2006
Fish Toxics Monitoring
Public Request and Year 2 Watershed Surveys

rock bass *Ambloplites rupestris*

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

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COMMONWEATH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
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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 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 MDFG's 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:

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, 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 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 performs 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, polychlorinated biphenyls (Aroclors and toxic congeners), and organochlorine pesticides). All data are sent to the MDPH and the MassDEP Office of Research and Standards (ORS) for risk assessment and advisory issuance if appropriate.

PCB Aroclors analyzed for include Aroclors 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, Endrin, and Aldrin. All organics analyses include lipid determination. 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 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. Additional species included in the 2006 surveys: bluegill *Lepomis macrochirus,* black crappie *Pomoxis nigromaculatus,* brown bullhead A*meiurus nebulosus,* pumpkinseed *Lepomis gibbosus,* white sucker *Catostomus commersonii,* rock bass *Ambloplites rupestris*, golden shiner *Notemigonus crysoleucas*, and yellow bullhead *Ameiurus natalis.*

During 2006, seven locations were sampled as a result of recommendations from the Interagency Committee. Two locations were sampled as part of a historic DWM commitment. And two locations were sampled as part of Year 2 watershed surveys as selected by the MassDEP watershed monitoring coordinators.

Waterbody	Watershed	Town	USGS Quadrangle
Ryder Pond[1] PALIS#[2] 96268	Cape Cod	Truro	WELLFLEET, MASS.
Herring Pond[1] PALIS#[2] 96134	Cape Cod	Wellfleet	WELLFLEET, MASS.
Great Pond[1] PALIS#[2] 96117	Cape Cod	Wellfleet	WELLFLEET, MASS.
Gull Pond[1] PALIS#[2] 96123	Cape Cod	Wellfleet	WELLFLEET, MASS.
Duck Pond[1] PALIS#[2] 96068	Cape Cod	Wellfleet	WELLFLEET, MASS.
Lake Garfield[1] PALIS#[2] 21040	Housatonic	Monterey	OTIS, MASS.
French River[1] SARIS#[2] 4230075	French	Oxford	WEBSTER, MASS. – CONN. – R.I.
Rice City Pond PALIS#[2] 51131	Blackstone	Uxbridge	UXBRIDGE, MASS.- R.I.
Blackstone River SARIS#[2] 5131000	Blackstone	Blackstone	UXBRIDGE, MASS.- R.I.
Buck Pond SARIS#[2] 32012	Westfield	Westfield	MT. TOM, MASS.
Windsor Pond SARIS#[2] 32076	Westfield	Windsor	PITTSFIELD EAST, MASS.

[1] Public Request Waterbody

[2] PALIS/SARIS# = Pond and Lake Identification System / Stream Classification numbers (Ackerman 1989/ Halliwell et.al. 1982)

Field Methods

Waterbodies were sampled using an electrofishing boat, a backpack electrofisher, trotlines, gill nets, and or rod and reel. Electrofishing was performed by maneuvering the boat or the backpack electrofisher through the littoral zone and/or shallow water habitat of a given waterbody, and collecting most fish shocked. Fish collected by electrofishing were stored in a live well or buckets filled with site water until the completion of sampling. Trotlines were baited with nightcrawlers or shiners, set, and left overnight. Gill nets were set in various locations and either checked every two hours or, on occasion, left overnight. Trotlines and gill nets set overnight were retrieved the following morning. Rod and reel fishing was performed by casting lures/baited hooks into fish holding cover and retrieving lures or bait hooks, and, on occasion, 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 were prepared in the field. In all cases, live fish, that were not included as part of the sample, were released.

Field Results

Ryder Pond: Gill nets set overnight and pulled on 5/24/06 resulted in the collection of seven yellow perch.

Herring Pond: Gill nets set overnight and pulled on 5/24/06 resulted in the collection of seven white perch. Other species observed included alewife *Alosa psuedoharengus*, white sucker, and rainbow trout *Oncorhynchus mykiss*.

Great Pond: Rod and reel fishing on 5/24/06 resulted in the collection of three yellow perch. Gill nets set overnight and pulled on 5/25/07 resulted in the collection of four additional yellow perch.

Gull Pond: Gill nets set overnight and pulled on 5/25/06 resulted in the collection of seven white perch.

Duck Pond: Rod and reel fishing on 5/25/06 resulted in the collection of two yellow perch. Gill nets set overnight and pulled on 5/25/07 resulted in the collection of five additional yellow perch.

Lake Garfield: Electrofishing at Lake Garfield in Monterey on 6/06/06 resulted in the collection of twelve largemouth bass, thirty yellow perch, three brown bullhead, three rock bass and three pumpkinseed. Additional species observed and or collected but not retained for analysis included chain pickerel, bluegill, and smallmouth bass *Micropterus dolomieu*.

French River: Electrofishing the French River below Hodges Village Dam in Oxford on 5/31/06 resulted in the collection of three largemouth bass, three white sucker, three yellow perch, three bluegill, three bullhead, and two rock bass. Additional species observed and or collected but not retained for analysis included American eel *Anguilla rostrata*, chain pickerel, pumpkinseed, golden shiner, black crappie, white perch, and creek chubsucker *Erimyzon oblongus*.

Rice City Pond (Blackstone River): Electrofishing at Rice City Pond in Uxbridge on 6/20/06 resulted in the collection of three common carp, three white sucker, three yellow perch, and three pumpkinseed.

Blackstone River Impoundment: Electrofishing at the impoundment upstream of the Gorge in Blackstone on 7/7/06 resulted in the collection of three common carp, three white sucker, three yellow perch, three bluegill, three largemouth bass, three black crappie, and three brown bullhead.

