2008
Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys

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

Robert J. Maietta
Jane Ryder
Richard F. Chase
Environmental Analysts
Division of Watershed Management

March 12, 2010

CN 357.0

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 numbers of 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. Variables 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 requests. 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:

Massachusetts Department of Environmental Protection

Division of Watershed Management 627 Main Street, 2nd Floor Worcester, MA 01608 (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) 792-7270

Year 2 Watershed Surveys

Massachusetts has adopted a watershed approach to planning and implementing water resource protection activities throughout the state. In 1993, the twenty-seven major watersheds and coastal drainage areas in Massachusetts were placed on a rotating five-year schedule for monitoring, assessment, total maximum daily load (TMDL) development, surface water permitting and non-point source pollution control. The rotating watershed cycle allows for the synchronization of these water quality planning and management activities within each watershed. During Year 1 of the rotating basin schedule all pertinent data and information relative to water resource management are gathered and reviewed to identify data gaps and the need for additional information. This process culminates in the development of a plan for obtaining this information during Year 2. At a minimum, a Quality Assurance Project Plan (QAPP) is formulated for all environmental monitoring activities to be performed. The scope of the monitoring effort varies depending upon the resources available and the prevailing water quality issues within each watershed. Input from outside agencies and the general public is actively solicited in order to gain further insight with respect to water quality goals and use-objectives. During Year 2 of this cycle the DWM may perform fish toxics monitoring surveys as part of their larger "biological monitoring" program.

Objective and Scope

The objective of Public Request and Watershed Surveys is to screen edible fillets of fishes for a variety of contaminants (i.e. mercury and/or other metals, polychlorinated biphenyls (Arochlors and toxic congeners), and organochlorine pesticides). All data is sent to the MDPH and the MassDEP Office of Research and Standards (ORS) for assessment and advisory issuance where appropriate.

PCB Arochlors analyzed for include Arochlors 1232, 1242, 1248, 1254, and 1260. PCB Toxic Congeners analyzed for include BZ #s 8, 18, 28, 44, 52, 66, 77, 81, 101, 105, 114, 118, 123, 126, 128, 138, 153, 156, 157, 167, 169, 170, 180, 187, 189, 195, 206, and 209. Organochlorine pesticides analyzed for include: Chlordane, Toxaphene, a-BHC, b-BHC, d-BHC, Lindane, Hexachlorocyclopentadiene, Trifluralin, Hexachlorobenzene, Heptachlor, Heptachlor Epoxide, Methoxychlor, DDD, DDE, DDT, and Aldrin. All organics analyses include percent lipid determination. Mercury is the only metal which is routinely analyzed for at the current time. All analyses for variables listed above are performed at the Senator William X. Wall Experiment Station (WES). Additional variables are addressed on a site-specific basis.

In order to assess the level of contamination present in fish of different trophic guilds and utilizing different 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 2008, a total of seven locations were sampled as a result of recommendations from the Interagency Committee. An additional seven locations were sampled as part of Year 2 watershed surveys as selected by the MassDEP watershed coordinators.

Waterbody	Watershed	Town	USGS Quadrangle
Kinnacum Pond PALIS#[1] 96163	Cape Cod	Wellfleet	WELLFLEET, MASS.
Spectacle Pond PALIS#[1] 96306	Cape Cod	Wellfleet	WELLFLEET, MASS.
Round Pond (west) PALIS#[1] 96261	Cape Cod	Truro	WELLFLEET, MASS.
Lower Mystic Lake PALIS#[1] 71027	Mystic River	Arlington	BOSTON NORTH, MASS.
Alewife Brook SARIS#[2] 7138250	Mystic River	Cambridge Arlington Somerville	BOSTON NORTH, MASS.
Windsor Pond PALIS#[1] 32076	Westfield River	Windsor	ASHFIELD, MASS.
Neponset River SARIS#[2] 7341000	Neponset River	Canton Norwood	NORWOOD, MASS.
Blackstone River Impoundment (Blackstone Gorge) SARIS#[2] 5131000	Blackstone River	Blackstone	UXBRIDGE, MASS. – R.I.
Manchaug Pond PALIS#[1] 51091	Blackstone River	Douglas Sutton	WEBSTER, MASS.-CONN.-R.I.
Lake Shirley PALIS#[1] 81122	Nashua River	Lunenburg	AYER, MASS.
Oxbow PALIS#[1] 34066	Connecticut River	Easthampton Northhampton	EASTHAMPTON, MASS.
Barton Cove (Connecticut River) PALIS#[1] 34122	Connecticut River	Montague Gill	GREENFIELD, MASS.
Red Bridge Impoundment PALIS#[1] 36171	Chicopee River	Ludlow Wilbraham	LUDLOW, MASS.
Browning Pond PALIS#[1] 36025	Chicopee River	Oakham Spencer	WORCESTER NORTH, MASS.

[1] PALIS# = Pond and Lake Identification System number (Ackerman 1989)
[2] SARIS#=Stream Classification Inventory of Rivers and Streams (Halliwell, Kimball, and Screpetis 1982)

Field Methods

Waterbodies were sampled using an electrofishing boat, trotlines, gill nets, fish traps, and/or rod and reel. 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. Trotlines and fish traps were baited with dog food, catfish bait, or dead fish and left overnight. Gill nets were set in various locations and either checked every two hours or, on occasion, left overnight. All gear left overnight was retrieved the following morning. Rod and reel fishing was performed by casting lures/baited hooks into fish holding cover and retrieving lures/hooks and, on occasion, a fish. Fish to be included in the sample were dispatched, stored on ice, and either transported to the Massachusetts Department of Environmental Protection (MassDEP) Division of Watershed Management (DWM) laboratory in Worcester, or the Wall Experiment Station (WES) in Lawrence. In few cases (Cape Cod Ponds), fish were filleted in the field and then stored on ice or frozen. In all cases, live fish that were not included as part of the sample, were released.

Field Results

Kinnacum Pond: Rod and reel fishing, gill nets, and fish traps set overnight at Kinnacum Pond in Wellfleet on 5/27/08 resulted in the collection of eight yellow perch. No other fish species were collected or observed.

Spectacle Pond : Gill nets and fish traps set overnight at Spectacle Pond in Wellfleet on 5/27/08 resulted in the collection of six yellow perch. Rod and reel fishing resulted in the collection of one largemouth bass. No other fish species were observed.

Round Pond (west): Rod and reel fishing and short duration gill nets set at Round Pond in Truro on 5/27/08 resulted in the collection of nine yellow perch. Pumpkinseed *Lepomis gibbosus* were observed but not collected.

.

Lower Mystic Lake: Electrofishing at Lower Mystic Lake in Arlington on 6/17/08 resulted in the collection of three common carp, and three white sucker *Catostomus commersoni*. Large numbers of blueback herring, *Alosa aestivalis,* or alewife, *Alosa pseudoharengus,* were also observed and collected. These were were not retained for analysis due to the fact that they cannot be legally taken by fishermen.

Alewife Brook: Electrofishing at Alewife Brook in Cambridge, Arlington and Somerville on 6/17/08 resulted in the collection of three common carp, three yellow perch, and three white perch. Other fish species observed included common carp, chain pickerel, pumpkinseed, and golden shiner *Notemigonus crysoleucas*.

Windsor Pond: Electrofishing and gill net sets at Windsor Pond in Windsor on 7/03/08 resulted in the collection of three largemouth bass, three yellow perch, three white sucker, and three pumpkinseed. Additional species collected and /or observed included golden shiner, black crappie, brown trout, and an unidentified minnow. All brown trout were captured with gill nets.

Neponset River: Electrofishing at the Neponset River in Canton and Norwood on 7/2/08 resulted in the collection of three common carp, three yellow perch, three white sucker, three bluegill, *Lepomis macrochirus*, and three American eel, *Anguilla rostrata*. Additional species collected and /or observed included black crappie, largemouth bass, and pumpkinseed. The fish community appeared to be dominated by common carp and white sucker.

Blackstone River Impoundment (Blackstone Gorge): Electrofishing the Blackstone River at the Blackstone Gorge in the town of Blackstone on 7/8/08 resulted in the collection of three largemouth bass, three common carp, three white sucker, three yellow perch, and three bluegill. Additional species collected and /or observed included chain pickerel, northern pike, *Esox lucius*, pumpkinseed, and golden shiner.

