminants. This work, however, is viewed as desirable by the three agencies relative to their respective authorities and mandates, including but not limited to, protecting public health, controlling toxic substances in the environment and protecting wildlife resources. This committee does not have responsibility to direct testing of fish for contaminants at hazardous material sites, but does participate in the process as part of the Superfund programs.

OBJECTIVES: The primary objective of the MOU is to establish a formal interagency mechanism to facilitate the communication, coordination and

dissemination of information pertaining to contaminants in freshwater fish. The objectives of the fish monitoring efforts are described below. Monitoring and assessment activities are planned annually and are based on the agencies' respective available resources. Therefore, in any given year, the scope of the monitoring and assessment efforts may or may not fulfill some or all of the following objectives.

- To determine the public health impacts from human consumption of contaminated fish species from various freshwater bodies in the Commonwealth.
- To develop appropriate technical support documents and public health advisories.
- To develop outreach strategies and environmental education programs for health care professionals, local health agencies and the potentially exposed target populations.
- To coordinate posting efforts with appropriate local, state and federal agencies.
- To provide information useful in managing and controlling toxic pollutants.
- To provide fish monitoring data for use as part of the overall assessment of the health of ecosystems.
- To respond to public requests for fish testing through a standardized questionnaire and ranking process to identify priority sites to be tested.
- To establish and maintain a statewide toxics-in-fish database for use by state and federal agencies, research and educational institutions and other interested parties.
- To conduct research and development projects to enhance fish monitoring activities and the overall health of the fish populations and associated ecosystems of the Commonwealth.

RESPONSIBILITIES: Each of the three agencies named in this MOU have responsibilities unique to its mission. Specific responsibilities that relate to current activities are described below:

- All members of the Interagency Committee participate in the overall planning of the Massachusetts fish toxics program, including the prioritization of testing sites, publication of fish toxics data and their use in assessing the health of ecosystems in Massachusetts.
- The Director of the Office of Research and Standards chairs and coordinates the activities of the Interagency Committee.
- DPH-ETP will formalize a protocol for evaluating the public health risks of consuming contaminated fish. DEP-ORS will work closely with DPH on this protocol to ensure that DEP's risk analysis program is considered.
- DPH-ETP will develop a standard interim protocol for development of fish advisories by spring of 1994. DPH is responsible for decisions regarding the need for public health advisories and for implementing them.

- DPH-ETP in conjunction with DPH-CAU will identify & notify human populations whose health may be affected due to consumption of contaminated fish.
- DPH-ETP in conjunction with DPH-PEU will provide relevant health information to health professionals (Boards of Health, medical community, etc.) and the public regarding potential hazards related to consumption of contaminated fish.
- DEP-OWM will plan and conduct annual fish sampling efforts in conjunction with DFWELE-DFW. DEP-OWM will collect and prepare fish samples, manage data and report results to the committee.
- DEP-OWM will utilize monitoring results for decisions on NPDES permits, for managing nonpoint pollution sources and to provide information for the Chapter 21E site discovery program in cases where oil and hazardous material contaminant levels are found in fish.
- DEP-DWPC will use monitoring results for determining compliance with Surface Water Quality Criteria and water use impairments.
- DFW is responsible for managing and regulating fishing as well as protecting, maintaining, and restorating the Commonwealth's freshwater fish populations.
- DEP-DEA provides QA/QC technical support to the OWM and the Interagency Committee dealing with fish sampling and sample management.
- DEP-DEA analyzes fish and related samples for toxic chemicals and other contaminants, and provides the validated data to the OWM and the Interagency Committee. DPH-EL will provide review and comment on analytical laboratory issues.
- In cooperation with the OWM and the Interagency Committee, DEP-DEA & ORS conduct and publish research dealing with the development and improvement of methods for the analysis of toxic and other contaminants in fish and other aquatic organisms; this includes evaluation of methods for assessing the exposure of fish populations to toxicants (e.g., approaches involving biomarkers and toxicity testing).
- DEP-DEA & ORS advise the OWM and the Interagency Committee on all matters related to the laboratory analysis of fish samples.

MEETINGS: Meetings are scheduled as needed. Meetings in the fall and early winter months generally focus on planning annual sampling activities. Spring meetings generally focus on the evaluations of laboratory analyses and appropriate agency responses.

This MOU will be reviewed and revised as necessary on an annual basis. The following signatures indicate that the three participating agencies view their work duties as set forth in this Memorandum of Understanding as being part of their respective responsibilities for controlling toxic contaminants in the environment, protecting the public health and protecting wildlife resources.

Tom Powers
Acting Commissioner
Department of Environmental Protection

David Mulligan
Commissioner
Department of Public Health

Wayne F. MacCallum
Director
Division of Fisheries & Wildlife
Department of Wildlife & Environmental Law Enforcement

Appendix C

FORM FOR REQUESTING FISH TESTING

The following information will be reviewed by representatives of the Departments of Environmental Protection, Public Health and Fisheries and Wildlife to reach a decision regarding the need for the state to conduct freshwater fish toxics testing. Please answer these questions to the extent possible.