Buck Pond: Electrofishing at Buck Pond in Westfield on 6/13/06 resulted in the collection of three largemouth bass, three yellow perch, three bluegill, three brown bullhead, and three golden shiner.

Windsor Lake Electrofishing at Windsor Lake in Windsor on 6/20/06 resulted in the collection of two largemouth bass, three white sucker, and three yellow perch.

Laboratory Methods

Fish brought to the MassDEP DWM laboratory in Worcester or in the case of the Cape Cod Ponds which were processed on site, 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 or after each sample. Samples targeted for % lipid, PCB and organochlorine pesticide analyses were wrapped in aluminum foil. Samples targeted for metals analysis were placed in VWR high density polyethylene (HDPE) cups with covers. With the exception of a pair of two fish samples (rock bass from the French River and largemouth bass from Windsor Lake) composite samples were composed of fillets from 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 include the following:

Mercury was analyzed by thermal decomposition, amalgamation and atomic absorption spectrophotometry using a Milestone DMA-80 Direct Mercury Analyzer following EPA method 7473. 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 are available from the laboratory.

Laboratory Results

One hundred and five samples were delivered to WES for analysis. All fish tissue data passed WES QC acceptance limits, however, most mercury data were reported with "qualification" (See Quality Contol Section). In addition, any result greater than the Method Detection Limit but less than the Reporting Detection Limit (>MDL but< RDL) were reported (and flagged) by the lab and appear so designated in the data tables.

Mercury (MDL 0.0020 mg/kg) was detected in all one hundred and five samples analyzed. Concentrations ranged from 0.025 mg/kg to 2.4 mg/kg. Mercury concentrations varied greatly between waterbodies and species. Waterbody mean mercury concentrations and ranges are listed below.

Waterbody	Mean total Hg (mg/kg wet weight)	Range min-max (mg/kg)
Ryder Pond	1.58 (n=7)	0.47 - 2.4
Herring Pond	0.25 (n=7)	0.18 - 0.32
Great Pond	0.93 (n=7)	0.80 - 1.4
Gull Pond	0.38 (n=7)	0.22 - 0.49
Duck Pond	1.49 (n=7)	0.49 - 2.3
Lake Garfield (bass)	0.45 (n=12)	0.23- 0.83
Lake Garfield (perch)	0.18 (n=30)	0.069 - 0.36
Lake Garfield (other species)	0.17 (n=3)	0.089 - 0.22
French River	0.50 (n=6)	0.29 - 1.2
Rice City Pond (Blackstone River)	0.07 (n=4)	0.025 - 0.11
Blackstone River Impoundment	0.18 (n=7)	0.026 - 0.35
Buck Pond	0.17 (n=5)	0.067 - 0.49
Windsor Lake	0.57 (n=3)	0.25 – 1.2

PCB Aroclors and congeners were detected in a number of samples. A fair number of the positive congener results were ">MDL but <RDL" (See Discussion for more detail). Organochlorine pesticides (with the exception of DDT (or its metabolites) and, in one instance, chlordane) were below the MDL. (See Discussion for more detail). Twenty five percent of the positive DDT (and metabolites) results were ">MDL but <RDL". Complete results of the PCB Aroclor, PCB toxic congener, and organochlorine pesticide analysis can be found in Appendix A Table 1.

Quality Control

Most 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 (EPA) recommended holding time of 28 days. Samples were in all cases delivered to WES within the 28 day holding time. Six sets of samples were delivered within 2 days of collection, two sets within 10 days of

collection and three sets within 20 days of collection. In addition any results greater than the Method Detection Limit but less than the Reporting Detection Limit (>MDL but< RDL) were reported (and flagged) by the lab and appear so designated in the data tables.

Complete results of the mercury analysis can be found in Appendix A Table 1. Lab duplicate precision estimates for mercury were generally within the acceptance criteria range of 0 – 20 RPD. One mercury duplicate sample RPD was reported as "….slightly outside of acceptance criteria. All other QC acceptable. Samples not qualified." Lab accuracy estimates for mercury using lab-fortified matrix samples were within the acceptable range from 70-130 % recovery. Mercury quality control sample recoveries and lab fortified blank recoveries were within the acceptable range of 85-115%. Complete quality control data for mercury are available upon request or from WES or DWM.

All lab organics blanks showed non-detectable concentrations. The lab blank sample recoveries for PCB Aroclors, PCB congeners, chlordane, heptachlor, DDE, DDD, DDT, and aldrin were all within the acceptance criteria range 60-140% recovery. Duplicate samples of PCB congeners, PCB Aroclor 1260, and organochlorine pesticides had resultant RPDs within the acceptance criteria range of 0-35%. All surrogate PCNB analyses resulted in percent recoveries within the acceptance criteria of 60-140 % recovery. Complete quality control data for PCB congeners, PCB Aroclor 1260, and organochlorine pesticides mercury are available upon request or from WES or DWM.

Analytical methods, project quantitation limits, method detection and reporting detection limits can be found in Appendix A, Table 2..

Discussion

Mercury continues to be both widespread and detectable at concentrations that exceed both MDPH trigger levels and, in some cases, USFDA Action levels. Mercury is discussed in the individual waterbody discussions that follow. MDPH has reviewed the 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, they are mostly found in rivers, although their presence in fishes from lakes and ponds can't be entirely ruled out in all cases. USFDA "Action Levels" are available for mercury (1.0 mg/kg methyl mercury), PCBs (2.0 mg/kg), chlordane, aldrin, and dieldrin (0.3 mg/kg for each individually), and for DDT and it's metabolites DDE and DDD (5.0 mg/ kg combined). The MDPH has "trigger levels" for mercury (0.5 mg/kg total mercury), PCBs (1.0 mg/kg total Aroclors), DDT and its metabolites (0.06 mg/kg), and chlordane (0.06 mg/kg).