Manchaug Pond: Electrofishing at Manchaug Pond in Douglas and Sutton on 6/19/08 resulted in the collection of three largemouth bass, three white perch, three yellow perch, three bluegill, and three brown bullhead. Additional species collected and /or observed included chain pickerel, pumpkinseed, yellow bullhead, and white sucker.

Lake Shirley: Electrofishing at Lake Shirley in Lunenburg on 6/12/08 resulted in the collection of three largemouth bass, three white sucker, three black crappie, three white perch, three yellow perch, one brown bullhead and two yellow bullhead. Additional species collected and /or observed included chain pickerel, pumpkinseed, and bluegill.

Oxbow: Electrofishing at the Oxbow in Easthampton and Northhampton on 8/05/08 resulted in the collection of three largemouth bass, three common carp, three black crappie, three white perch, three yellow perch, one three brown bullhead and two yellow bullhead. Additional species collected and /or observed included northern pike, walleye, *Sander vitreus*, golden shiner, white sucker, bowfin, *Amia calva*, American eel and pumpkinseed.

Barton's Cove: Electrofishing at Barton's Cove (Connecticut River) in Montague and Gill on 8/07/08 resulted in the collection of three largemouth bass, three white sucker, three yellow perch, three pumpkinseed, and three brown bullhead. Additional species collected and /or observed included bluegill, American eel, golden shiner, and rock bass, *Ambloplites rupestris*.

Red Bridge Impoundment: Electrofishing at Red Bridge Impoundment (Chicopee River) in Ludlow/ Wilbraham on 8/07/08 resulted in the collection of three largemouth bass, three white sucker, three yellow perch, three white perch, three balck crappie, and three bluegill. Additional species collected and /or observed included chain pickerel, pumpkinseed, redbreast sunfish *Lepomis auritus*, and brown bullhead.

Browning Pond: Fish traps set overnight at Browning Pond in Oakham and Spencer on 5/27/08 resulted in the collection of two yellow bullhead on 5/28/08 and three yellow perch were obtained from a rod and reel fisherman at that time Electrofishing at Browning Pond on 7/29/08 resulted in the collection of three largemouth bass and three bluegill. Additional species collected and /or observed included chain pickerel and pumpkinseed..

Laboratory Methods

Fish brought 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, spines, or pectoral fin ray samples 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 were placed in VWR high density polyethylene (HDPE) cups with covers. Composite samples were composed of portions of two or three fillets from 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). PCB Aroclor, PCB congener, 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, Congeners, and Organochlorine Pesticides."(MA DEP 2002b). Additional information on analytical techniques used at WES is available from the laboratory.

Laboratory Results

Sixty samples were delivered to WES for analysis. All fish tissue data passed WES QC acceptance limits, however, fifty percent of the mercury data were reported with "qualification" (See Quality Control Section). Mercury (MDL 0.0020 mg/kg) was detected in all samples analyzed. Concentrations ranged from 0.017 mg/kg to 1.5 mg/kg. Mercury concentrations varied greatly between waterbodies and species. Waterbody mean mercury concentrations and ranges are detailed on the following page. Complete results of the mercury analysis can be found in Appendix A Table 1. PCB Aroclor, congener, and organochlorine pesticide results greater than the Method Detection Limit but less than the Reporting Detection Limit (>MDL but< MRL) were reported (and flagged) by the lab and appear so designated in the data tables (See Appendix A, Table 1). Complete results for PCB Aroclors, PCB congeners, and organochlorine pesticides can also be found in Appendix A Table 1.

Waterbody	Mean Total Hg (mg/kg wet weight)	Range (mg/kg (min-max))
Kinnacum Pond	0.40 (n=3)	0.21–0.63
Spectacle Pond	0.62 (n=3)	0.31–0.93
Round Pond (West)	0.82 (n=3)	0.45–1.5
Lower Mystic Lake	0.11 (n=2)	0.11-0.12
Alewife Brook	0.07 (n=3)	0.037-0.11
Windsor Pond	0.37 (n=4)	0.045–1.2
Neponset River	0.15 (n=5)	0.097-0.21
Blackstone River Impoundment	0.11 (n=5)	0.054–0.22
Manchaug Pond	0.31 (n=5)	0.038–0.58
Lake Shirley	0.54 (n=6)	0.017-0.99
Oxbow	0.14 (n=6)	0.063-0.24
Barton Cove	0.25 (n=5)	0.088-0.37
Red Bridge Impoundment	0.40 (n=6)	0.24-0.63
Browning Pond	0.40 (n=4)	0.30-0.47

Quality Control

Fifty percent of the mercury data were reported with "qualification". The qualification in all cases was due to "EPA holding time" exceedances. Mercury was analyzed after the U.S. Environmental Protection Agency (USEPA) recommended holding time of 28 days and samples were qualified as "Holding time not met but previous studies by WES show that frozen fish samples are stable for mercury for at least one year." It should be noted that samples were in all cases delivered to WES within the USEPA 28 day holding time. Six sets of samples were delivered within 3 days of collection, eight sets within 10 days of collection and one set within 13 days of collection. Lab duplicate precision estimates for mercury were generally within the acceptance criteria range of 0 – 20 RPD. All other QC was acceptable. Lab accuracy estimates for mercury using lab-fortified matrix samples were within the acceptable range from 70-130 % recovery. 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 or from WES or DWM.

PCB Aroclors, PCB congeners, and DDE were detected in a number of samples. PCB Aroclors and congeners were detected in eighteen of the thirty two samples analyzed (56%). DDE was detected in thirteen of the thirty two samples analyzed (41%). Many of the positive congener results were reported as "analyte concentration greater than Method Detection Limit but less than Minimum Reporting Limit" (See Discussion for more detail). For one sample (2008155-005), all PCB Aroclor and PCB congener were qualified due to a surrogate recovery being below acceptance criteria. In addition, a number of PCB Aroclors, PCB congeners, and DDE were qualified for sample number 2008154-001 due to a duplicate result which was greater than RPD control limit. The possible explanation given was "Sample may not be homogenous." All laboratory blanks for organics resulted in non-detectable concentrations. Duplicate samples analyzed for PCB congeners, PCB Aroclors, and organochlorine pesticides in most cases had resultant RPDs within the acceptance criteria range of 0-35%. The lab fortified blank sample recoveries for toxaphene and PCB Aroclor 1260 and the laboratory fortified matrix sample recoveries for chlordane and PCB Aroclor 1254 were all within the acceptance criteria range 60-140% recovery. All surrogate PCNB analyses (except that for sample # 2008155-005 noted

previously) resulted in percent recoveries within the acceptance criteria of 60-140 % recovery. Complete quality control data for PCB congeners, PCB Aroclors, and organochlorine pesticides are available upon request or from WES or DWM.

Discussion

Edible tissue total mercury continues to be both widespread and detectable at concentrations that at times exceed the USEPA water quality criterion (0.3 μg/g methyl mercury), the MDPH trigger level (0.5 μg/g total mercury) and the USFDA Action level (1.0 μg/g methyl mercury). (USEPA 2005 and USFDA 2009). Mercury concentrations are addressed in the individual waterbody discussions that follow. MDPH is in the process of assessing the 2008 mercury data with regard to the need for waterbody specific advisory issuance where warranted.

PCB Aroclors, PCB toxic congeners, 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, these toxic contaminants 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 TDE (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). PCB toxic congener analysis allows for a detailed look at the PCB compounds that exhibit dioxin-like toxicity. MassDEPs ORS and the MDPH are in the process of looking more closely at evaluating the potential benefits of using PCB toxic congener results in determining the need for fish consumption advisories. Currently all PCB advisories are issued based on total Aroclor concentrations. While only summarized congener results appear in Appendix A Table 1, complete PCB congener results are available from DWM or WES.

PCB Aroclors and congeners as well as organochlorine pesticides (DDT and its metabolites) were found in a number of samples analyzed in 2008. These data are addressed in the individual waterbody discussions that follow. This information may result in fish consumption advisories and/or modifications.

Kinnacum Pond: Located within Cape Cod National Seashore, Kinnacum Pond is a three acre (Ackerman 1989) oligotrophic kettle pond located in the town of Wellfleet. The shoreline is mostly undeveloped with only one seasonal residence present. Land use within the pond's immediate watershed is almost entirely forested.

