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# Emerging Contaminants in Surface Water and Fish: Results from Statewide Monitoring

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This data brief provides an overview of the laboratory analyses of surface water and freshwater fish samples collected by the Massachusetts Department of Public Health (DPH) in May and June 2022. Data analysis was conducted by the DPH Environmental Toxicology Program (ETP) to determine whether sampled waterbodies require a waterbody-specific risk assessment or a fish consumption advisory.

## Sampling Methods

Waterbodies were selected based on having permitted public beaches and in part on proximity to Environmental Justice (EJ) populations, beach popularity and use (e.g., those beaches that provided a source of outdoor use and recreation for EJ communities were ranked higher than those beaches that may be bigger in size/popularity), and professional judgment on the amount of fishing conducted at each waterbody. DPH referenced the 2020 municipal EJ population data from the Massachusetts Executive Office of Energy and Environmental Affairs, which classifies EJ populations based on English isolation, income, and minority population (Massachusetts Executive Office of Energy and Environmental Affairs, 2020). Appendix A presents the waterbody selection methods scoring system.

From May 20 to May 24, 2022, DPH contractors collected surface water samples at 20 state-operated (Department of Conservation and Recreation) properties in Massachusetts (7 marine and 13 fresh waterbodies). The number of samples collected at each waterbody depended on the number of permitted beaches and waterbody size (i.e., acreage for fresh waterbodies and beach length for marine waterbodies). One sample was collected from most waterbodies. For larger marine waterbodies, up to five samples (e.g., at Revere Beach) were collected from multiple beach access points. For larger fresh waterbodies, up to three samples were collected. A total of 54 surface water samples were collected where exposure to the most vulnerable populations is most likely to occur (e.g., at wading depths).

From June 6 to June 14, 2022, DPH contractors sampled fish from all 13 fresh waterbodies sampled for surface water. DPH targeted fish species that are most likely caught and consumed by recreational fishers, have a wide geographic distribution, are abundant, and

easy to catch and identify, with the goal of informing a public health evaluation of PFAS exposure from the ingestion of fish. For each waterbody, three to five individual fish from each of three to six species were targeted, for a minimum of nine and a maximum of 18 fish. The number of fish targeted at each waterbody depended on the waterbody size and presence of target species. Because of availability of fish during the sampling period, DPH collected four to twenty fish per waterbody, or a total of 146 fish. Across the 13 waterbodies, the DPH contractor collected seven different fish species, including bluegill, smallmouth bass, largemouth bass, yellow perch, black crappie, pumpkinseed, and brown bullhead. The greatest number of samples per species were collected for bluegill (54 fish); the least number of samples were collected for brown bullhead and smallmouth bass (4 fish each).

To demonstrate the overall integrity of the samples and sampling process, the sampling team collected quality control (QC) samples and implemented strict sample handling practices. Equipment blanks were collected to verify that contamination was not introduced by field sampling equipment. An equipment rinsate blank was collected from the field equipment used to collect the tissue sample. Field blanks were collected to verify that PFAS contamination was not introduced by the sampling environment during field activities due to ambient conditions. For fish sampling, a field blank consisted of a sample of tinfoil wrapping handled in the same manner as the field samples. For surface water sampling, a field blank consisted of transferring laboratory provided PFAS-free water into a pre-screened PFAS-free bottle. Trip blanks were collected to verify that PFAS contamination was not introduced by shipping and handling procedures. One trip blank was submitted per cooler shipment with the samples collected in the field.

The surface water QC samples included 5 duplicates and 8 field blanks. The fish QC samples included 13 field blanks (one per waterbody) and five equipment blanks. One trip blank was also included for each cooler shipment.

SGS AXYS Analytical Services (SGS AXYS) (British Columbia, Canada) conducted the laboratory analysis for surface water and fish, using SGS AXYS Method MLA-110 Rev. 02 Ver. 08, which targets all 40 PFAS from EPA Methods 537.1 and 533.