PCB toxic congener analysis allows for a detailed look at the PCB compounds that exhibit dioxin-like toxicity. MassDEP's 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. 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 2006. This resulted in fish consumption advisories which are detailed in the individual waterbody results section below.

Ryder Pond: Located within Cape Cod National Seashore, Ryder Pond is an 18 acre (Ackerman 1989) oligotrophic kettle pond located in the town of Truro. Ryder was one of five ponds which were sampled in conjunction with a United States Geological Survey (USGS) project involving the comparisons of East and West Coast mercury concentrations. The shoreline is mostly undeveloped although there are a few single family residences located along the shore or within the pond's watershed. The remainder of the watershed is forested with the exception of Route 6, which skirts the pond to within 50 meters of its eastern shore.

Mercury in yellow perch exceeded both the MDPH "trigger level" of 0.5 mg/kg and the USFDA Action level of 1.0 mg/kg. in six of the seven fish analyzed. It should be noted that the six fish that exceeded the aforementioned criteria were all very large "trophy sized" yellow perch. Mercury concentrations have resulted in a MDPH advisory which recommends that the "no one should consume any fish" from Ryder Pond (MDPH 2007).

Herring Pond: Also sampled as part of the aforementioned USGS survey, Herring Pond is a 19 acre (Ackerman 1989) mesotrophic pond located within the Cape Cod National Seashore in the town of Wellfleet. The shoreline is relatively undeveloped and land use within the pond's immediate watershed is entirely forested. Herring Pond receives flow from Gull, Higgins, and Williams Ponds and discharges via the Herring River to Cape Cod Bay.

Mercury concentrations were well below the MDPH "trigger level" of 0.5 mg/kg in seven individual white perch. The white perch that were collected and analyzed were average sized fish which would definitely be targeted and consumed by fishermen and women.

Great Pond: The third of five ponds sampled as part of the aforementioned USGS survey and located within the Cape Cod National Seashore, Great Pond is a 37-acre oligotrophic kettle pond in the town of Wellfleet (Ackerman 1989). The shoreline is largely undeveloped although there are a few scattered residences. Land use within the ponds immediate watershed is primarily forested with the exception of Cahoon Hollow Road which passes within 100 meters of the southern edge of the pond. There is a town owned swimming beach located off of Cahoon Hollow Road but otherwise public access is severely limited.

Mercury exceeded the MDPH "trigger level" of 0.5 mg/kg in each of seven individual yellow perch. It should be noted that many of these perch were very small (less than 6 inches in length).The elevated mercury in yellow perch has resulted in a MDPH advisory which recommends that "no one should consume any fish" from Great Pond (MDPH 2007).

Gull Pond: Part of the aforementioned USGS survey, this 109 acre kettle pond is also located in the Town of Wellfleet within the Cape Cod National Seashore. There is a hydraulic connection between Gull Pond and Higgins and Herring Ponds located downstream. The shoreline is mostly undeveloped although there are scattered residences along the shoreline and within the pond's watershed. Aside from the low-density residential areas, land use is predominantly forested. There is a town owned swimming beach and boat ramp that can accommodate small trailerable boats, canoes and/or kayaks located on the south eastern shoreline. Gasoline motors are not allowed on Gull Pond.

Mercury concentrations were below the MDPH "trigger level" of 0.5 mg/kg in seven individual white perch. The white perch that were collected and analyzed were average sized fish which would definitely be targeted and consumed by fishermen and women.

Duck Pond: The last of the ponds sampled as part of the USGS survey, Duck Pond is a 13-acre oligotrophic kettle pond located in the town of Wellfleet (Ackerman 1989). With the exception of one residence located on the northern shore, the shoreline is undeveloped. Land use within the pond's immediate watershed is almost entirely forested.

The MDPH "trigger level" and the USEPA Action Level for mercury were exceeded in five of the seven yellow perch analyzed. In addition, a sixth yellow perch exceeded the MDPH trigger level but was below the USFDA Action level for mercury. It should be noted that the six fish which exceeded mercury criteria were all very large "trophy sized" individuals. Mercury concentrations have resulted in a MDPH advisory which recommends that the "no one should consume any fish" from Ryder Pond (MDPH 2007).

Lake Garfield: This 262 acre mesotrophic, stratified, lake is located in the Town of Monterey within the Housatonic River Watershed. The immediate shoreline is around fifty percent developed residentially, and

the land use within the watershed is a mix of forested and low to medium density residential with a small amount of agricultural land. There is a public boat ramp located on the northwest corner of the lake.

Sampled as the result of a public request, Lake Garfield was also chosen for inclusion as an Office of Research and Standards (ORS) long term fish tissue mercury monitoring site. In addition to analyzing composite samples, twelve individual largemouth bass and thirty individual yellow perch were also analyzed.

Although mercury exceeded the MDPH trigger level of 0.5 mg/Kg in five largemouth bass the mean mercury concentration in bass was below the MDPH "trigger level". All other fish were well below the MDPH "trigger level" for mercury.

French River: The sampled reach of the French River is a large circular pool/pond located just downstream from Hodges Village Dam and flood control structure in Oxford. The pool is relatively shallow and the French River enters the southwest corner of the pool and exits in the southeast corner. The pool is relatively stagnant and appears to be fairly productive as evidenced by macrophyte growth in the shallower areas.
The French River was sampled as the result of a request by a local advocacy group called "The French River Connection".