Although the mean mercury concentration in yellow perch (0.40 μg/g, n=3) is below the MDPH "trigger level" of 0.5 μg/g, mercury in the largest composite sample of yellow perch (0.63 μg/g) exceeded the MDPH "trigger level" of 0.5 μg/g. These yellow perch were very large and represent a true "trophy" size class clearly made up of the oldest individuals from this particular population. It appears that the fish population in Kinnacum Pond is comprised mainly of yellow perch as no other species were observed.

It should be noted that the MDPH usually does not issue size specific mercury advisories and due to the fact that the other two composite concentrations (and the mean concentration) of mercury in yellow perch were below the "trigger level", an advisory will most likely not be issued.

Spectacle Pond: Spectacle Pond is a two acre (Ackerman 1989) oligotrophic kettle pond located in the town of Wellfleet. Like Kinnacum Pond, Spectacle Pond is also is located within Cape Cod National Seashore. The shoreline is totally undeveloped and land use within the watershed is entirely forested.

Mercury exceeded the MDPH "trigger level" of 0.5 μg/g in two composite samples of yellow perch and was slightly below the trigger level in an individual largemouth bass. The elevated mercury in yellow perch will most likely result in a MDPH advisory. In light of the fact that no other largemouth bass were collected or observed it is possible that this fish was illegally "stocked" in Spectacle Pond.

Round Pond (West): Located within Cape Cod National Seashore, Round Pond (West) is a four acre (Ackerman 1989) oligotrophic kettle pond located in the town of Truro. The shoreline is entirely undeveloped The watershed is forested with the exception of Route 6 which skirts the pond to within 50 meters of its northeastern shore.

The mean mercury concentration in yellow perch (0.82 μg/g, n=3) is well above the MDPH "trigger level" of 0.5 μg/g. Two of the three composite samples of yellow perch exceeded the MDPH "trigger level", and the mercury concentration in the composite of the largest yellow perch was highly elevated (1.5 μg/g). The mercury concentration in the remaining composite sample was slightly below the MDPH trigger level. It appears that the fish population in Round Pond (West) is also comprised mainly of yellow perch.

Although MDPH does not issue size specific mercury advisories, due to the fact that the mean concentration exceeded the MDPH trigger level a fish consumption advisory will most likely be issued by MDPH in the near future.

Lower Mystic Lake: Lower Mystic Lake was first sampled in 1999. It is a 111-acre natural lake which receives flow from the Aberjona River (via Upper Mystic Lake) and Mill Brook. The Lake's shoreline is heavily developed along the western shore and undeveloped along the eastern shore. The watershed of Lower Mystic Lake is heavily developed residentially, commercially, and industrially. There are a number of combined sewer overflows (CSOs) which continue to impact Lower Mystic Lake. Historic discharges to the Aberjona River are also well documented. Fish passage structures at the Amelia Earhart Dam allow for anadromous fish to enter the Mystic River and Lower Mystic Lake. The lake is very productive and appears to be supporting a large local population of black-crowned night- heron *Nycticorax nycticorax,* as well as many other fish eating bird species including double-crested commorant, *Phalacrocorax auritus*, mergansers *Mergus* sp, and seagulls *Larus* sp.

Although four species were collected in 1999, sampling at that time also included the Mystic River. Sampling of Lower Mystic Lake was marginally successful in 2008 with only common carp and white sucker being collected. Mercury was well below the MDPH trigger level of 0.5 μg/g in all fish both in 1999 and again in 2008. Total PCB Aroclors and DDE exceeded the MDPH trigger levels of 1.0 μg/g and 0.06 μg/g respectively in white sucker, however, concentrations in common carp were below the respective trigger levels in 2008. Although the concentrations of total PCBs and DDE in common carp were much lower in 2008 as compared to 1999, it should be noted that the lipid concentrations were also much lower in the 2008 common carp sample.

Although there is currently a MDPH fish consumption advisory in effect for the Mystic River ("No one should consume fish from this waterbody"), it does not currently include Lower Mystic Lake although fish passage between the two waterbodies is un-impeded. (MDPH 2009). The 2008 data will most likely result in the issuance of a fish consumption advisory specifically targeting Lower Mystic Lake.

Alewife Brook: Little Pond (the headwaters of Little River and Alewife Brook) was first sampled in 1988. Mercury and PCBs were below all MDPH trigger levels at that time. Alewife Brook connects the Little River (and Little Pond) with the Mystic River. There are no barriers to migration between any of these waterbodies. The shoreline of Alewife Brook is heavily developed along both banks The watershed of Alewife Brook is also heavily developed residentially, commercially, and industrially. There are a number of combined sewer overflows (CSOs) which discharge into Alewife Brook. Fish passage structures at the Amelia Earhart Dam allow for anadromous fish to enter the Mystic River, Alewife Brook, Little River, and ultimately Little Pond as well.

Only common carp and yellow perch were collected during the 2008 fish survey. Mercury was well below the MDPH trigger level of 0.5 μg/g in both samples analyzed. Total PCB Aroclors and DDE were at the MDPH trigger level of 1.0 μg/g and just below the trigger level of 0.06 μg/g respectively in common carp, however, these contaminants were below detection in the composite of yellow perch. It should be noted that the yellow perch were fairly small specimens (less than 190 mm).

As noted in the discussion regarding Lower Mystic Lake, there is a MDPH fish consumption advisory in effect for the Mystic River which states that "No one should consume fish from this waterbody" (MDPH 2009). The advisory currently does not include Alewife Brook although fish passage between the two waterbodies is un-impeded. The 2008 data will most likely result in the issuance of a fish consumption advisory which specifically targets Alewife Brook, or a modification of the existing Mystic River advisory which would include Alewife Brook. .

Windsor Pond: Windsor Pond was first sampled as part of the 2006 Westfield River Watershed assessment. Windsor is a 44 acre mesotrophic lake located in the town of Windsor. The immediate shoreline is approximately sixty to seventy percent developed residentially, but land use within the watershed is primarily forested. There is a paved state boat ramp located on the northeast corner of the lake.

Mercury exceeded the MDPH "trigger level" of 0.5 μg/g in largemouth bass in 2006. It should be noted however that only a two fish composite of largemouth bass was obtained at that time and one of the bass was on the large size (greater than 1 kilogram). All other fish were below the MDPH trigger level for mercury. Although mercury exceeded the MDPH "trigger level" in largemouth bass, an advisory was not issued. The MDPH asked that Windsor Lake be re-sampled and that a larger sample of largemouth bass be collected.

Sampling conducted in 2008 again resulted in the collection and analysis of a composite sample of largemouth bass, but this time the sample contained two fish that were over 1 kilogram. Mercury once again exceeded the MDPH trigger level of 0.5 μg/g in largemouth bass, and was below the trigger level in other species (yellow perch and white sucker). The elevated mercury in largemouth bass will most likely result in a MDPH advisory.

Neponset River: The Neponset River Watershed is heavily developed residentially, commercially, and industrially. The river itself has a strong industrial history as well. The

Neponset was first sampled for fish toxics by DWM in 1994. Fish species collected and analyzed at that time included largemouth bass, black crappie, common carp and brown bullhead. Elevated concentrations of PCB Aroclor 1254 in brown bullhead resulted in the issuance of a MDPH fish consumption advisory for the Neponset River.

Total PCB aroclor concentrations in common carp from 2008 also exceeded the MDPH "trigger level". Mercury was well below the MDPH "trigger level" of 0.5 mg/kg in all fish sampled during both surveys.

The current MDPH advisory recommends that children younger than 12-years, pregnant women, and nursing mothers, should not consume any brown bullhead from the Neponset River from the Hollingsworth and Vose Dam in Walpole to the Walter Baker Dam in Boston. The advisory also recommends that the general public should limit consumption of brown bullhead from the same segment of the Neponset River to two meals per month. Common carp will most likely be added to the list of species covered by this advisory.

Blackstone River Impoundment : The Blackstone River Impoundment at the Blackstone Gorge in Blackstone is formed by Rolling Dam. Upstream of the dam, the Blackstone Canal flows into Factory Pond located to the east. Sampling was limited to the mainstem river impoundment and the very western end of the Blackstone Canal. The shoreline of the impoundment is mostly forested land, with some low to medium residential development on the eastern side. The watershed upstream is heavily developed both industrially, commercially, and residentially. The River has a long history of both point and non-point sources of pollution.

