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**Emerging Contaminant Surveillance in Surface Water and Fish: Results from Cape Cod Pilot Study**

**November 2, 2021**

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 2021. The analyses of these data were conducted by the DPH Environmental Toxicology Program to determine if sampled waterbodies require a waterbody-specific risk assessment or a fish consumption advisory.

**Sampling Methods**

On May 14 and 15, 2021, DPH contractors conducted surface water sampling at 16 public or semi-public bathing beaches on Cape Cod. One sample was collected from most waterbodies. For larger waterbodies, two samples were collected from multiple beach access points. Samples were collected where exposure to the most vulnerable populations is most likely to occur (e.g., at wading depths).

From May 24 to 26, 2021, DPH contractors sampled fish from five of the 16 waterbodies sampled for surface water. For each waterbody, three to five individual fish from each of three to five species were targeted, for a minimum of 9 fish and a maximum of 18 fish. To demonstrate the overall integrity of the samples and sampling process, the sampling team collected quality control samples and implemented strict sample handling practices.

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**

Surface water concentrations were evaluated using DPH’s candidate Surface Water Action Level (cSWAL) for PFAS. DPH recommends a cSWAL of 23 nanograms (ng) of PFAS, per Liter (L) of water (also known as parts per trillion or ppt) for surface water bodies that are intended for swimming (e.g., permitted bathing beaches). Consistent with ATSDR recommendations for evaluating PFAS compounds individually, this value was applied to individual measurements of perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), and perfluorooctane sulfonate (PFOS). If any of these compounds (individually) exceed the cSWAL of 23 ng/L, a water-body specific risk assessment would be required.

Fish tissue concentrations were evaluated using DPH’s candidate Fish Action Level (cFAL) for PFAS. DPH recommends a cFAL of 22 µg of PFAS, per kilogram (kg) of fish (also known as parts per billion or ppb). Consistent with ATSDR recommendations for evaluating PFAS compounds individually, this value was applied to individual measurements of PFOA, PFNA, PFHxS, and PFOS. If the concentration for any of these compounds exceeds a cFAL of 0.22 µg/kg a waterbody-specific analyses would be required. When a site-specific assessment is required following an exceedance of the DPH PFAS fish action level (0.22 ppb), threshold values that account for different individual sensitivities and consumption patterns will be used to develop more refined waterbody-specific recommendations. This location-specific assessment will also trigger local public health notification, as to allow consideration of non-recreational activities (e.g. subsistence fishing) at a specific waterbody that may result in greater potential PFAS exposure than evaluated in typical recreational use exposure scenarios (e.g., > 1 meal/day).

**Surface Water Results**

All waterbodies sampled contained some detectable amount of one or more PFAS compounds (Tables 1a, 1b). However, samples from only one waterbody, Johns Pond, had PFAS concentrations that exceeded the cSWAL of 23 nanograms per liter (ng/L), where average concentrations of PFNA, PFHxS, and PFOS were 24.6, 54.0, and 55.4 ng/L, respectively. Of the forty PFAS compounds tested, PFOS had the highest maximum and average concentration (across all waterbodies) at 64.3 and 6.27 ng/L, respectively. Concentrations of PFHxS were the second highest, with a maximum and average concentration of 55.3 ng/L and 5.43 ng/L, respectively. DPH determined that all sampled waterbodies are safe for recreational activities such as wading, boating, and catch-and-release fishing.