Mercury in largemouth bass exceeded both the MDPH "trigger level" of 0.5 mg/kg and the USFDA Action level of 1.0 mg/kg. It should be noted that even though mercury was below the MPDH "trigger level" in five other species, mercury concentrations have resulted in a MDPH advisory which recommends the following:

1.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.

2. The general public should not consume largemouth bass from this waterbody.

3. The general public should limit consumption of all other fish species from this waterbody to two meals per month.

Although trace amounts of PCB congeners and DDT (or it's metabolites DDD and DDE) were found in two samples, all concentrations were well below any MDPH or USFDA criteria. It is unclear where PCBs and pesticides might be originating, but given the incredible amount of development within the French River watershed, pesticides could well be from historic household use. Concentrations do not appear to be indicative of an ongoing source of these contaminants.

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Blackstone River (Rice City Pond): Rice City Pond and the Blackstone River Impoundment at the Blackstone Gorge in Blackstone were sampled as the result of a request by the Blackstone River Watershed Association. Rice City Pond is an impoundment of the Blackstone River located in the town of Uxbridge. The shoreline of Rice City Pond is undeveloped and owned by the Commonwealth as part of the Blackstone River and Canal Heritage State Park, however, the watershed upstream is heavily developed both industrially, commercially, and residentially. The River and Rice City Pond have a long history of both point and non-point sources of pollution.

Mercury concentrations were well below the MDPH "trigger level" of 0.5 mg/kg in the four samples analyzed. It should be noted that no predatory fishes were collected or analyzed and therefore "worst-case" conditions for mercury were not assessed.

PCB Aroclors, and/or PCB congeners were detected in all samples. DDT (and/or its metabolites) were detected in two samples. PCB Arochlors exceeded MDPH trigger levels in common carp and white sucker. Both represent bottom feeding species with relatively high lipid contents. Fish from Rice City Pond 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. The advisory recommends the following for Rice City Pond:

1. 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.

2. The general public should not consume carp or white sucker from this waterbody.

3. The general public should limit consumption of all other fish species from this waterbody to two meals per month.

Although PCBs continue to be elevated in both carp and white sucker, the concentrations in carp were much lower in 2006 than in 1993. In contrast, white sucker PCB concentrations were actually higher in 2006, but the fish were also larger (and presumably older). 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. .

Blackstone River Impoundment (upstream from Blackstone Gorge) in Blackstone: Also sampled as the result of a request by the Blackstone River Watershed Association, 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 impoundment is mostly forested land, with some low to medium residential development on the eastern shoreline. Like the previous Blackstone River location, 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.

Mercury concentrations were well below the MDPH "trigger level" of 0.5 mg/kg in the 7 samples analyzed. It should be noted that 2 predatory fishes were collected (largemouth bass and black crappie) and analyzed. Therefore, worst-case conditions for mercury were assessed.

PCB Aroclors, and/or PCB congeners were detected in six of the seven samples analyzed. In addition DDE was detected in one sample. PCB Arochlors exceeded the MDPH trigger level in common carp only. Common carp represent bottom feeding species with relatively high lipid content which is usually worst case for PCBs and pesticides. Fish from the Blackstone River Impoundment were first sampled and analyzed by DEP in 1993. The 1993 survey resulted in the issuance of the following fish consumption advisory due to elevated PCBs in carp and white sucker:

1. 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.

2. The general public should not consume carp or white sucker from this waterbody.

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

Buck Pond: Sampled as part of the 2006 Westfield River Watershed assessment, Buck Pond is a 25 acre mesotrophic, kettle pond located in the town of Westfield. It is one of the smaller ponds in a group of ponds known as the Hampton Ponds. The immediate shoreline is approximately thirty percent developed residentially and the land use within the watershed is a mix of forested, low to medium density residential, and commercial transportation (airport). It is unclear whether or not stormwater from the airport enters Buck Pond. There is car top boat access located on the northwestern corner of the lake.

Mercury concentrations were below the MDPH "trigger level" of 0.5 mg/kg in the four samples analyzed, however, it should be noted that the largemouth bass composite was found to contain 0.49 mg/Kg of

mercury. The bass in this composite sample were approximately 15 inches long and larger bass can be expected to contain mercury in excess of the MDPH trigger level.

Windsor Pond: Also sampled as part of the 2006 Westfield River Watershed assessment, Windsor Pond 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 mg/kg in largemouth bass. It should be noted however that one of the largemouth bass included in the composite was over 16 inches in length. 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 has asked that Windsor Lake be re-sampled and that a larger sample of largemouth bass be collected.

Conclusions

The 2006 Public Request and Year 2 Watershed data sets support previous findings that mercury is a widespread problem, and that, although individual ponds or regions may be at higher risk, mercury is primarily a problem in predatory or piscivorous fish 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 from 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, mercury bioaccumulation in fishes also poses threats with regard to ecological risks to piscivorous wildlife (Eisler 1987). Mercury in fish poses a health risk to eagles, loons, and ospreys as well as many other fish eating species. Reductions with regard the amount of mercury in the municipal waste stream and the emissions noted above may 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 2006). In addition, a long term trend monitoring program managed by ORS has suggested that mercury concentrations in yellow perch and largemouth bass are also on the decrease in a number of the monitored waterbodies (Mass DEP 2006). Only time will tell how long it will take before concentrations in fish drop to a point where human and/or ecological health risks will reach acceptable levels.

The 2006 data set 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 concentrations of PCB Aroclors and toxic congeners, DDT and it's metabolites, and in some cases chlordane . The MassDEP ORS and the MDPH will continue to evaluate the potential benefits of using PCB toxic congener results in determining the need for fish consumption advisories.