## Data Evaluation

All field and QC sampling data were validated by the analytical lab and reported as complete and accurate in accordance with the laboratory quality assurance protocol. The data were evaluated by DPH in accordance with Quality Assurance/Quality Control (QA/QC) metrics specified in DPH's Standard Operating Procedures (SOPs) for surface water (DPH, September 2022) and fish sampling (DPH, January 2022). With the exception of one equipment blank, concentrations of all QC samples were either less than the limit of quantification, or non-detect. The PFOS concentration in the equipment blank sample, which was associated with fish sampling, was relatively low, and was two to three orders of magnitude lower than PFOS concentrations in the associated field samples. DPH determined that all data were complete and the overall program data quality objectives were achieved. Thus, DPH concluded that the data were valid and appropriate for performing risk assessments and decision-making.

Results reported as less than the minimum detection limit (MDL) were considered non-detect (ND) results and treated as a concentration of zero "0". Results reported as greater than or equal to the MDL but less than the reporting limit (RL) were defined by the laboratory as "J" qualified data to be considered as an approximate value. To be conservative, "J" qualified data considered approximate concentrations were treated as half of the RL value to statistically evaluate PFAS compounds, but were not included in the PFAS6 sum calculations, consistent with the Massachusetts Department of Environmental Protection (MassDEP) Drinking Water program (MassDEP, 2021).

The data evaluation involved comparing PFAS concentrations measured in surface water and fish to action levels developed by DPH for swimming and fishing at recreational waterbodies. DPH developed these action levels to identify waterbodies subject to notification of the presence of PFAS or recommend advisories for swimming or fishing.

To evaluate surface waterbodies intended for swimming (e.g., those with permitted bathing beaches), DPH uses the MassDEP Maximum Contaminant Level (MCL) for PFAS of 20 nanograms (ng) per Liter (L) of water (ng/L) as an initial conservative screening value. In accordance with the Draft DPH Bathing Beach Operational PFAS Guidance (December 2023), DPH recommends public notification of the presence of PFAS if PFAS concentrations are greater than 20 ng/L, as confirmed by at least two rounds of sampling. For evaluating public safety while swimming, DPH uses an action level of 90 ng/L, consistent with MassDEP's Imminent Hazard Level for PFAS. Waterbodies with PFAS levels exceeding this level warrant site-specific evaluation to determine appropriate restrictions on swimming.

Consistent with ATSDR recommendations for evaluating PFAS compounds individually, these action levels are applied to individual measurements of all PFAS for which there are established toxicity criteria. Currently, there are established toxicity criteria for seven PFAS, including: perfluorobutane sulfonic acid (PFBS), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), hexafluoropropylene oxide dimer acid (GenX), perfluorooctane sulfonate (PFOS), and perfluorobutanoic acid (PFBA). Consistent with the MassDEP Drinking Water program PFAS guidance[5], comparisons to surface water data were also made to the sum of six PFAS analytes, abbreviated as "PFAS6" including PFOS, PFOA, PFHxS, PFNA, perfluoroheptanoic acid (PFHpA), and perfluorodecanoic acid (PFDA).

DPH developed a Fish Action Level (FAL) of 0.22 ng of PFAS per gram of fish (ng/g) to represent unlimited fish consumption at or below this concentration. The average concentrations of PFAS in each fish species and the average concentration of all fish within each waterbody are compared to the DPH FAL. If the average concentration in fish for any of the individual PFAS exceed the FAL, DPH conducts a waterbody-specific analysis to evaluate how frequently individuals should consume fish from the waterbody.

## Surface Water Results

Of the twenty waterbodies sampled, eleven had detectable levels of at least one PFAS. Chicopee Reservoir had the highest average PFAS concentrations, which exceeded the initial screening value for PFOS (116 ng/L), PFHxS (88 ng/L) and PFOA (38 ng/L). The PFAS6

concentration at this waterbody was 251 ng/L (Table 1, Figure 1). Across all analytes and waterbodies, concentrations were highest for PFOS and PFHxS, with maximum concentrations of 123 and 89 ng/L, respectively, for the sample collected at Chicopee Beach – West (Table 2). For the other ten waterbodies where PFAS was detected, concentrations were less than the screening value. Based on a site-specific evaluation, DPH determined that Chicopee Reservoir was safe for all recreational activities, including swimming.