**Fish Results**

All five waterbodies had at least one fish species with PFOS levels above the lowest threshold for the general population (0.71 ppb; Tables 2a, 2b, 2c, 2d). All fish samples exceeded the cFAL of 0.22 µg/kg. Similar to the surface water results, PFOS had the highest average and maximum concentration of all 40 PFAS tested in fish tissues. PFOS concentrations were highest in fish from John’s Pond with an average PFOS tissue concentration of 97.76 ppb. Although PFOS concentrations were lower in the four remaining waterbodies, they were still high enough to trigger fish consumption advisories.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Waterbody** | **Crooked  Pond** | **Flax  Pond** | **Grews  Pond** | **Hen  Cove** | **Jenkins  Pond (N)** | **Jenkins  Pond (NE)** | | **Johns  Pond (NE)** | **Johns  Pond (SE)** | | **Mares  Pond** | **Mashpee-Wakeby  Pond (S)** |
| Sample collection date | 5/15 | 5/15 | 5/15 | 5/14 | 5/15 | 5/15 | 5/15 | 5/15 | 5/15 | 5/15 | 5/15 | 5/14 |
| PFBA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 5.3 | 5.17 | 5.28 | <MRL | <MRL |
| PFPeA | 1.06 | <MRL | 0.943 | <MRL | 0.817 | <MRL | <MRL | 12.7 | 12.4 | 12.9 | <MRL | 1.08 |
| PFHxA | 1.2 | 0.48 | 0.891 | 0.457 | 1.14 | 1.1 | 0.994 | 15.7 | 17 | 16.1 | 0.458 | 1.15 |
| PFHpA | 0.744 | <MRL | 1.08 | <MRL | 0.554 | 0.736 | 0.742 | 9.57 | 8.9 | 8.82 | 0.568 | 0.703 |
| PFOA | 1.25 | 0.622 | 2.12 | <MRL | 1.45 | 1.19 | 1.56 | 17.4 | 18.4 | 15.5 | <MRL | 0.757 |
| PFNA | <MRL | <MRL | 0.621 | <MRL | <MRL | <MRL | <MRL | **24.9** | **24.2** | **24.4** | <MRL | <MRL |
| PFDA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFUnA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFDoA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFTrDA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFTeDA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFBS | 1.4 | 0.576 | 0.562 | <MRL | 0.905 | 0.959 | 0.915 | 5.48 | 5.44 | 5.41 | <MRL | 0.958 |
| PFPeS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 5.73 | 6.06 | 5.66 | <MRL | <MRL |
| PFHxS | 0.461 | 0.626 | <MRL | 1.08 | 0.497 | 0.499 | 0.561 | **55.3** | **52.4** | **52.9** | <MRL | 0.711 |
| PFHpS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 1.02 | 1.02 | 1.08 | <MRL | <MRL |
| PFOS | <MRL | <MRL | 0.538 | 3.48 | 0.51 | 0.624 | 0.676 | **51.8** | **64.3** | **53.7** | <MRL | 0.591 |
| PFNS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFDS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFDoS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| 4:2FTS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| 6:2FT | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| 8:2 FTS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFOSA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| N-MeFOSA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| N-EtFOSA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| MeFOSAA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| EtFOSAA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| N-MeFOSE | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| N-EtFOSE | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| HFPO-DA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| ADONA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| 9Cl-PF3ONS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| 11Cl-PF3OUdS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| 3:3 FTCA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| 5:3 FTCA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| 7:3 FTCA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFEESA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFMPA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFMBA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| NFDHA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |