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 the DWM monitoring coordinators in the watersheds where work was conducted. Additional copies of this report are available from the MassDEP, Division of Watershed Management, 627 Main Street 2nd Floor, Worcester, MA 01608.

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LIST OF APPENDICES

APPENDIX A

Table 1. Analytical Results for 2006 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)	Laboratory Sample ID#)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Aroclors and Congeners (µg/g)	Pesticides (µg/g)
Ryder Pond, Truro, Cape Cod Coastal Watershed													
RP06-001	5/24/06	YP	361	480	2006172-001	-	-	2.4H	-	-	-	-	-
RP06-002	5/24/06	YP	382	630	2006172-002	-	-	1.9H	-	-	-	-	-
RP06-003	5/24/06	YP	364	560	2006172-003	-	-	1.5H	-	-	-	-	-
RP06-004	5/24/06	YP	339	450	2006172-004	-	-	1.8H	-	-	-	-	-
RP06-005	5/24/06	YP	355	480	2006172-005	-	-	1.7H	-	-	-	-	-
RP06-006	5/24/06	YP	337	390	2006172-006	-	-	1.3H	-	-	-	-	-
RP06-007	5/24/06	YP	263	160	2006172-007	-	-	0.47H	-	-	-	-	-
Herring Pond, Wellfleet, Cape Cod Coastal Watershed													
HP06-001	5/24/06	WP	266	300	2006171-001	-	-	0.19H	-	-	-	-	-
HP06-002	5/24/06	WP	270	280	2006171-002	-	-	0.32H	-	-	-	-	-
HP06-003	5/24/06	WP	280	300	2006171-003	-	-	0.29H	-	-	-	-	-
HP06-004	5/24/06	WP	270	290	2006171-004	-	-	0.18H	-	-	-	-	-
HP06-005	5/24/06	WP	278	290	2006171-005	-	-	0.28H	-	-	-	-	-
HP06-006	5/24/06	WP	284	320	2006171-006	-	-	0.21H	-	-	-	-	-
HP06-007	5/24/06	WP	284	300	2006171-007	-	-	0.26H	-	-	-	-	-
Great Pond, Wellfleet, Cape Cod Coastal Watershed													
GT06-001	5/25/06	YP	251	160	2006175-001	-	-	1.4H	-	-	-	-	-
GT06-002	5/25/06	YP	218	120	2006175-002	-	-	0.80H	-	-	-	-	-
GT06-003	5/25/06	YP	202	70	2006175-003	-	-	0.80H	-	-	-	-	-
GT06-004	5/25/06	YP	177	60	2006175-004	-	-	0.87H	-	-	-	-	-
GT06-005	5/25/06	YP	156	40	2006175-005	-	-	0.88H	-	-	-	-	-
GT06-006	5/25/06	YP	230	120	2006175-006	-	-	0.86H	-	-	-	-	-
GT06-007	5/25/06	YP	172	40	2006175-007	-	-	0.89H	-	-	-	-	-
Gull Pond, Wellfleet, Cape Cod Coastal Watershed													
GP06-001	5/25/06	WP	244	180	2006173-001	-	-	0.33H	-	-	-	-	-
GP06-002	5/25/06	WP	277	240	2006173-002	-	-	0.41H	-	-	-	-	-
GP06-003	5/25/06	WP	265	220	2006173-003	-	-	0.36H	-	-	-	-	-
GP06-004	5/25/06	WP	249	200	2006173-004	-	-	0.49H	-	-	-	-	-
GP06-005	5/25/06	WP	272	250	2006173-005	-	-	0.38H	-	-	-	-	-
GP06-006	5/25/06	WP	255	200	2006173-006	-	-	0.48H	-	-	-	-	-
GP06-007	5/25/06	WP	231	170	2006173-007	-	-	0.22H	-	-	-	-	-