Fish from the Blackstone River Impoundment were first sampled and analyzed by DEP in 1993. The 1993 survey resulted in the issuance of a MDPH fish consumption advisory due to elevated PCBs in carp and white sucker. This location was then re-sampled as the result of a request from of the Blackstone River Watershed Association in 2006. At that time mercury concentrations were well below the MDPH "trigger level" of 0.5 mg/kg in the 7 samples analyzed. PCB Aroclors and/or PCB congeners were detected in six of the seven samples analyzed in 2006. In addition DDE was detected in one sample. PCB Arochlors exceeded the MDPH trigger level in common carp only however. Common carp represent a bottom feeding species, with relatively high lipid content, which is considered worst case with regard to the bioaccumulation of PCBs and pesticides.

Although PCB Aroclors continue to be elevated in common carp, the concentrations were much lower in 2006 than those found in 1993. In addition, white sucker PCB Aroclor concentrations were below the MDPH trigger level in 2006. The MDPH requested that white sucker from this location be re-sampled in the future to assess whether PCB aroclor concentrations have decreased to a safe level.

Results from the 2008 sampling confirmed the presence of PCBs in common carp and white sucker and once again the concentrations exceeded the MDPH trigger level in the composite sample of carp, but not in white sucker. PCBs were below the MDPH "trigger level" in the remainder of the samples (and species) analyzed in 2008 as well. In addition, although DDE was detected in carp, white sucker, and bluegill. Concentrations exceeded the MDPH trigger level of 0.06 in the composite of common carp only. Mercury was well below the MDPH "trigger level" in all samples analyzed in 2008.

It is unclear where PCBs and pesticides might be originating, but given the incredible amount of historical industrial development within the Blackstone River Watershed, sources are most likely from past discharges and/or hazardous waste sites.

The current advisory recommends that children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any fish from this waterbody and that the general public should not consume carp or white sucker from this waterbody. White sucker will most likely be removed from the advisory as it pertains to the general public in the near future.

Manchaug Pond : Manchaug Pond is a 348 acre (141 ha.) pond located in the Blackstone River Watershed in the towns of Sutton and Douglas (Ackerman 1989). The pond's watershed is mostly forested, however there is a small amount of agricultural and residential land use mixed in. The shoreline and immediate watershed is approximately 50% developed with residences. There is a formal public access located on the southeastern shore of the pond.

Mercury exceeded the MDPH "trigger level" of 0.5 μg/g in largemouth bass. All other fish were below the MDPH trigger level for mercury. The elevated mercury in largemouth bass will most likely result in a MDPH advisory.

Lake Shirley: Lake Shirley is a 376 acre (152 ha.) lake located in the Nashua River Watershed in the town of Lunenburg (Ackerman 1989). Land use classes within the pond's watershed include a mix of forested, forested wetland, residential, agricultural, and mining. The shoreline and immediate watershed is approximately 80% developed with residences.

Mercury exceeded the MDPH "trigger level" of 0.5 μg/g in largemouth bass, black crappie, white perch, and yellow perch. Mercury concentrations in bullhead and white sucker were below the MDPH "trigger level". While it is common to find mercury at concentrations exceeding the MDPH "trigger level" in predators such as largemouth bass and black crappie (and at times larger white perch) it is much less common to find such concentrations in yellow perch. The elevated mercury concentrations will most likely result in a MDPH advisory for Lake Shirley.

Oxbow: The Oxbow in Easthampton and Northampton is a 168 acre (68 ha.) oxbow lake associated with the Connecticut River (Ackerman 1989). Oxbow lakes are formed from U-shaped river meanders, which ultimately close upon themselves (Wetzel 1975). The downstream end of the Oxbow meander is still open to the Connecticut River, and the lake rises and falls with the water level in the river. Fish have free access between the two waterbodies.

Although the pond's immediate watershed and shoreline is mostly agricultural and forested, there is a large marina, a residential development and an industrial property located there as well. In addition, the pond also receives flow from the Manhan River, which flows through the town of Easthampton. The Manhan River's watershed contains a diverse mix of land uses including forested, residential, commercial, industrial, and agricultural.

Mercury was well below the MDPH "trigger level" of 0.5 mg/kg in the six samples analyzed (including largemouth bass and black crappie, both top level predators). PCB Aroclors, Congeners, and organochlorine pesticides were below MDLs in most samples analyzed. The composite of common carp was found to contain a trace amount of DDE and PCB congeners (congener results were qualified due to the analyte concentrations being "greater than Method Detection Limit but less than Reporting Detection Limit"). Trace amounts of PCB congener BZ#

167 were also detected in yellow perch. The detected concentrations of PCBs and DDE do not appear to be indicative of an ongoing source of these contaminants.

Barton Cove: Barton Cove is a 200 acre (81 ha.) cove of the Connecticut River located upstream of the Turners Falls Dam in the Town of Gill. The shoreline of Barton Cove is approximately 30% developed with residences. The cove's immediate watershed is a mix of forested and residential land uses, however, the cove is totally connected to and influenced by the flow of the Connecticut River.

Mercury was well below the MDPH "trigger level" of 0.5 mg/kg in the five samples analyzed (including largemouth bass, a top level predator). PCB Aroclors, Congeners, and organochlorine pesticides were below MDLs in most samples analyzed. The composite of brown bullhead was found to contain a trace amount of PCB congener BZ# 187 (congener results were qualified due to the analyte concentrations being "greater than Method Detection Limit but less than Reporting Detection Limit").

Red Bridge Impoundment: Red Bridge Impoundment is an 83 acre (33.5 ha.) hydropower impoundment of the Chicopee River located in Wilbraham, Ludlow, and Palmer. The dam and the impoundment are used in the generation of electricity. The shoreline is less than five percent developed with residences, and land use within the pond's immediate watershed is a mix of forested, agricultural and a limited amount of medium density residential. It should be noted that the Chicopee River Watershed upstream from the impoundment includes the Swift, Ware, and Quaboag River Watersheds. Although these watersheds are heavily forested, land uses also include industrial, commercial, and residential.

Mercury exceeded the MDPH "trigger level" of 0.5 mg/kg in largemouth bass (0.63 mg.kg) and black crappie (0.51 mg/kg). It should be noted that the fish making up these samples were of average size, and certainly do not represent worst case conditions for these two species. PCB Aroclors, congeners, and organochlorine pesticides were below MDLs in most samples analyzed. The composite of white sucker (a bottom feeding omnivore) was found to contain a trace amount of PCB congeners BZ#s 180, 138, and 187 (congener BZ#138 and BZ#187 results were qualified due to the analyte concentrations being "greater than Method Detection Limit but less than Reporting Detection Limit"). The detected concentrations of PCBs congeners do not appear to be indicative of an ongoing source of these contaminants. Elevated mercury concentrations will most likely result in the issuance of a MDPH advisory.

Browning Pond: Browning Pond is a 106 acre (42.8 ha.) mesotrophic pond located in the towns of Oakham and Spencer. The shoreline is predominatly forested with some residential development located in the southeast corner near the outlet. There is a large boy scout camp located on the northern end of the pond. The watershed as a whole is mostly forested with a small amount of agricultural and residential land use mixed in. There is an informal un-improved boat ramp located on the southwestern corner of the pond.

Mercury was below the MDPH "trigger level" of 0.5 mg/kg in all four samples. Unfortunately the largemouth bass which were collected and analyzed were fairly small and under the legal length limit of twelve inches total length. Bluegill and yellow perch were larger (and presumably older) and were approaching the "trigger level. It is very likely that larger bass from Browning Pond contain mercury concentrations which would exceed the MDPH trigger level.

Conclusions

The 2008 Public Request and Watershed Surveys data set supports previous findings that mercury is a widespread problem, and that, although individual ponds or regions may be at higher risk, it is primarily a problem in predatory or piscivorous species. 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. Reducing direct human health risks associated with eating freshwater fish can only 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, the mercury problem also poses threats with regard to 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. Reductions with regard to the amount of mercury in the municipal waste stream and the emissions noted above will also reduce the environmental consequences of this contaminant. It is unclear how rapidly mercury concentrations will respond to recent changes in air emissions standards, however, recent studies of sediment cores from lakes suggest that mercury deposition rates may be on the decrease. (MassDEP 2005) It is unclear how long it will take before concentrations of mercury in fish will drop to a point where human and/or ecological health risks will reach acceptable levels.