**Table 1a: PFAS Concentrations in Surface Water (Bolded Concentrations Exceed cSWAL)**

**Table 1b: PFAS Concentrations in Surface Water**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Waterbody** | **Mashpee-Wakeby  Pond (SW)** | **Peters Pond (N)** | **Peters Pond (S)** | | **Picture Lake  (Flax Pond)** | **Round  Pond** | **Santuit  Pond** | **Shubael  Pond** | **Snake  Pond** | **Squeteague  Harbor** | | **Triangle  Pond** |
| Sample collection date | 5/14 | 5/14 | 5/14 | 5/14 | 5/14 | 5/15 | 5/14 | 5/14 | 5/14 | 5/14 | 5/14 | 5/14 |
| PFBA | <MRL | 1.91 | 1.75 | 1.92 | 1.78 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 1.97 |
| PFPeA | 1.11 | 2.76 | 2.88 | 2.73 | 2.72 | <MRL | 1.43 | 1.32 | <MRL | <MRL | <MRL | 4.39 |
| PFHxA | 1.04 | 2.43 | 2.31 | 2.81 | 3.38 | 0.836 | 1.54 | 1.35 | 0.479 | 0.876 | 0.922 | 2.89 |
| PFHpA | 0.732 | 1.54 | 1.63 | 1.71 | 1.88 | 0.725 | 0.562 | 0.916 | 0.68 | 0.723 | 0.568 | 3.46 |
| PFOA | 0.943 | 2.17 | 2.13 | 2.63 | 4.29 | 1.26 | 1.46 | 1.79 | 0.72 | 2.62 | 2.79 | 2.25 |
| PFNA | <MRL | <MRL | 0.49 | 0.468 | <MRL | <MRL | <MRL | <MRL | <MRL | 0.959 | 1.03 | 0.421 |
| PFDA | <MRL | <MRL | 0.418 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 0.46 | 0.411 | <MRL |
| PFUnA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFDoA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFTrDA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFTeDA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFBS | 0.867 | 0.697 | 0.746 | 0.713 | 2.23 | 0.8 | 1.76 | 0.972 | <MRL | 1.16 | 1.16 | 0.466 |
| PFPeS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFHxS | 0.897 | 0.636 | 0.795 | 0.971 | 1.64 | 0.599 | 0.947 | 0.733 | <MRL | 0.748 | 0.727 | <MRL |
| PFHpS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFOS | 0.537 | 0.578 | 1.95 | 1.8 | 1.66 | 0.616 | 0.542 | 0.484 | <MRL | 7.67 | 8.55 | <MRL |
| PFNS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFDS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFDoS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| 4:2FTS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| 6:2FTS | 3.14 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| 8:2 FTS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFOSA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 0.45 | 0.53 | <MRL |
| N-MeFOSA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| N-EtFOSA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| MeFOSAA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| EtFOSAA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| N-MeFOSE | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| N-EtFOSE | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| HFPO-DA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| ADONA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| 9Cl-PF3ONS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| 11Cl-PF3OUdS | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| 3:3 FTCA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| 5:3 FTCA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| 7:3 FTCA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFEESA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFMPA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| PFMBA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| NFDHA | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |

**Table 2a: Average Fish Tissue Results for All PFAS Tested**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Waterbody | Species | PFBA | PFPeA | PFHxA | PFHpA | PFOA | PFNA | PFDA | PFUnA | PFDoA | PFTrDA | PFTeDA |
| Flax Pond (Picture Lake) | Waterbody average | <MRL | <MRL | <MRL | <MRL | <MRL | 0.07 | 0.25 | 0.45 | 0.28 | 0.37 | 0.21 |
| Bluegill | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 0.23 | 0.43 | 0.28 | 0.36 | 0.21 |
| Yellow perch | <MRL | <MRL | <MRL | <MRL | <MRL | 0.28 | 0.41 | 0.64 | 0.30 | 0.47 | 0.20 |
| Grews Pond | Waterbody average | <MRL | <MRL | <MRL | <MRL | <MRL | 0.07 | 0.25 | 0.61 | 0.44 | 0.91 | 0.34 |
| Bluegill | <MRL | <MRL | <MRL | <MRL | <MRL | 0.07 | 0.25 | 0.61 | 0.44 | 0.91 | 0.34 |
| Jenkins Pond | Waterbody average | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 0.22 | 0.84 | 0.88 | 1.58 | 0.60 |
| Largemouth bass | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 0.21 | 0.76 | 0.68 | 1.34 | 0.51 |
| Smallmouth bass | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 0.39 | 1.45 | 1.45 | 2.45 | 1.03 |
| Yellow bullhead | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 0.37 | 0.72 | 1.59 | 0.49 |
| Johns Pond | Waterbody average | <MRL | <MRL | <MRL | <MRL | 0.08 | 1.65 | 0.33 | 0.28 | 0.36 | 0.62 | 0.31 |
| Bluegill | <MRL | <MRL | <MRL | <MRL | <MRL | 0.93 | 0.35 | 0.38 | 0.45 | 0.83 | 0.42 |
| Chain pickerel | <MRL | <MRL | <MRL | <MRL | <MRL | 1.78 | 0.24 | 0.14 | 0.25 | 0.41 | 0.24 |
| Largemouth bass | <MRL | <MRL | <MRL | <MRL | <MRL | 0.18 | 0.26 | 0.29 | 0.41 | 0.77 | 0.36 |
| Pumpkinseed | <MRL | <MRL | <MRL | <MRL | 0.22 | 2.06 | 0.33 | 0.18 | 0.16 | 0.22 | 0.16 |
| White perch | <MRL | <MRL | <MRL | <MRL | <MRL | 1.29 | 0.40 | 0.37 | 0.49 | 0.85 | 0.39 |
| Yellow perch | <MRL | <MRL | <MRL | <MRL | 0.07 | 3.89 | 0.33 | 0.22 | 0.26 | 0.41 | 0.22 |
| Mashpee-Wakeby Pond | Waterbody average | <MRL | <MRL | 0.06 | <MRL | 0.06 | 0.06 | 0.07 | 0.27 | 0.15 | 0.25 | 0.14 |
| Chain pickerel | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 0.09 | <MRL | 0.11 | <MRL |
| Largemouth bass | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 0.35 | 0.23 | 0.35 | 0.18 |
| Pumpkinseed | <MRL | <MRL | 0.08 | <MRL | 0.09 | 0.1 | 0.08 | 0.23 | 0.15 | 0.23 | 0.17 |
| Smallmouth bass | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 0.09 | 0.46 | 0.27 | 0.41 | 0.22 |
| White perch | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 0.24 | 0.13 | 0.20 | <MRL |
| White sucker | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 0.15 | 0.47 | 0.31 | 0.42 | 0.29 |
| Yellow perch | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 0.17 | 0.07 | 0.18 | 0.08 |