Table 1. Continued. Analytical Results for 2006 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys. Results reported in wet weight, are from composite or individual samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (mm)	Weight (g)	Laboratory Sample ID#)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Aroclors and Congeners (µg/g)	Pesticides (µg/g)
Duck Pond, Wellfleet, Cape Cod Coastal Watershed													
DP06-001	5/25/06	YP	360	490	2006174-001	-	-	2.2H	-	-	-	-	-
DP06-002	5/25/06	YP	320	400	2006174-002	-	-	1.6H	-	-	-	-	-
DP06-003	5/25/06	YP	330	400	2006174-003	-	-	1.7H	-	-	-	-	-
DP06-004	5/25/06	YP	374	460	2006174-004	-	-	2.3H	-	-	-	-	-
DP06-005	5/25/06	YP	341	500	2006174-005	-	-	1.5H	-	-	-	-	-
DP06-006	5/25/06	YP	160	40	2006174-006	-	-	0.67H	-	-	-	-	-
DP06-007	5/25/06	YP	137	20	2006174-007	-	-	0.49H	-	-	-	-	-
Lake Garfield, Monterey, Housatonic River Watershed													
LGF06-1	6/6/06	LMB	390	960	2006198-001	-	-	0.60H	-	-	-	-	-
LGF06-2	6/6/06	LMB	375	720	2006198-002	-	-	0.53H	-	-	-	-	-
LGF06-3	6/6/06	LMB	360	720	2006198-003	-	-	0.40H	-	-	-	-	-
LGF06-4	6/6/06	LMB	307	410	2006198-004	-	-	0.24H	-	-	-	-	-
LGF06-5	6/6/06	LMB	343	660	2006198-005	-	-	0.55H	-	-	-	-	-
LGF06-6	6/6/06	LMB	300	400	2006198-006	-	-	0.23H	-	-	-	-	-
LGF06-7	6/6/06	LMB	388	940	2006198-007	-	-	0.56H	-	-	-	-	-
LGF06-8	6/6/06	LMB	330	440	2006198-008	-	-	0.37H	-	-	-	-	-
LGF06-9	6/6/06	LMB	350	710	2006198-009	-	-	0.28H	-	-	-	-	-
LGF06-10	6/6/06	LMB	440	1220	2006198-010	-	-	0.83H	-	-	-	-	-
LGF06-11	6/6/06	LMB	350	800	2006198-011	-	-	0.36H	-	-	-	-	-
LGF06-12	6/6/06	LMB	325	580	2006198-012	-	-	0.42H	-	-	-	-	-
LGF06-13	6/6/06	YP	240	200	2006198-013	-	-	0.19H	-	-	-	-	-
LGF06-14	6/6/06	YP	145	40	2006198-014	-	-	0.069H	-	-	-	-	-
LGF06-15	6/6/06	YP	250	200	2006198-015	-	-	0.17H	-	-	-	-	-
LGF06-16	6/6/06	YP	212	140	2006198-016	-	-	0.13H	-	-	-	-	-
LGF06-17	6/6/06	YP	190	100	2006198-017	-	-	0.12H	-	-	-	-	-
LGF06-18	6/6/06	YP	190	100	2006198-018	-	-	0.12H	-	-	-	-	-
LGF06-19	6/6/06	YP	160	70	2006198-019	-	-	0.081H	-	-	-	-	-
LGF06-20	6/6/06	YP	210	140	2006198-020	-	-	0.16H	-	-	-	-	-
LGF06-21	6/6/06	YP	190	110	2006198-021	-	-	0.16H	-	-	-	-	-
LGF06-22	6/6/06	YP	215	140	2006198-022	-	-	0.19H	-	-	-	-	-
LGF06-23	6/6/06	YP	225	150	2006198-023	-	-	0.31H	-	-	-	-	-
LGF06-24	6/6/06	YP	250	200	2006198-024	-	-	0.30H	-	-	-	-	-

Table 1. Continued. Analytical Results for 2006 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys. Results reported in wet weight, are from composite or individual samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (mm)	Weight (g)	Sample ID (laboratory sample #)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Aroclors and Congeners (µg/g)	Pesticides (µg/g)
Lake Garfield, Monterey, Housatonic River Watershed													
LGF06-25	6/6/06	YP	235	200	2006198-025	-	-	0.29H	-	-	-	-	-
LGF06-26	6/6/06	YP	220	160	2006198-026	-	-	0.13H	-	-	-	-	-
LGF06-27	6/6/06	YP	160	60	2006198-027	-	-	0.057H	-	-	-	-	-
LGF06-28	6/6/06	YP	220	140	2006198-028	-	-	0.19H	-	-	-	-	-
LGF06-29	6/6/06	YP	195	100	2006198-029	-	-	0.13H	-	-	-	-	-
LGF06-30	6/6/06	YP	180	100	2006198-030	-	-	0.12H	-	-	-	-	-
LGF06-31	6/6/06	YP	200	100	2006198-031	-	-	0.099H	-	-	-	-	-
LGF06-32	6/6/06	YP	225	160	2006198-032	-	-	0.26H	-	-	-	-	-
LGF06-33	6/6/06	YP	260	210	2006198-033	-	-	0.34H	-	-	-	-	-
LGF06-34	6/6/06	YP	220	140	2006198-034	-	-	0.16H	-	-	-	-	-
LGF06-35	6/6/06	YP	230	140	2006198-035	-	-	0.20H	-	-	-	-	-
LGF06-36	6/6/06	YP	250	190	2006198-036	-	-	0.36H	-	-	-	-	-
LGF06-37	6/6/06	YP	210	120	2006198-037	-	-	0.12H	-	-	-	-	-
LGF06-38	6/6/06	YP	225	130	2006198-038	-	-	0.17H	-	-	-	-	-
LGF06-39	6/6/06	YP	240	160	2006198-039	-	-	0.13H	-	-	-	-	-
LGF06-40	6/6/06	YP	240	200	2006198-040	-	-	0.25H	-	-	-	-	-
LGF06-41	6/6/06	YP	250	210	2006198-041	-	-	0.18H	-	-	-	-	-
LGF06-42	6/6/06	YP	215	120	2006198-042	-	-	0.26H	-	-	-	-	-
LGF06-43	6/6/06	BB	350	680									
LGF06-44	6/6/06	BB	345	580	2006199-001	-	-	0.089H	-	-	-	-	-
LGF06-45	6/6/06	BB	340	600									
LGF06-46	6/6/06	RB	210	200									
LGF06-47	6/6/06	RB	200	180	2006199-002	-	-	0.21H	-	-	-	-	-
LGF06-48	6/6/06	RB	195	160									
LGF06-49	6/6/06	P	195	180									
LGF06-50	6/6/06	P	200	200	2006199-003	-	-	0.22H	-	-	-	-	-
LGF06-51	6/6/06	P	205	260									