Per the DPH Draft Bathing Beach Operational PFAS Guidance (December 2023), DPH recommends public notification for the presence of PFAS confirmed by at least two rounds of sampling at permitted bathing beaches. Therefore, DPH re-sampled surface water at Chicopee Reservoir in March 2023 to provide a second round of sampling. The results of this sampling confirmed the 2022 sampling results, with similar PFAS concentrations. The highest average concentration was 113 ng/L, for PFOS, with a PFAS6 concentration of 253 ng/L (DPH, 2023). Thus, the site-specific evaluation for the second round of sampling confirmed that Chicopee Reservoir was safe for all recreational activities, including swimming.

## Fish Results

All thirteen waterbodies where fish were sampled contained at least one fish species with average PFAS levels above the DPH FAL, with PFOS exceeding the FAL in all fish samples. (Table 3). Similar to the surface water results, PFOS had the highest average (369 ng/g, Table 3) across all 40 PFAS, at Chicopee Reservoir. The numbers of fish samples by species at each waterbody is provided in Table 3.

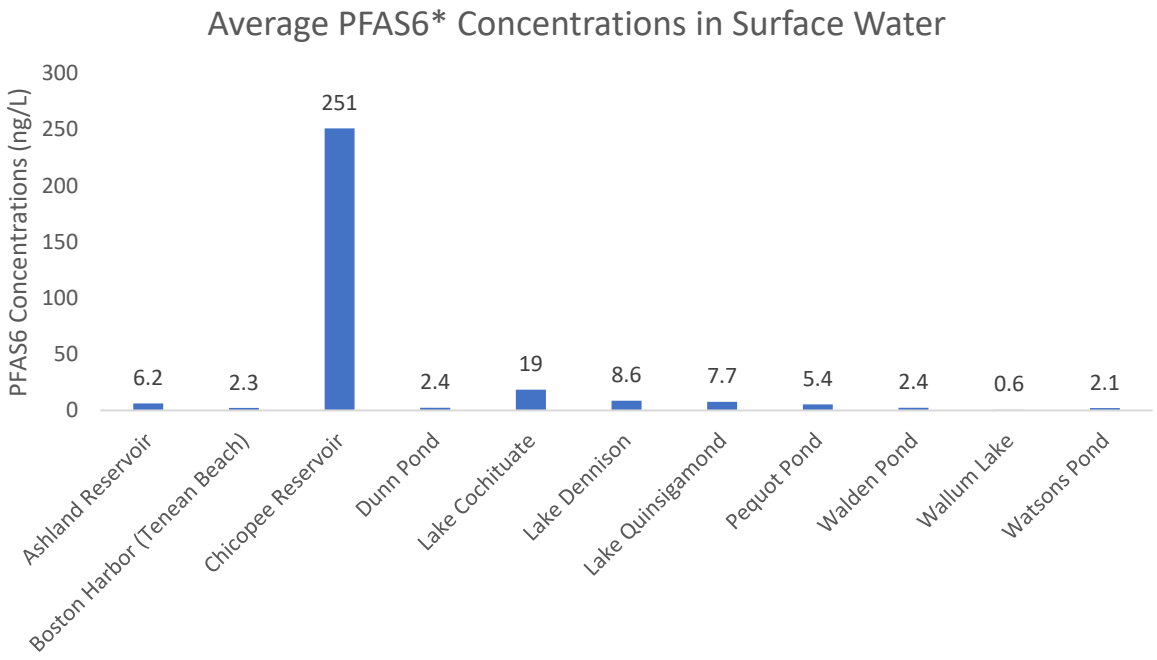
Fish consumption advisories were issued at all 13 waterbodies in the Spring of 2023 with guidance on the number of fish that can be safely consumed from each individual location. Table 4 presents the guidelines used for issuing fish consumption advisories for PFAS based on serving size and PFAS concentration. This guidance varies depending on the levels of PFAS found in the fish, other contaminants that have been evaluated in the past, and the population that may consume the fish. The advisories were developed for sensitive populations (including children under 12, people who are or may become pregnant, and nursing mothers) and for all others in the general population. The new fish consumption advisories are different for each waterbody, recommendations ranged from consuming two meals per week to no fish consumption.