*Values reported as µg/kg (parts per billion, ppb)*

*Max concentration used if fewer than three fish collected per species; average concentration calculated if three or more species collected per species*

**Table 2b: Fish Tissue Results for All PFAS Tested**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Waterbody | Species | PFBS | PFHxS | PFHpS | PFPeS | PFOS | PFNS | PFDS | PFDoS | 4:2 FTS | 6:2 FTS | 8:2 FTS |
| Flax Pond (Picture Lake) | Waterbody average | <MRL | <MRL | <MRL | <MRL | 2.64 | <MRL | <MRL | <MRL | <MRL | 0.35 | <MRL |
| Bluegill | <MRL | <MRL | <MRL | <MRL | 2.54 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Yellow perch | <MRL | <MRL | <MRL | <MRL | 3.44 | <MRL | <MRL | <MRL | <MRL | 1.72 | <MRL |
| Grews Pond | Waterbody average | <MRL | <MRL | <MRL | <MRL | 0.97 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Bluegill | <MRL | <MRL | <MRL | <MRL | 0.97 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Jenkins Pond | Waterbody average | <MRL | <MRL | <MRL | <MRL | 2.80 | <MRL | 0.05 | <MRL | <MRL | <MRL | <MRL |
| Largemouth bass | <MRL | <MRL | <MRL | <MRL | 2.71 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Smallmouth bass | <MRL | <MRL | <MRL | <MRL | 4.68 | <MRL | 0.15 | <MRL | <MRL | <MRL | <MRL |
| Yellow bullhead | <MRL | <MRL | <MRL | <MRL | 0.34 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Johns Pond | Waterbody average | <MRL | 0.58 | 0.18 | <MRL | 97.76 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Bluegill | <MRL | 0.32 | 0.18 | <MRL | 144.33 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Chain pickerel | <MRL | 0.83 | 0.21 | <MRL | 86.10 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Largemouth bass | <MRL | 0.16 | <MRL | <MRL | 73.37 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Pumpkinseed | <MRL | 1.38 | 0.12 | <MRL | 45.70 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| White perch | <MRL | 0.13 | 0.24 | <MRL | 140.25 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Yellow perch | <MRL | 1.01 | 0.30 | <MRL | 74.90 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Mashpee-Wakeby Pond | Waterbody average | <MRL | 0.06 | <MRL | <MRL | 0.67 | <MRL | <MRL | <MRL | <MRL | 1.73 | <MRL |
| Chain pickerel | <MRL | <MRL | <MRL | <MRL | 0.40 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Largemouth bass | <MRL | <MRL | <MRL | <MRL | 0.91 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Pumpkinseed | <MRL | <MRL | <MRL | <MRL | 0.62 | <MRL | <MRL | <MRL | <MRL | 1.65 | <MRL |
| Smallmouth bass | <MRL | <MRL | <MRL | <MRL | 1.02 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| White perch | <MRL | <MRL | <MRL | <MRL | 0.87 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| White sucker | <MRL | 0.16 | <MRL | <MRL | 0.69 | <MRL | <MRL | <MRL | <MRL | 17.1 | <MRL |
| Yellow perch | <MRL | <MRL | <MRL | <MRL | 0.55 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |

*Values reported as µg/kg (parts per billion, ppb)*

*Max concentration used if fewer than three fish collected per species; average concentration calculated if three or more species collected per species*

**Table 2c: Fish Tissue Results for All PFAS Tested**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Waterbody | Species | PFOSA | N-MeFOSA | N-EtFOSA | MeFOSAA | EtFOSAA | N-MeFOSE | N-EtFOSE | HFPO-DA | ADONA | 9Cl-PF3ONS | 11Cl-PF3OUdS |
| Flax Pond (Picture Lake) | Waterbody average | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Bluegill | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Yellow perch | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Grews Pond | Waterbody average | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Bluegill | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Jenkins Pond | Waterbody average | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Largemouth bass | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Smallmouth bass | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Yellow bullhead | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Johns Pond | Waterbody average | 0.14 | <MRL | <MRL | <MRL | <MRL | <MRL | 0.39 | <MRL | <MRL | <MRL | <MRL |
| Bluegill | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 0.51 | <MRL | <MRL | <MRL | <MRL |
| Chain pickerel | 0.60 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Largemouth bass | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Pumpkinseed | 0.15 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| White perch | 0.09 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Yellow perch | 0.21 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Mashpee-Wakeby Pond | Waterbody average | 0.10 | <MRL | <MRL | <MRL | <MRL | <MRL | 0.62 | <MRL | <MRL | <MRL | <MRL |
| Chain pickerel | 0.30 | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Largemouth bass | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Pumpkinseed | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Smallmouth bass | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 0.54 | <MRL | <MRL | <MRL | <MRL |
| White perch | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| White sucker | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | 3.30 | <MRL | <MRL | <MRL | <MRL |
| Yellow perch | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |

*Values reported as µg/kg (parts per billion, ppb)*

*Max concentration used if fewer than three fish collected per species; average concentration calculated if three or more species collected per species*

**Table 2d: Fish Tissue Results for All PFAS Tested**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Waterbody | Species | 3:3 FTCA | 5:3 FTCA | 7:3 FTCA | PFMPA | PFEESA | NFDHA | PFMBA |
| Flax Pond (Picture Lake) | Waterbody average | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Bluegill | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Yellow perch | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Grews Pond | Waterbody average | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Bluegill | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Jenkins Pond | Waterbody average | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Largemouth bass | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Smallmouth bass | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Yellow bullhead | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Johns Pond | Waterbody average | <MRL | 1.81 | 1.69 | <MRL | <MRL | <MRL | <MRL |
| Bluegill | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Chain pickerel | <MRL | <MRL | 9.09 | <MRL | <MRL | <MRL | <MRL |
| Largemouth bass | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Pumpkinseed | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| White perch | <MRL | 3.71 | <MRL | <MRL | <MRL | <MRL | <MRL |
| Yellow perch | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Mashpee-Wakeby Pond | Waterbody average | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Chain pickerel | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Largemouth bass | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Pumpkinseed | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Smallmouth bass | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| White perch | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| White sucker | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |
| Yellow perch | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL | <MRL |

*Values reported as µg/kg (parts per billion, ppb)*

*Max concentration used if fewer than three fish collected per species; average concentration calculated if three or more species collected per species*