Table 1. Continued. Analytical Results for 2006 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys. Results reported in wet weight, are from composite or individual samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (mm)	Weight (g)	Laboratory Sample ID#)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Aroclors and Congeners (µg/g)	Pesticides (µg/g)
French River, Oxford, French and Quinebaug Rivers Watershed													
FRF06-1	5/31/06	LMB	365	760									
FRF06-2	5/31/06	LMB	338	540	2006197-001	-	-	1.2H	-	-	0.10	ND	ND
FRF06-3	5/31/06	LMB	317	400									
FRF06-4	5/31/06	WS	490	1080									
FRF06-5	5/31/06	WS	488	1180	2006197-002	-	-	0.48H	-	-	0.72	TBZ[2]-0.010M	DDD-0.0036M DDE-0.012
FRF06-6	5/31/06	WS	456	900									
FRF06-7	5/31/06	YP	202	140									
FRF06-8	5/31/06	YP	177	80	2006197-003	-	-	0.29H	-	-	0.10	ND	ND
FRF06-9	5/31/06	YP	173	70									
FRF06-10	5/31/06	B	202	190									
FRF06-11	5/31/06	B	182	140	2006197-004	-	-	0.32H	-	-	0.09	ND	ND
FRF06-12	5/31/06	B	179	140									
FRF06-13	5/31/06	BB	231	160									
FRF06-14	5/31/06	YB	246	220	2006197-005	-	-	0.32H	-	-	0.09	ND	DDE-0.0061M
FRF06-15	5/31/06	YB	228	180									
FRF06-16	5/31/06	RB	251	320	2006197-006	-	-	0.38H	-	-	0.08	ND	ND
FRF06-17	5/31/06	RB	224	240									
Rice City Pond, Uxbridge, Blackstone River Watershed													
RCF06-1	7/11/06	C	525	2220									
RCF06-2	7/11/06	C	485	1760	2006311-001	-	-	0.025	-	-	1.0	A1254-0.59 A1260-0.62 TBZ-0.365M	DDE-0.047 DDD-0.013
RCF06-3	7/11/06	C	511	2100									
RCF06-4	7/11/06	WS	391	650									
RCF06-5	7/11/06	WS	446	980	2006311-002	-	-	0.082	-	-	1.4	A1254-1.4 A1260-0.91 TBZ-0.705M	DDD-0.041 DDE-0.071
RCF06-6	7/11/06	WS	405	620									
RCF06-7	7/11/06	YP	265	160									
RCF06-8	7/11/06	YP	240	200	2006311-003	-	-	0.11	-	-	0.13	A1254-0.17 A1260-0.023M TBZ-0.107M	ND
RCF06-9	7/11/06	YP	210	120									
RCF06-10	7/11/06	P	135	70									
RCF06-11	7/11/06	P	143	80	2006311-004	-	-	0.063	-	-	0.20	TBZ-0.024	ND
RCF06-12	7/11/06	P	155	90									

Table 1. Continued. Analytical Results for 2006 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys. Results reported in wet weight, are from composite or individual samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (mm)	Weight (g)	Laboratory Sample ID#)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Aroclors and Congeners (µg/g)	Pesticides (µg/g)
Blackstone River Impoundment, Blackstone, Blackstone River Watershed													
BRF06-1	7/7/06	C	549	2000									
BRF06-2	7/7/06	C	590	2900	2006310-001	-	-	0.064	-	-	1.4	A1254-0.71 A1260-0.58 TBZ-0.305M	DDE-0.044
BRF06-3	7/7/06	C	490	2580									
BRF06-4	7/7/06	LMB	390	860									
BRF06-5	7/7/06	LMB	345	680	2006310-002	-	-	0.29H	-	-	0.11	A1254-0.030M A1260-0.042M TBZ-0.027M	ND-
BRF06-6	7/7/06	LMB	395	900									
BRF06-7	7/7/06	BC	270	310									
BRF06-8	7/7/06	BC	180	100	2006310-003	-	-	0.28H	-	-	0.11	ND	ND
BRF06-9	7/7/06	BC	145	60									
BRF06-10	7/7/06	YP	225	150									
BRF06-11	7/7/06	YP	220	140	2006310-004	-	-	0.14H	-	-	0.11	BZ180-0.0029M	ND
BRF06-12	7/7/06	YP	233	180									
BRF06-13	7/7/06	B	212	200									
BRF06-14	7/7/06	B	205	190	2006310-005	-	-	0.35H	-	-	0.11	BZ180-0.0015M	ND
BRF06-15	7/7/06	B	190	180									
BRF06-16	7/7/06	BB	265	240									
BRF06-17	7/7/06	BB	280	280	2006310-006	-	-	0.026H	-	-	0.17	BZ180-0.0030M -	ND
BRF06-18	7/7/06	BB	260	240									
BRF06-19	7/7/06	WS	395	830									
BRF06-20	7/7/06	WS	425	850	2006310-007	-	-	0.090H	-	-	0.44	A1254-0.16 TBZ-0.033	ND
BRF06-21	7/7/06	WS	430	1000									
Windsor Lake, Windsor, Westfield River Watershed													
WLF06-1	6/20/06	LMB	328	440	2006255-001	-	-	1.2H	-	-	-	-	-
WLF06-2	6/20/06	LMB	412	1120									
WLF06-3	6/20/06	WS	450	730									
WLF06-4	6/20/06	WS	305	290	2006255-002	-	-	0.25H	-	-	-	-	-
WLF06-5	6/20/06	WS	350	400									
WLF06-6	6/20/06	YP	135	20									
WLF06-7	6/20/06	YP	149	30	2006255-003	-	-	0.25H	-	-	-	-	-
WLF06-8	6/20/06	YP	144	30									

Table 1. Continued. Analytical Results for 2006 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys. Results reported in wet weight, are from composite or individual samples of fish fillets (skin off).