**Table 1 Average** Surface Water Results by Waterbody (ng/L)

| Waterbody | PFAS6 | PFOS | PFOA | PFHxS | PFHpA | PFDA | PFNA | PFBS | PFBA |
|---|---|---|---|---|---|---|---|---|---|
| Ashland Reservoir | 6.2 | 2.2 | 4.0 | *0.22* | *0.22* | 0 | *0.22* | 2.1 | *0.88* |
| Boston Harbor (Carson Beach) | 0 | *0.10* | *0.20* | 0 | 0 | 0 | 0 | 0 | 0 |
| Boston Harbor (Constitution Beach) | 0 | *0.20* | *0.20* | 0 | 0 | 0 | 0 | 0 | 0 |
| Boston Harbor (Savin Hill Beach) | 0 | *0.20* | *0.20* | *0.20* | *0.20* | 0 | 0 | *0.10* | 0 |
| Boston Harbor (Tenean Beach) | 2.3 | 2.3 | *0.20* | *0.20* | *0.20* | 0 | 0 | *0.20* | 0 |
| Broad Sound (Revere Beach) | 0 | 0 | *0.05* | 0 | 0 | 0 | 0 | 0 | 0 |
| Chicopee Reservoir | 251 | 116 | 38 | 88 | 8.6 | *0.22* | *0.22* | 8.8 | 9.1 |
| Dunn Pond | 2.4 | *0.29* | 2.4 | *0.23* | *0.23* | 0 | *0.23* | *0.23* | 0 |
| Fearing Pond | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Houghton's Pond | 0 | *0.24* | *0.24* | 0 | 0 | 0 | 0 | 0 | 0 |
| Lake Cochituate | 19 | 7.1 | 6.0 | 2.8 | 2.6 | *0.14* | *0.21* | 3.7 | *0.86* |
| Lake Dennison | 8.7 | *0.23* | 6.2 | 0 | 2.5 | 0 | *0.23* | *0.23* | *0.29* |
| Lake Quinsigamond | 7.7 | 3.4 | 4.3 | *0.33* | *0.40* | 0 | *0.24* | 3.6 | *0.89* |
| Nahant Bay (Kings Beach) | 0 | *0.07* | *0.13* | 0 | 0 | 0 | 0 | 0 | 0 |
| Pearce Lake | 0 | *0.20* | *0.20* | 0 | *0.20* | 0 | *0.07* | 0 | 0 |
| Pequot Pond | 5.4 | 2.4 | 3.0 | *0.22* | *0.22* | 0 | *0.22* | *0.22* | *0.88* |
| Quincy Bay (Wollaston Beach) | 0 | *0.20* | *0.20* | 0 | 0 | 0 | 0 | 0 | 0 |
| Walden Pond | 2.4 | *0.22* | 2.4 | 0 | *0.22* | 0 | *0.22* | *0.07* | 0 |
| Wallum Lake | 0.74 | *0.21* | 0.74 | 0 | *0.21* | 0 | *0.21* | *0.14* | 0 |
| Watson Pond | 2.1 | *0.21* | 2.1 | *0.21* | *0.21* | 0 | 0 | *0.21* | *0.83* |

*Notes:*
*"0" – Not detected.*
*PFAS6 sum includes PFHpA, PFHxS, PFOA, PFOS, PFNA, and PFDA.*
*Blue shading indicates PFAS concentration > screening value for PFAS (20 ng/L)*
*Values in italics indicate average contains "J" qualified concentrations (value in table is ½ the Reporting Limit)*
*PFUnA, PFDoA, PFTrDA, PFTeDA, PFNS, PFDS, PFDoS, 4:2 FTS, 8:2 FTS, N-MeFOSA, N-EtFOSA, MeFOSAA, EtFOSAA, N-MeFOSE, N-EtFOSE, GENX, ADONA, 9Cl-PF3ONS, 11Cl-PF3OUdS, 3:3 FTCA, 5:3 FTCA, 7:3 FTCA, PFEESA, PFMPA, PFMBA, and NFDHA weren't detected.*

**Figure 1** Average PFAS6 Concentrations by Waterbody




*PFAS6 is the sum of PFOS, PFOA, PFHxS, PFNA, PFHpA, and PFDA.
PFAS6 not detected at Boston Harbor beaches (Carson, Savin Hill, Constitution), Broad Sound (Revere Beach), Fearings Pond, Houghton's Pond, Nahant Bay (Kings Beach), Quincy Bay (Wollaston Beach), and Pearce Lake.