1. Name of the pond/lake river:_____

2. Location (city/town):_____

3. Why do you think that testing is necessary?_____

_____

_____

_____

4. If known, what type of testing is requested? Please state what chemical(s) or compounds are suspected:

_____

_____

5. Do you know of any private testing that has been done at this location? If so, please submit the results, including the quality assurance and control data:_____

_____

_____

_____

_____

6. Do you and your family fish at this location? (Please check one):

Yes___ No___

7. Please estimate how many fish meals you and your family consume over the course of a year of fish caught at this location? (Please check one):

   None (0)____ One (1) Meal a Month _____ 2-4 Meals a Month_____

8. What kind of fish do you eat from this location?:_____

   _____

   _____

   _____

   _____

9. Please not below any additional information you think might be useful in reviewing this request (Example: known or suspected pollution source):

   _____

   _____

   _____

   _____

   _____

   _____

   Your Name: _____

   Address: _____

   Telephone: _____

Thank you for taking the time to provide us with the above information. We will consider your request and will respond to you in mid to late February.

Please return this form to:

Robert Maietta
Department of Environmental Protection
Division of Watershed Management
8 New Bond Street
Worcester, MA 01606

Appendix D

CRITERIA FOR RANKING FISH TOXICS TESTING REQUESTS

Criteria for evaluating and ranking requested fish toxics studies have been developed for the purpose of ensuring that the state's fish toxics testing efforts are aimed at the situations that are most critical for protecting public health and the environment. In addition to prioritizing state efforts, the criteria and ranking scheme provide that all requested studies will be evaluated consistently.

A requested fish testing study will fall into one of four possible categories, where Category A is the highest priority and Category D is the lowest. Table 1 is followed by specific definitions of the criteria used.

TABLE 1

CATEGORY A		
	1.	The location is **heavily-fished**, and
	2.	Have **strong evidence** which indicates a potential for fish contamination.
CATEGORY B		
B1	1.	The location is **moderately-fished**, and
	2.	Have **strong evidence** which indicates a potential for fish contamination.
B2	1.	The location is **heavily-fished**, and
	2.	Have **some evidence** which indicates a potential for fish contamination.
CATEGORY C		
C1	1.	The location is **lightly-fished**, and
	2.	Have **strong evidence** which indicates a potential for fish contamination.
C2	1.	The location is **moderately-fished**, and
	2.	Have **some evidence** which indicates a potential for fish contamination.
C3	1.	The location is **heavily-fished**, and
	2.	Have **no evidence** which indicates a potential for fish contamination.
CATEGORY D		
D1	1.	The location is **lightly-fished**, and
	2.	Have **some or no evidence** which indicates a potential for fish contamination.
D2	1.	The location is **moderately-fished**, and
	2.	Have **no evidence** which indicates a potential for fish contamination.

DEFINITION OF CRITERIA

A. Criteria to estimate the frequency of exposure to fish that is consumed from a *single* location over the course of a year.

1. **Heavily-fished** - the location is one where the amount of fish caught comprise a substantial fraction of diets of individuals. A substantial fraction of the diet is classified when it is estimated that the number of fish meals exceeds four per month or when in the range of two to four meals per month.
2. **Moderately-fished** - the location is one where the amount of fish caught comprise some fairly consistent fraction of diets of individuals and is at a moderate level. A moderate level of fish consumption is classified when the number of fish meals is estimated at one a month throughout the year.
3. **Lightly-fished** - information indicates that fishing and consumption of fish from the location is rare or null.

B. Criteria to estimate the weight of evidence for a potential fish contamination problem at a given location.

1. **Strong evidence** – exists when there is knowledge that

    a. known sources release chemicals into the location (sources include point and/or nonpoint sources), and

    b. the chemicals are ones that tend to bioaccumulate/biomagnify in fish (ex. mercury, PCBs) and have been associated with human health effects traced to the consumption of contaminated fish.

    c. In addition to the above or in combination with either (a) or (b), the fish populations at the location have been shown to indicate evidence of toxic exposure, for example, fish are contaminated or are exposed to toxics associated with fish tumors, lesions, abnormal growth, or reproductive effects.

2. **Some evidence** – exists when there is knowledge that

    a. known sources release chemicals into the location (sources include point and/or nonpoint sources), and

    b. the chemicals are ones that do not bioaccumulate/biomagnify extensively in fish (ex. heavy metals) and have not been commonly associated with human health effects traced to the consumption of contaminated fish.

    c. The fish populations at the location have not been shown to indicate evidence of toxic exposure to toxics associated with fish tumors, lesions, abnormal growth, or reproductive effects.