Sample ID	Collection Date	Species Code[1]	Length (mm)	Weight (g)	Sample ID (laboratory sample #)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Aroclors and Congeners (µg/g)	Pesticides (µg/g)
Buck Pond, Westfield, Westfield River Watershed													
BPF06-1	6/13/06	LMB	384	860									
BPF06-2	6/13/06	LMB	385	750	2006254-001	-	-	0.49H	-	-	0.06	ND	ND
BPF06-3	6/13/06	LMB	361	590									
BPF06-4	6/13/06	BB	275	250									
BPF06-5	6/13/06	BB	260	200	2006254-002	-	-	0.067H	-	-	2.1	ND	Chlor-0.028M
BPF06-6	6/13/06	BB	225	140									
BPF06-7	6/13/06	GS	221	140									
BPF06-8	6/13/06	GS	176	80	2006254-003	-	-	0.094H	-	-	0.68	ND	ND
BPF06-9	6/13/06	GS	182	80									
BPF06-10	6/13/06	B	145	60									
BPF06-11	6/13/06	B	144	60	2006254-004	-	-	0.12H	-	-	0.18	BZ180-0.0058M	ND
BPF06-12	6/13/06	B	139	60									
BPF06-13	6/13/06	YP	165	60									
BPF06-14	6/13/06	YP	158	60	2006254-005	-	-	0.092H	-	-	0.17	ND	ND
BPF06-15	6/13/06	YP	150	50									

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[1] Species Code	Common Name	*Scientific name*
B	bluegill	*Lepomis macrochirus*
BB	brown bullhead	*Ameiurus nebulosus*
BC	black crappie	*Pomoxis nigromaculatus*
BT	brown trout	*Salmo trutta*
C	common carp	*Cyprinus carpio*
CP	chain pickerel	*Esox niger*
LMB	largemouth bass	*Micropterus salmoides*
P	pumpkinseed	*Lepomis gibbosus*
RT	rainbow trout	*Oncorynchus mykiss*
SMB	smallmouth bass	*Micropterus dolomieu*
WP	white perch	*Morone americana*
WS	white sucker	*Catostomus commersoni*
YB	yellow bullhead	*Ameiurus natalis*
YP	yellow perch	*Perca flavescens*

[2] TBZ = sum of detected PCB congeners

Data Qualifiers as reported by WES

< = not detected or the analytical result is at or below the established Method Detection Limit
H = USEPA holding time exceeded
M = includes at least one analyte concentration greater than Method Detection Limit but less than Reporting Detection Limit
ND = analyzed for, but not detected above Method Detection Level

< = not detected or the analytical result is at or below the established Method Detection Limit

Table 2. 2006 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
Arsenic	ug/g wet	Unknown	0.080	0.080	EPA 200.9
Cadmium	ug/g wet	Unknown	0.20	0.60	EPA 200.7
Lead	ug/g wet	Unknown	0.20	0.60	EPA 200.7
Mercury	ug/g wet	0.5	0.0020	0.0060	EPA 7473
Selenium	ug/g wet	Unknown	0.20	0.60	EPA 200.7
PCB Aroclor 1232	µg/g wet	1.0 (total)	0.019	0.057	Modified AOAC 983.21
PCB Aroclor 1242	µg/g wet	1.0 (total)	0.019	0.057	Modified AOAC 983.21
PCB Aroclor 1248	µg/g wet	1.0 (total)	0.038	0.11	Modified AOAC 983.21
PCB Aroclor 1254	µg/g wet	1.0 (total)	0.013	0.039	Modified AOAC 983.21
PCB Aroclor 1260	µg/g wet	1.0 (total)	0.022	0.066	Modified AOAC 983.21
Chlordane	µg/g wet	0.3	0.025	0.075	Modified AOAC 983.21
Toxaphene	µg/g wet	Unknown	0.045	0.14	Modified AOAC 983.21
a-BHC	µg/g wet	Unknown	0.0022	0.0066	Modified AOAC 983.21
b-BHC	µg/g wet	Unknown	0.0038	0.011	Modified AOAC 983.21
Lindane	µg/g wet	Unknown	0.0030	0.0090	Modified AOAC 983.21
d-BHC	µg/g wet	Unknown	0.010	0.030	Modified AOAC 983.21
Hexachlorocyclopentadiene	µg/g wet	Unknown	0.017	0.051	Modified AOAC 983.21
Hexachlorobenzene	µg/g wet	Unknown	0.012	0.036	Modified AOAC 983.21
Trifluralin	µg/g wet	Unknown	0.046	0.14	Modified AOAC 983.21
Heptachlor	µg/g wet	0.3	0.0031	0.0093	Modified AOAC 983.21
Heptachlor Epoxide	µg/g wet	Unknown	0.0031	0.0093	Modified AOAC 983.21
Methoxychlor	µg/g wet	Unknown	0.0035	0.011	Modified AOAC 983.21
Endosulfan I	µg/g wet	Unknown	0.0031	0.0093	Modified AOAC 983.21
DDD	µg/g wet	0.3 (total)	0.0030	0.0090	Modified AOAC 983.21
DDE	µg/g wet	0.3 (total)	0.0031	0.0093	Modified AOAC 983.21
DDT	µg/g wet	0.3 (total)	0.0030	0.0090	Modified AOAC 983.21
Aldrin	µg/g wet	0.3(total)	0.0024	0.011	Modified AOAC 983.21
Endrin	µg/g wet	Unknown	0.0036	0.011	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

Table 2. Continued. 2006 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
PCB Congener BZ # 187	µg/g wet	Unknown	0.0022	0.0066	Modified AOAC 983.21
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

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/MRL values are based on most recent analyses by WES (2007), and as all Detection Limit values, subject to change.
4) Methods
-EPA 200.7 – Metals and Trace Elements
-EPA 200.9 – Trace Elements
-EPA 245.6 – Mercury in Tissues by Cold Vapor
--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 restoring 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.