The 2008 data set also supports the assertion that PCBs remain essentially a problem in rivers and lakes that have received historic PCB discharges and that high concentrations of organochlorine pesticides continue to be rare in edible fillets of freshwater fishes. It is apparent however that high lipid fishes can certainly bioaccumulate significant levels of PCB Arochlors and toxic congeners as well as DDT and it's metabolites. The MassDEP ORS and the MDPH continue to evaluate the potential value of using PCB toxic congeners to assess risk with regard to fish consumption.

The DWM will continue to screen for contaminants in freshwater fishes as part of Public Request and Year 2 watershed surveys. 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 online at *http://www.mass.gov/dep/* or from the MassDEP, Division of Watershed Management, 627 Main Street 2nd Floor, Worcester, MA 01608.

REFERENCES

Ackerman, M.T., 1989. *Compilation of Lakes, Ponds, Reservoirs, and Impoundments Relative to the Massachusetts Clean Lakes Program.* Publication: #15901-171-50-4-89-C.R. Technical Services Branch, Massachusetts Division of Water Pollution Control, Department of Environmental Quality Engineering, Westborough, MA.

Batdorf. C. (Carol.Batdorf@state.ma.us) 2009. *Re:Method 7473* Massachusetts Department of Environmental Protection, Wall Experiment Station, Lawrence, MA. Email to Robert Maietta, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA dated 22 February 2009.

Eisler, R. 1987. *Mercury Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review.* Patuxent Wildlife Research Center, U.S. Fish and Wildlife Service, Laurel, MD

Halliwell, D. B., Kimball, W. A., Screpetis, A. J. 1982. *Massachusetts Stream Classification Program Part I Inventory of Rivers and Streams.* . Technical Services Branch, Massachusetts Division of Water Pollution Control, Department of Environmental Quality Engineering,

Hartel, K. E., D.B. Halliwell, and A. E. Launer. 2002. Inland Fishes of Massachusetts. Massachusetts Audubon Society. Lincoln, Massachusetts.

MA DEP. 2007. *Standard Operating Procedure for USEPA Method 7473.* Wall Experiment Station, Lawrence.

MA DEP. 2002b. *Standard Operating Procedure for AOAC Method 983.21*. Wall Experiment Station, Lawrence.

MassDEP. 2005. *DRAFT FINAL REPORT MASSACHUSETTS FISH TISSUE MERACURY STUDIES: LONG-TERM MONITORING RESULTS,1999-2004.* Massachusetts Department of Environmental Protection Office of Research and Standards, Boston, MA and Wall Experiment Station Lawrence, MA.

McVoy, R.S. 1992. *Commonwealth of Massachusetts Summary of Water Quality 1992. Appendix II – Massachusetts Lake Classification Program.* Massachusetts Department of Environmental Protection, Division of Water Pollution Control, Technical Services Branch, North Grafton, Massachusetts.

MDPH. 2009. *Freshwater Fish Consumption Advisory List.* Massachusetts Department of Public Health, Bureau of Environmental Health, Boston.

Nelson, J.S., E.J. Crossman, H. Espinosa-Pérez, L.T. Findley, C.R. Gilbert, R.N. Lea, and J.D. Williams. 2004. *Common and Scientific Names of Fishes from the United States, Canada, and Mexico.* American Fisheries Society, Special Publication 29, Bethesda, Maryland.

Tetra Tech Inc. 1986. *Guidance Manual for Health Risk Assessment of Chemically Contaminated Seafood.* U.S. Environmental Protection Agency. Region 10. Office of Puget Sound.

USEPA, 2005. *National Recommended Water Quality Criteria* [online] Unoted States Environmental Protection Agency. http://www.epa.gov/waterscience/criteria/wqctable/

USFDA, August 2000. *Guidance for Industry: Action Levels for Poisonous or Deleterious Substances in Human Food and Animal Feed.* [Online] United States Food and Drug Administration, http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/ChemicalContaminantsandPesticides/ucm077969.htm (updated 2009)

Wetzel, R. G. 1975. *Limnology.* Saunders College Publishing/Holt,Rinehart and Winston. Philadelphia, PA.

LIST OF APPENDICES

APPENDIX A

Table 1. Analytical Results for 2008 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (cm)	Weight (g)	Sample ID (laboratory sample #)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Arochlors and Congeners (µg/g)	Pesticides (µg/g)
Kinnacum Pond, Wellfleet, Cape Cod Watershed													
2008148-001A	5/27/08	YP	295	300	2008148-001			0.36					
2008148-001B	5/27/08	YP	290	280									
2008148-001C	5/27/08	YP	293	280									
2008148-002A	5/27/08	YP	364	580	2008148-002			0.63					
2008148-002B	5/27/08	YP	399	840									
2008148-003A	5/27/08	YP	270	200	2008148-003			0.21					
2008148-003B	5/27/08	YP	240	140									
2008148-003C	5/27/08	YP	231	120									
Spectacle Pond, Wellfleet, Cape Cod Watershed													
2008149-001A	5/28/08	LMB	365	850	2008149-001			0.31					
2008149-002A	5/28/08	YP	211	60	2008149-002			0.63					
2008149-002B	5/28/08	YP	213	70									
2008149-002C	5/28/08	YP	209	80									
2008149-003A	5/28/08	YP	247	130	2008149-003			0.93					
2008149-003B	5/28/08	YP	255	160									
2008149-003C	5/28/08	YP	259	160									
Round Pond (West) Truro, Cape Cod Watershed													
2008150-001A	5/27/08	YP	379	480	2008150-001			1.5					
2008150-001B	5/27/08	YP	346	400									
2008150-001C	5/27/08	YP	376	500									
2008150-002A	5/27/08	YP	282	200	2008150-002			0.53					
2008150-002B	5/27/08	YP	289	240									
2008150-002C	5/27/08	YP	268	170									
2008150-003A	5/27/08	YP	205	80	2008150-003			0.45					
2008150-003B	5/27/08	YP	215	100									
2008150-003C	5/27/08	YP	204	70									

Sample ID	Collection Date	Species Code[1]	Length (cm)	Weight (g)	Sample ID (laboratory sample #)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Arochlors and Congeners (µg/g)	Pesticides (µg/g)
Lower Mystic Lake, Arlington, Mystic River Watershed													
2008151-001A 2008151-001B 2008151-001C	6/17/08 6/17/08 6/17/08	C C C	549 518 536	2400 1840 2090	2008151-001			0.11H			0.52	A1254-0.22 A1260-0.21 BZ#77-0.015M BZ#118-0.013M BZ#156-0.0015 BZ#157-0.013 BZ#170-0.021 BZ#180-0.031 BZ#52-0.0064M BZ#101-0.015M BZ#128-0.012 BZ#138-0.035 BZ#153-0.033 BZ#195-0.015 BZ#206-0.016	DDE-0.041
2008151-002A 2008151-002B 2008151-002C	6/17/08 6/17/08 6/17/08	WS WS WS	485 510 440	1360 1530 1180	2008151-002			0.12H			2.8	A1254-0.50 A1260-0.75 BZ#77-0.056 BZ#105-0.0079M BZ#114-0.012M BZ#156-0.017 BZ#157-0.015 BZ#170-0.041 BZ#180-0.078 BZ#101-0.035 BZ#128-0.014 BZ#138-0.092 BZ#153-0.11 BZ#187-0.049 BZ#195-0.019 BZ#206-0.018	DDE-0.12