**Table 2** Individual Surface Water Sample Results by Waterbody (ng/L)

| Waterbody | PFAS6 | PFOS | PFOA | PFHxS | PFHpA | PFDA | PFNA | PFBS | PFBA |
|---|---|---|---|---|---|---|---|---|---|
| **Ashland Reservoir** | | | | | | | | | |
| Ashland Reservoir - East | 6.2 | 2.17 | 4.0 | *0.21* | *0.21* | 0 | *0.21* | 2.2 | *0.9* |
| Ashland Reservoir - West | 6.2 | 2.31 | 3.9 | *0.22* | *0.22* | 0 | *0.22* | 2.0 | *0.9* |
| **Boston Harbor** | | | | | | | | | |
| Carson Beach at Bathhouse | 0 | *0.20* | *0.20* | 0 | 0 | 0 | 0 | 0 | 0 |
| Carson Beach at I Street | 0 | 0 | *0.20* | 0 | 0 | 0 | 0 | 0 | 0 |
| Constitution Beach - Middle | 0 | *0.20* | *0.20* | 0 | 0 | 0 | 0 | 0 | 0 |
| Constitution Beach - North | 0 | *0.21* | *0.21* | 0 | 0 | 0 | 0 | 0 | 0 |
| Constitution Beach Rec Center | 0 | *0.21* | *0.21* | 0 | 0 | 0 | 0 | 0 | 0 |
| Savin Hill Beach - Central | 0 | *0.20* | *0.20* | *0.20* | *0.20* | 0 | 0 | *0.20* | 0 |
| Savin Hill Beach - East | 0 | *0.20* | *0.20* | *0.20* | *0.20* | 0 | 0 | 0 | 0 |
| Savin Hill Beach - West | 0 | *0.19* | *0.19* | *0.19* | *0.19* | 0 | 0 | *0.19* | 0 |
| Tenean Beach | 2.3 | 2.3 | *0.20* | *0.20* | *0.20* | 0 | 0 | *0.20* | 0 |
| **Broad Sound** | | | | | | | | | |
| Revere Beach at Beach Street | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Revere Beach at Carey Circle | 0 | 0 | *0.20* | 0 | 0 | 0 | 0 | 0 | 0 |
| Revere Beach at Oak Island Street | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Revere Beach at State Police | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Chicopee Reservoir** | | | | | | | | | |
| Chicopee Beach - Central | 254 | 118 | 38 | 89 | 8.8 | *0.22* | *0.22* | 9.0 | 9.4 |
| Chicopee Beach - East | 240 | 108 | 37 | 86 | 8.2 | *0.22* | *0.22* | 8.8 | 8.8 |
| Chicopee Beach - West | 259 | 123 | 38 | 89 | 8.8 | *0.23* | *0.23* | 8.6 | 9.0 |
| **Dunn Pond** | | | | | | | | | |
| Dunn Pond Beach | 2.4 | *0.29* | 2.4 | *0.23* | *0.23* | 0 | *0.23* | *0.23* | 0 |
| **Fearing Pond** | | | | | | | | | |