Table 1. Continued Analytical Results for 2008 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (cm)	Weight (g)	Sample ID (laboratory sample #)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Arochlors and Congeners (µg/g)	Pesticides (µg/g)
Alewife Brook, Cambridge Arlington, Somerville, Mystic River Watershed													
2008152-001A 2008152-001B 2008152-001C	6/17/08 6/17/08 6/17/08	C C C	504 565 507	1680 2340 1780	2008152-001			0.11			0.54	A1254-0.30 A1260-0.70 BZ#77-0.025 BZ#118-0.015 BZ#156-0.015 BZ#157-0.014 BZ#170-0.031 BZ#180-0.055 BZ#44-0.0098M BZ#52-0.021 BZ#66-0.018M BZ#101-0.025M BZ#128-0.012 BZ#138-0.050 BZ#153-0.060 BZ#195-0.017 BZ#206-0.020	DDE-0.054
2008152-002A 2008152-002B 2008152-002C	6/17/08 6/17/08 6/17/08	YP YP YP	176 182 185	80 80 80	2008152-002			0.037			0.08	ND	ND
2008152-003A 2008152-003B 2008152-003C	6/17/08 6/17/08 6/17/08	WP WP WP	200 185 184	120 100 100	2008152-003			0.068			0.26	A1260-0.033M BZ#170-0.014 BZ#180-0.015 BZ#138-0.0043 BZ#187-0.0086M	DDE-0.0098
Windsor Pond, Windsor, Westfield River Watershed													
2008153-001A 2008153-001B 2008153-001C	7/03/08 7/03/08 7/03/08	LMB LMB LMB	440 427 364	1200 1020 700	2008153-001			1.2H					
2008153-002A 2008153-002B 2008153-002C	7/03/08 7/03/08 7/03/08	YP YP YP	151 149 170	20 20 50	2008153-002			0.10H					
2008153-003A 2008153-003B 2008153-003C	7/03/08 7/03/08 7/03/08	WS WS WS	363 340 330	430 370 340	2008153-003			0.15H					
2008153-004A 2008153-004B 2008153-004C	7/03/08 7/03/08 7/03/08	P P P	168 170 162	120 100 90	2008148-004			0.045H					

Table 1. Continued Analytical Results for 2008 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (cm)	Weight (g)	Sample ID (laboratory sample #)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Arochlors and Congeners (µg/g)	Pesticides (µg/g)
Neponset River, Canton, Neponset River Watershed													
2008154-001A 2008154-001B 2008154-001C	7/02/08 7/02/08 7/02/08	C C C	532 537 510	2030 2060 1760	2008154-001			0.16H			1.4	A1254-1.5J A1260-0.17J BZ#81-0.062J BZ#105-0.012M BZ#118-0.084J BZ#156-0.024 BZ#157-0.016 BZ#167-0.017 BZ#170-0.026 BZ#28-0.011M BZ#44-0.018M BZ#52-0.071J BZ#101-0.14J BZ#128-0.031J BZ#138-0.15J BZ#153-0.12J BZ#187-0.024J BZ#195-0.015 BZ#206-0.017 BZ#209-0.012	DDE-0.055J
2008154-002A 2008154-002B 2008154-002C	7/02/08 7/02/08 7/02/08	WS WS WS	400 383 379	680 600 620	2008154-002			0.11H			1.8	A1254-0.66 BZ#77-0.12 BZ#81-0.028 BZ#105-0.0069M BZ#118-0.037 BZ#156-0.016 BZ#157-0.013 BZ#170-0.018 BZ#180-0.019 BZ#28-0.012M BZ#44-0.014M BZ#52-0.031 BZ#101-0.053 BZ#128-0.017 BZ#138-0.057 BZ#153-0.041 BZ#187-0.013M	DDE 0.026
2008154-003A 2008154-003B 2008154-003C	7/02/08 7/02/08 7/02/08	YP YP YP	229 226 225	180 160 170	2008154-003			0.18H			0.19	BZ#167-0.012M BZ#138-0.0039	ND

Table 1. Continued Analytical Results for 2008 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (cm)	Weight (g)	Sample ID (laboratory sample #)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Arochlors and Congeners (µg/g)	Pesticides (µg/g)
Neponset River, Canton, Neponset River Watershed CONTINUED													
2008154-004A 2008154-004B 2008154-004C	7/02/08 7/02/08 7/02/08	B B B	167 173 146	120 120 80	2008154-004			0..097H			1.0	A1254-0.25 BZ#77-0.028 BZ#156-0.014 BZ#167-0.013M BZ#170-0.015 BZ#180-0.015 BZ#52-0.015M BZ#101-0.017M BZ#128-0.010 BZ#138-0.018 BZ#153-0.0087M BZ#187-0.010M BZ#195-0.013	DDE-0.042
2008154-005A 2008154-005B 2008154-005C	7/02/08 7/02/08 7/02/08	AE AE AE	594 553 532	390 260 220	2008154-005			0.21H			14	A1254-2.4 A1260-0.11 BZ#81-0.092 BZ#105-0.024 BZ#118-0.11 BZ#156-0.022 BZ#157-0.015 BZ#167-0.019 BZ#170-0.022 BZ#28-0.016M BZ#44-0.017M BZ#52-0.19 BZ#101-0.10 BZ#128-0.037 BZ#138-0.17 BZ#153-0.12 BZ#187-0.055 BZ#195-0.013	DDE 0.22
Blackstone River upstream of Blackstone Gorge, Blackstone, Blackstone River Watershed													
2008155-001A 2008155-001B 2008155-001C	7/08/08 7/08/08 7/08/08	LMB LMB LMB	381 376 347	820 820 660	2008155-001			0.22			0.12	A1260-0.037M BZ#156-0.013 BZ#157-0.012 BZ#170-0.016 BZ#180-0.020 BZ#138-0.0099 BZ#187-0.013M BZ#195-0.014	ND

Table 1. Continued Analytical Results for 2008 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (cm)	Weight (g)	Sample ID (laboratory sample #)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Arochlors and Congeners (µg/g)	Pesticides (µg/g)
Blackstone River upstream of Blackstone Gorge, Blackstone, Blackstone River Watershed CONTINUED													
2008155-002A 2008155-002B 2008155-002C	7/08/08 7/08/08 7/08/08	C C C	606 525 601	3480 2100 3520	2008155-002			0.058			2.3	A1254-0.93 A1260-1.7 BZ#77-0.14 BZ#81-0.038 BZ#156-0.018 BZ#157-0.0018M BZ#170-0.051 BZ#180-0.11 BZ#189-0.014 BZ#28-0.010M BZ#52-0.022 BZ#101-0.098 BZ#138-0.16 BZ#153-0.17 BZ#195-0.022 BZ#206-0.024 BZ#209-0.012	DDE-0.089
2008155-003A 2008155-003B 2008155-003C	7/08/08 7/08/08 7/08/08	YP YP YP	221 224 217	140 140 130	2008155-003			0.14			0..07	A1254-0.08 A1260-0.047M BZ#170-0.015 BZ#138-0.0057 BZ#187-0.014M	ND
2008155-004A 2008155-004B 2008155-004C	7/08/08 7/08/08 7/08/08	WS WS WS	417 395 409	820 770 750	2008155-004			0.054			1.5	A1254-0.25 A1260-0.46 BZ#77-0.038 BZ#81-0.0058M BZ#118-0.011M BZ#156-0.015 BZ#157-0.014 BZ#167-0.013M BZ#170-0.025 BZ#180-0.041 BZ#28-0.0096M BZ#101-0.019M BZ#128-0.012 BZ#138-0.045 BZ#153-0.046 BZ#187-0.034 BZ#195-0.015 BZ#206-0.017	DDE-0.050

Table 1. Continued Analytical Results for 2008 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (cm)	Weight (g)	Sample ID (laboratory sample #)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Arochlors and Congeners (µg/g)	Pesticides (µg/g)
Blackstone River upstream of Blackstone Gorge, Blackstone, Blackstone River Watershed CONTINUED													
2008155-005A 2008155-005B 2008155-005C	7/08/08 7/08/08 7/08/08	B B B	188 183 181	130 110 120	2008155-005			0.10			0.12	A1254-0.54J A1260-0.12J BZ#157-0.014J BZ#167-0.014MJ BZ#170-0.019J BZ#180-0.026J BZ#52-0.030J BZ#128-0.010J BZ#138-0.025J BZ#153-0.024J BZ#195-0.015J BZ#206-0.018J	DDE-0.049
Manchaug Pond, Sutton, Blackstone River Watershed													
2008156-001A 2008156-001B 2008156-001C	6/19/08 6/19/08 6/19/08	LMB LMB LMB	391 390 360	840 700 520	2008156-001			0.58H					
2008156-002A 2008156-002B 2008156-002C	6/19/08 6/19/08 6/19/08	WP WP WP	270 260 270	260 230 260	2008156-002			0.33H					
2008156-003A 2008156-003B 2008156-003C	6/19/08 6/19/08 6/19/08	YP YP YP	278 267 286	230 220 230	2008156-003			0.34H					
2008156-004A 2008156-004B 2008156-004C	6/19/08 6/19/08 6/19/08	B B B	221 221 202	200 210 160	2008156-004			0.25H					
2008156-005A 2008156-005B 2008156-005C	6/19/08 6/19/08 6/19/08	BB BB BB	370 367 361	630 650 640	2008156-005			0..038H					
Lake Shirley, Lunenburg, Nashua River Watershed													
2008157-001A 2008157-001B 2008157-001C	6/12/08 6/12/08 6/12/08	LMB LMB LMB	421 430 421	990 820 900	2008157-001			0..99H					
2008157-002A 2008157-002B 2008157-002C	6/12/08 6/12/08 6/12/08	WS WS WS	478 436 490	1100 850 1200	2008157-002			0.17H					