| Waterbody | PFAS6 | PFOS | PFOA | PFHxS | PFHpA | PFDA | PFNA | PFBS | PFBA |
|---|---|---|---|---|---|---|---|---|---|
| Fearings Pond Campers Beach 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fearings Pond Campers Beach 2 - East | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fearings Pond Campers Beach 2 - West | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Houghton's Pond** | | | | | | | | | |
| Houghton's Pond at Bathhouse - Central | 0 | *0.31* | *0.31* | 0 | 0 | 0 | 0 | 0 | 0 |
| Houghton's Pond at Bathhouse - East | 0 | *0.21* | *0.21* | 0 | 0 | 0 | 0 | 0 | 0 |
| Houghton's Pond at Bathhouse - West | 0 | *0.21* | *0.21* | 0 | 0 | 0 | 0 | 0 | 0 |
| **Lake Cochituate** | | | | | | | | | |
| Cochituate Lake - North Beach - Central | 19 | 7.3 | 6.0 | 2.9 | 2.7 | *0.21* | *0.21* | 3.6 | *0.84* |
| Cochituate Lake - North Beach North | 19 | 7.4 | 6.2 | 2.9 | 2.6 | *0.21* | *0.21* | 3.9 | *0.83* |
| Cochituate Lake - North Beach South | 17 | 6.6 | 5.8 | 2.6 | 2.5 | 0 | *0.23* | 3.5 | *0.91* |
| **Lake Dennison** | | | | | | | | | |
| Lake Dennison State Park - Day Beach West | 8.4 | *0.22* | 6.1 | 0 | 2.3 | 0 | *0.22* | *0.22* | *0.88* |
| Lake Dennison State Park - Day Beach East | 8.3 | *0.24* | 5.9 | 0 | 2.4 | 0 | *0.24* | *0.24* | 0 |
| Lake Dennison State Park - North Camp Beach | 9.1 | *0.24* | 6.5 | 0 | 2.6 | 0 | *0.24* | *0.24* | 0 |
| **Lake Quinsigamond** | | | | | | | | | |
| Lake Quinsigamond - Lake Park Beach | 7.1 | 3.3 | 3.9 | *0.23* | *0.23* | 0 | *0.23* | 3.7 | *0.92* |
| Lake Quinsigamond - Regatta Point Beach North | 7.8 | 3.6 | 4.2 | *0.21* | *0.21* | 0 | *0.21* | 3.6 | *0.84* |
| Lake Quinsigamond - Regatta Point Beach South | 8.0 | 3.2 | 4.8 | *0.56* | *0.77* | 0 | *0.28* | 3.7 | *0.92* |
| **Nahant Bay** | | | | | | | | | |
| Kings Beach at Kimball Road | 0 | 0 | *0.20* | 0 | 0 | 0 | 0 | 0 | 0 |
| Kings Beach at Pierce Road | 0 | *0.20* | *0.20* | 0 | 0 | 0 | 0 | 0 | 0 |
| Kings Beach Eastern Ave. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Pearce Lake** | | | | | | | | | |
| Pearce Lake at Breakheart - Central | 0 | *0.20* | *0.20* | 0 | *0.20* | 0 | *0.20* | 0 | 0 |
| Pearce Lake at Breakheart - North | 0 | *0.20* | *0.20* | 0 | *0.20* | 0 | 0 | 0 | 0 |
| Pearce Lake at Breakheart - South | 0 | *0.19* | *0.19* | 0 | *0.19* | 0 | 0 | 0 | 0 |

| Waterbody | PFAS6 | PFOS | PFOA | PFHxS | PFHpA | PFDA | PFNA | PFBS | PFBA |
|---|---|---|---|---|---|---|---|---|---|
| **Pequot Pond** | | | | | | | | | |
| Kingsley Beach - North | 5.27 | 2.2 | 3.1 | *0.24* | *0.24* | 0 | *0.24* | *0.24* | *0.95* |
| Kingsley Beach - South | 5.19 | 2.6 | 2.6 | *0.21* | *0.21* | 0 | *0.21* | *0.21* | *0.83* |
| Lamberts Beach | 5.62 | 2.4 | 3.2 | *0.21* | *0.21* | 0 | *0.21* | *0.21* | *0.85* |
| **Quincy Bay** | | | | | | | | | |
| Wollaston Beach at Channing Street | 0 | *0.20* | *0.20* | 0 | 0 | 0 | 0 | 0 | 0 |
| Wollaston Beach at Milton Street | 0 | *0.20* | *0.20* | 0 | 0 | 0 | 0 | 0 | 0 |
| Wollaston Beach at Rice Road | 0 | *0.20* | *0.20* | 0 | 0 | 0 | 0 | 0 | 0 |
| Wollaston Beach at Sachem Street | 0 | *0.19* | *0.19* | 0 | 0 | 0 | 0 | 0 | 0 |
| **Walden Pond** | | | | | | | | | |
| Walden Pond - Main Beach | 2.4 | *0.21* | 2.4 | 0 | *0.21* | 0 | *0.21* | *0.21* | 0 |
| Walden Pond - Red Cross East | 2.3 | *0.22* | 2.3 | 0 | *0.22* | 0 | *0.22* | 0 | 0 |
| Walden Pond - Red Cross West | 2.5 | *0.24* | 2.5 | 0 | *0.24* | 0 | *0.24* | 0 | 0 |
| **Wallum Lake** | | | | | | | | | |
| Wallum Lake Beach - Central | 0 | *0.22* | *0.22* | 0 | *0.22* | 0 | *0.22* | 0 | 0 |
| Wallum Lake Beach - North | 1.8 | *0.20* | 1.8 | 0 | *0.20* | 0 | *0.20* | *0.20* | 0 |
| Wallum Lake Beach - South | 0 | *0.20* | *0.20* | 0 | *0.20* | 0 | *0.20* | *0.20* | 0 |
| **Watson Pond** | | | | | | | | | |
| Watsons Pond Beach | 2.1 | *0.21* | 2.1 | *0.21* | *0.21* | 0 | 0 | *0.21* | *0.83* |

*Notes:*
*"0" – Not detected.*
*PFAS6 sum includes PFHpA, PFHxS, PFOA, PFOS, PFNA, and PFDA.*
*Blue shading indicates PFAS concentration > screening value for PFAS (20 ng/L)*
*Values in italics indicate concentration is "J" qualified (value in table is ½ the Reporting Limit)*
*PFUnA, PFDoA, PFTrDA, PFTeDA, PFNS, PFDS, PFDoS, 4:2 FTS, 8:2 FTS, N-MeFOSA, N-EtFOSA, MeFOSAA, EtFOSAA, N-MeFOSE, N-EtFOSE, GENX, ADONA, 9Cl-PF3ONS, 11Cl-PF3OUdS, 3:3 FTCA, 5:3 FTCA, 7:3 FTCA, PFEESA, PFMPA, PFMBA, and NFDHA weren't detected.*

**Table 3** PFAS Detections in Fish Tissue - Averages by Waterbody/Species (ng/g)

| Waterbody (Species) | Count | PFOS | PFHxS | PFNA |
|---|---|---|---|---|
| **Ashland Reservoir** | **18** | **9.2** | **0** | **0.12** |
| Black Crappie | 3 | 13 | 0 | 0.54 |
| Bluegill | 3 | 9.7 | 0 | 0 |
| Largemouth Bass | 4 | 11 | 0 | 0 |
| Pumpkinseed | 3 | 4.0 | 0 | 0 |
| Yellow Perch | 5 | 8.2 | 0 | 0 |
| **Chicopee Reservoir** | **5** | **369** | **1.2** | **0** |
| Bluegill | 5 | 369 | 1.2 | 0 |
| **Dunn Pond** | **14** | **7.2** | **0** | **0** |
| Bluegill | 5 | 7.8 | 0 | 0 |
| Pumpkinseed | 4 | 3.3 | 0 | 0 |
| Yellow Perch | 5 | 9.8 | 0 | 0 |
| **Fearing Pond** | **7** | **0.49** | **0** | **0** |
| Bluegill | 5 | 0.35 | 0 | 0 |
| Largemouth Bass | 2 | 0.85 | 0 | 0 |
| **Houghton's Pond** | **5** | **2.1** | **0** | **0** |
| Bluegill | 5 | 2.1 | 0 | 0 |
| **Lake Cochituate** | **20** | **25** | **0** | **0.16** |
| Black Crappie | 5 | 25 | 0 | 0.40 |
| Bluegill | 5 | 20 | 0 | 0 |
| Largemouth Bass | 5 | 29 | 0 | 0 |
| Yellow Perch | 5 | 24 | 0 | 0.23 |
| **Lake Dennison** | **13** | **4.5** | **0** | **0** |
| Bluegill | 5 | 4.4 | 0 | 0 |
| Pumpkinseed | 3 | 6.1 | 0 | 0 |
| Yellow Perch | 5 | 3.6 | 0 | 0 |
| **Lake Quinsigamond** | **15** | **9.2** | **0** | **0** |
| Bluegill | 5 | 6.1 | 0 | 0 |
| Largemouth Bass | 5 | 16 | 0 | 0 |
| Yellow Perch | 5 | 5.6 | 0 | 0 |
| **Pearce Lake (Lower Pond)** | **4** | **0.97** | **0** | **0** |
| Bluegill | 4 | 0.97 | 0 | 0 |
| **Pequot Pond** | **20** | **12** | **0** | **0** |
| Bluegill | 4 | 17 | 0 | 0 |
| Brown Bullhead | 4 | 3.3 | 0 | 0 |
| Largemouth Bass | 4 | 16 | 0 | 0 |
| Pumpkinseed | 5 | 4.1 | 0 | 0 |
| Yellow Perch | 3 | 25 | 0 | 0 |
| **Walden Pond** | **5** | **6.7** | **0** | **0** |
| Bluegill | 5 | 6.7 | 0 | 0 |
| **Wallum Lake** | **15** | **3.8** | **0** | **0** |