Table 1. Continued Analytical Results for 2008 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (cm)	Weight (g)	Sample ID (laboratory sample #)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Arochlors and Congeners (µg/g)	Pesticides (µg/g)
Lake Shirley, Lunenburg, Nashua River Watershed CONTINUED													
2008157-003A 2008157-003B 2008157-003C	6/12/08 6/12/08 6/12/08	BC BC BC	313 275 250	340 240 200	2008157-003			0.74H					
2008157-004A 2008157-004B 2008157-004C	6/12/08 6/12/08 6/12/08	YP YP YP	294 264 250	280 200 170	2008157-004			0.54H					
2008157-005A 2008157-005B 2008157-005C	6/12/08 6/12/08 6/12/08	WP WP WP	286 281 268	290 250 270	2008157-005			0.57H					
2008157-006A 2008157-006B 2008157-006C	6/12/08 6/12/08 6/12/08	BB YB YB	300 282 290	310 270 300	2008157-006			0.38H					
Oxbow, Easthampton/Northhampton, Connecticut River Watershed													
2008159-001A 2008159-001B 2008159-001C	8/05/08 8/05/08 8/05/08	LMB LMB LMB	425 347 313	520 650 500	2008159-001			0.24H			0.21	ND	ND
2008159-002A 2008159-002B 2008159-002C	8/05/08 8/05/08 8/05/08	C C C	421 418 419	1100 1100 1180	20081595-002			0.063H			1.3	BZ#167-0.013M BZ#138-0.0015M	DDE-0.019
2008159-003A 2008159-003B 2008159-003C	8/05/08 8/05/08 8/05/08	WP WP WP	218 177 182	160 100 100	2008159-003			0.11H			0.38	ND	ND
2008159-004A 2008159-004B 2008159-004C	8/05/08 8/05/08 8/05/08	YP YP YP	237 216 218	170 130 130	2008159-004			0.15H			0.11	BZ#167-0.014M	ND
2008159-005A 2008159-005B 2008159-005C	8/05/08 8/05/08 8/05/08	BC BC BC	206 236 206	150 180 140	2008159-005			0.24H			0.12	ND	ND
2008159-006A 2008159-006B 2008159-006C	8/05/08 8/05/08 8/05/08	BB YB YB	319 230 217	500 180 160	2008159-006			0.064H			0.12	ND	ND

Table 1. Continued Analytical Results for 2008 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (cm)	Weight (g)	Sample ID (laboratory sample #)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Arochlors and Congeners (µg/g)	Pesticides (µg/g)
Barton Cove, Gill/Montague, Connecticut River Watershed													
2008160-001A 2008160-001B 2008160-001C	8/07/08 8/07/08 8/07/08	LMB LMB LMB	366 395 361	640 860 580	2008160-001			0.37			0.06	ND	ND
2008160-002A 2008160-002B 2008160-002C	8/07/08 8/07/08 8/07/08	WS WS WS	505 434 472	1450 1000 1150	2008160-002			0.28			0.52	ND	ND
2008160-003A 2008160-003B 2008160-003C	8/07/08 8/07/08 8/07/08	YP YP YP	266 263 258	210 200 205	2008160-003			0.30			0.11	ND	ND
2008160-004A 2008160-004B 2008160-004C	8/07/08 8/07/08 8/07/08	P P P	185 170 177	160 110 115	2008160-004			0.21			0.17	ND	ND
2008160-005A 2008160-005B 2008160-005C	8/07/08 8/07/08 8/07/08	BB BB BB	326 327 317	415 420 410	2008160-005			0.088			0.28	A1260-0.028M BZ#187-0.013M	ND
Red Bridge Impoundment, Ludlow/Wilbraham, Chicopee River Watershed													
2008162-001A 2008162-001B 2008162-001C	7/31/08 7/31/08 7/31/08	LMB LMB LMB	362 377 339	620 640 560	2008162-001			0.63			0.04	ND	ND
2008162-002A 2008162-002B 2008162-002C	7/31/08 7/31/08 7/31/08	WS WS WS	392 394 446	560 600 720	2008162-002			0.24			1.1	BZ#180-0.014 BZ#138-0.0015M BZ#187-0.0084M	ND
2008162-003A 2008162-003B 2008162-003C	7/31/08 7/31/08 7/31/08	WP WP WP	220 211 199	130 110 80	2008162-003			0.42			0.30	ND	ND
2008162-004A 2008162-004B 2008162-004C	7/31/08 7/31/08 7/31/08	YP YP YP	228 202 180	120 70 50	2008162-004			0.28			0.08	ND	ND
2008162-005A 2008162-005B 2008162-005C	7/31/08 7/31/08 7/31/08	BC BC BC	231 232 215	150 160 120	2008162-005			0.51			0.07	ND	ND
2008162-006A 2008162-006B 2008162-006C	7/31/08 7/31/08 7/31/08	B B B	205 190 179	140 120 90	2008162-006			0.30			0.07	ND	ND

Table 1. Continued Analytical Results for 2008 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys. Results reported in wet weight, are from composite samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (cm)	Weight (g)	Sample ID (laboratory sample #)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Arochlors and Congeners (µg/g)	Pesticides (µg/g)
Browning Pond, Oakham/Spencer, Chicopee River Watershed													
2008391-001A 2008391-001B 2008391-001C	7/29/08 7/29/08 7/29/08	LMB LMB LMB	289 276 276	300 280 260	2008391-001			0.37H					
2008391-002A 2008391-002B 2008391-002C	7/29/08 7/29/08 7/29/08	B B B	225 212 217	220 180 200	2008391-002			0.46H					
2008391-003A 2008391-003B 2008391-003C	8/15/08 8/15/08 8/15/08	YP YP YP	285 263 262	220 200 160	2008391-003			0.47					
2008391-004A 2008391-004B	8/15/08 8/15/08	YB YB	251 160	210 40	2008391-004			0.30					

[1] Species Code	Common Name	*Scientific name*	Data Qualifiers as reported by WES
AE	American eel	*Anguilla rostrata*	H = USEPA holding time exceeded
B	bluegill	*Lepomis macrochirus*	M = analyte concentration greater than Method Detection Limit but less than Minimum Reporting Limit
BB	brown bullhead	*Ameiurus nebulosus*	ND = analyzed for, but not detected above Method Detection Level
BC	black crappie	*Pomoxis nigromaculatus*	J = Duplicate result greater than RPD control limit. Sample may not be homogenous.
C	common carp	*Cyprinus carpio*	
LMB	largemouth bass	*Micropterus salmoides*	
P	pumpkinseed	*Lepomis gibbosus*	
WP	white perch	*Morone Americana*	
WS	white sucker	*Catostomus commersoni*	
YB	yellow bullhead	*Ameiurus natalis*	
YP	yellow perch	*Perca flavescens*	

Table 2. 2008 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 Reporting Detection Limit (RDL)	Method
Lipid Concentration	%	N/A	N/A	N/A	Modified AOAC 983.21
Arsenic	ug/g wet	Unknown	0.080	0.080	EPA 200.9
Cadmium	ug/g wet	Unknown	0.20	0.60	EPA 200.9
Lead	ug/g wet	Unknown	0.20	0.60	EPA 200.9
Mercury	ug/g wet	0.5	0.020	0.060	EPA 7473
Selenium	ug/g wet	Unknown	0.20	0.60	EPA 200.9
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)	0.019	0.057	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)	0.013	0.039	Modified AOAC 983.21
PCB Arochlor 1260	µg/g wet	1.0 (total)	0.022	0.066	Modified AOAC 983.21
Chlordane	µg/g wet	0.3	0.046	0.14	Modified AOAC 983.21
Toxaphene	µg/g wet	Unknown	0.045	0.14	Modified AOAC 983.21
a-BHC	µg/g wet	Unknown	0.0054	0.016	Modified AOAC 983.21
b-BHC	µg/g wet	Unknown	0.0055	0.017	Modified AOAC 983.21
Lindane	µg/g wet	Unknown	0.0056	0.017	Modified AOAC 983.21
d-BHC	µg/g wet	Unknown	0.012	0.036	Modified AOAC 983.21
Hexachlorocyclopentadiene	µg/g wet	Unknown	0.038	0.11	Modified AOAC 983.21
Hexachlorobenzene	µg/g wet	Unknown	0.018	0.054	Modified AOAC 983.21
Trifluralin	µg/g wet	Unknown	0.032	0.096	Modified AOAC 983.21
Heptachlor	µg/g wet	0.3	0.0078	0.023	Modified AOAC 983.21
Heptachlor Epoxide	µg/g wet	Unknown	0.027	0.081	Modified AOAC 983.21
Methoxychlor	µg/g wet	Unknown	0.018	0.054	Modified AOAC 983.21
DDD	µg/g wet	5.0 (total)	0.0051	0.015	Modified AOAC 983.21
DDE	µg/g wet	5.0 (total)	0.0055	0.017	Modified AOAC 983.21
DDT	µg/g wet	5.0 (total)	0.0064	0.019	Modified AOAC 983.21
Aldrin	µg/g wet	5.0 (total)	0.0057	0.017	Modified AOAC 983.21
PCNB	% recovery	NA	NA	NA	Modified AOAC 983.21
PCB Congener BZ # 8	µg/g wet	Unknown	0.0010	0.0030	Modified AOAC 983.21
PCB Congener BZ # 18	µg/g wet	Unknown	0.0016	0.0048	Modified AOAC 983.21
PCB Congener BZ # 28	µg/g wet	Unknown	0.0033	0.0099	Modified AOAC 983.21
PCB Congener BZ # 44	µg/g wet	Unknown	0.0010	0.0030	Modified AOAC 983.21
PCB Congener BZ # 52	µg/g wet	Unknown	0.0022	0.0066	Modified AOAC 983.21
PCB Congener BZ # 66	µg/g wet	Unknown	0.0022	0.0066	Modified AOAC 983.21
PCB Congener BZ # 101	µg/g wet	Unknown	0.0022	0.0066	Modified AOAC 983.21
PCB Congener BZ # 128	µg/g wet	Unknown	0.0012	0.0036	Modified AOAC 983.21
PCB Congener BZ # 138	µg/g wet	Unknown	0.0017	0.0051	Modified AOAC 983.21
PCB Congener BZ # 153	µg/g wet	Unknown	0.0014	0.0042	Modified AOAC 983.21
PCB Congener BZ # 187	µg/g wet	Unknown	0.0022	0.0066	Modified AOAC 983.21

Table 2. Continued. 2008 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 Reporting Detection Limit (RDL)	Method
PCB Congener BZ # 195	µg/g wet	Unknown	0.0011	0.0033	Modified AOAC 983.21
PCB Congener BZ # 206	µg/g wet	Unknown	0.0012	0.0036	Modified AOAC 983.21
PCB Congener BZ # 209	µg/g wet	Unknown	0.0014	0.0042	Modified AOAC 983.21
PCB Congener BZ # 81	µg/g wet	Unknown	0.0010	0.0030	Modified AOAC 983.21
PCB Congener BZ # 77	µg/g wet	Unknown	0.0046	0.014	Modified AOAC 983.21
PCB Congener BZ # 123	µg/g wet	Unknown	0.0013	0.0039	Modified AOAC 983.21
PCB Congener BZ # 118	µg/g wet	Unknown	0.0012	0.0036	Modified AOAC 983.21
PCB Congener BZ # 114	µg/g wet	Unknown	0.0013	0.0039	Modified AOAC 983.21
PCB Congener BZ # 105	µg/g wet	Unknown	0.0013	0.0039	Modified AOAC 983.21
PCB Congener BZ # 126	µg/g wet	Unknown	0.0032	0.0096	Modified AOAC 983.21
PCB Congener BZ # 167	µg/g wet	Unknown	0.0012	0.0036	Modified AOAC 983.21
PCB Congener BZ # 156	µg/g wet	Unknown	0.0011	0.0033	Modified AOAC 983.21
PCB Congener BZ # 157	µg/g wet	Unknown	0.0012	0.0036	Modified AOAC 983.21
PCB Congener BZ # 180	µg/g wet	Unknown	0.0012	0.0036	Modified AOAC 983.21
PCB Congener BZ # 169	µg/g wet	Unknown	0.0006	0.0018	Modified AOAC 983.21
PCB Congener BZ # 170	µg/g wet	Unknown	0.0013	0.0039	Modified AOAC 983.21
PCB Congener BZ # 189	µg/g wet	Unknown	0.0013	0.0039	Modified AOAC 983.21
Phenol	µg/g wet	Unknown	N/A	250	EPA 8270C
2-Chlorophenol	µg/g wet	Unknown	N/A	250	EPA 8270C
NDPA	µg/g wet	Unknown	N/A	250	EPA 8270C
2-Nitrophenol	µg/g wet	Unknown	N/A	250	EPA 8270C
Dichlorophenol	µg/g wet	Unknown	N/A	250	EPA 8270C
Napthalene	µg/g wet	Unknown	0.050	2.5	EPA 8270C
4-Chloro-3-methylphenol	µg/g wet	Unknown	N/A	250	EPA 8270C
Hexachlorcyclopentadiene	µg/g wet	Unknown	N/A	2.5	EPA 8270C
Trichlorophenol	µg/g wet	Unknown	N/A	250	EPA 8270C
Dimethyl phthalate	µg/g wet	Unknown	N/A	2.5	EPA 8270C
Acenaphathylene	µg/g wet	Unknown	0.060	2.5	EPA 8270C
Acenaphthene	µg/g wet	Unknown	0.070	2.5	EPA 8270C
2,4-Dinitrophenol	µg/g wet	Unknown	N/A	250	EPA 8270C
4-Nitrophenol	µg/g wet	Unknown	N/A	250	EPA 8270C
Florene	µg/g wet	Unknown	0.080	2.5	EPA 8270C
Diethylphthalate	µg/g wet	Unknown	N/A	2.5	EPA 8270C
Pentachlorophenol	µg/g wet	Unknown	N/A	250	EPA 8270C
Phenanthrene	µg/g wet	Unknown	0.12	2.5	EPA 8270C
Anthracene	µg/g wet	Unknown	0.13	2.5	EPA 8270C
Dibutylphthalate	µg/g wet	Unknown	N/A	2.5	EPA 8270C
Fluoranthene	µg/g wet	Unknown	0.17	2.5	EPA 8270C
Pyrene	µg/g wet	Unknown	0.15	2.5	EPA 8270C
Butylbenzylphthalate	µg/g wet	Unknown	N/A	2.5	EPA 8270C

Table 2. Continued. 2008 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 Reporting Detection Limit (RDL)	Method
Bis(2-ethylhexyl)adipate	µg/g wet	Unknown	N/A	2.5	EPA 8270C
Benzo(a)anthracene	µg/g wet	Unknown	0.14	2.5	EPA 8270C
Chrysene	µg/g wet	Unknown	0.14	2.5	EPA 8270C
Bis(2-ethylhexyl)phthalate	µg/g wet	Unknown	N/A	2.5	EPA 8270C
Benzo(b)fluoranthene	µg/g wet	Unknown	0.13	2.5	EPA 8270C
Benzo(k)fluoranthene	µg/g wet	Unknown	0.14	2.5	EPA 8270C
Benzo(a)pyrene	µg/g wet	Unknown	0.11	2.5	EPA 8270C
Indeno(1,2,3-cd)pyrene	µg/g wet	Unknown	0.14	2.5	EPA 8270C
Dibenzo(ah)anthracene	µg/g wet	Unknown	0.13	2.5	EPA 8270C
Benzo(ghi)perylene	µg/g wet	Unknown	0.13	2.5	EPA 8270C

Notes:
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 200.9 – Trace Elements
-EPA 7473 – Mercury in Solids and Solutions by Thermal Decomposition, Amalgamation, and AAS
-EPA 8270C – Semivolatile Organic Compounds by GC/MS Cap Col
-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
627 Main Street, 2nd Floor
Worcester, MA 01608

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.