| Waterbody (Species) | Count | PFOS | PFHxS | PFNA |
|---|---|---|---|---|
| Bluegill | 3 | 2.2 | 0 | 0 |
| Largemouth Bass | 5 | 4.5 | 0 | 0 |
| Smallmouth Bass | 4 | 5.9 | 0 | 0 |
| Yellow Perch | 3 | 1.2 | 0 | 0 |
| **Watson Pond** | **5** | **3.2** | **0** | **0** |
| Bluegill | 5 | 3.2 | 0 | 0 |

No detections for PFOA, PFHpA, PFDA, GenX, PFBS, PFBA
Orange shading identifies a PFAS concentration > FAL (0.22 ng/g)

**Table 4 Guidelines for Issuing Recreational Fish Consumption Advisories for PFAS**

| Target Population | Frequency | Meals* / Year | Serving Size (g/day) | PFAS Threshold (ppb) |
|---|---|---|---|---|
| General Population | 1 meal / day | 365 | 226.8 | ≤ 0.50 |
| | 2 meals / week | 104 | 64.6 | ≤ 1.76 |
| | 1 meal / week | 52 | 32.3 | ≤ 3.52 |
| | 2 meals / month | 24 | 14.9 | ≤ 7.62 |
| | 1 meal / month | 12 | 7.5 | ≤ 15.2 |
| | 1 meal / 2 months | 6 | 3.7 | ≤ 30.5 |
| | 1 meal / 6 months | 2 | 1.2 | ≤ 91.4 |
| | 1 meal / year | 1 | 0.6 | ≤ 183 |
| | Do Not Consume | 0 | -- | >183 |
| Sensitive Populations | 1 meal / day | 365 | 113.4 | ≤ 0.22** |
| | 2 meals / week | 104 | 32.3 | ≤ 0.78 |
| | 1 meal / week | 52 | 16.2 | ≤ 1.56 |
| | 2 meals / month | 24 | 7.5 | ≤ 3.38 |
| | 1 meal / month | 12 | 3.7 | ≤ 6.76 |
| | 1 meal / 2 months | 6 | 1.9 | ≤ 13.5 |
| | 1 meal / 6 months | 2 | 0.62 | ≤ 40.6 |
| | 1 meal / year | 1 | 0.31 | ≤ 81.1 |
| | Do Not Consume | 0 | -- | >81.1 |

**Appendix A** Waterbody selection methods scoring system

| **Environmental Justice** | **Score** |
|---|---|
| Municipalities in highest quartile | 4 |
| Municipalities in third quartile | 3 |
| Municipalities in second quartile | 2 |
| Municipalities in lowest quartile | 1 |
| *Additional point if English isolation EJ criteria met* | *(+1)* |
| *Additional point if income EJ criteria met* | *(+1)* |
| *Additional point if minority population EJ criteria met* | *(+1)* |

| **Beach Use (Lifeguard Coverage)** | **Score** |
|---|---|
| Guarded for the entirety of the swim season | 4 |
| Guarded for part of the swim season | 3 |
| Unguarded during swim season | 1 |
| No information provided | 0 |

| **Fishing Pressure** | **Score** |
|---|---|
| *Criteria 1: Boat Access* | |
| Accessible by boat ramp | **4** |
| Accessible by car-top boat/canoe launch; no boat ramp | **2** |
| No formal boat access point | **0** |
| *Criteria 2: Stocked with Fish* | |
| Waterbody is stocked with fish | **4** |
| Waterbody is NOT stocked with fish | **0** |
| *Criteria 3: Waterbody Max Depth [ft]* | |
| >100 | **4** |
| 51 – 100 | **3** |
| 26 – 50 | **2** |
| 0 – 25 | **1** |

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