Maryland
Department of
the Environment

Overview of MDE's PFAS Work in Surface Water, Crabs, Oysters, and Fish

May 2022

MDE's PFAS Goals

The risk posed by exposure to PFAS is an emerging and evolving national concern. Maryland is focused on:

- **Understanding the risk** through sampling, science, and assessment
- **Communicating the risk** through public information, and outreach
- **Reducing unacceptable risks** through appropriate funding, regulation, partnerships, and agency coordination

MDE is putting a priority on the implementation of a science-based comprehensive plan for PFAS risk that is focused first on determining whether there are locations in Maryland where there are unacceptable risks to human health associated with exposures to PFAS and whether there are locations of continuing releases of PFAS compounds.

Maryland's PFAS Scientific Roundtable

- The (PFAS) Science Roundtable sponsored by the University of Maryland Center for Environmental Science (UMCES) in cooperation with the Maryland Department of the Environment (MDE) was held on October 5, 2020, with over 20 scientists and PFAS experts from academia, six federal agencies, and the states of Pennsylvania and Delaware.
- This Roundtable highlighted several areas that impact our program in relation to Aquatic Life and Fish Tissue:
  - toxicity, fate and transport, degradation of PFAS in the environment; human exposure and the most significant pathways; treatment effectiveness; and obtaining accurate measurements of PFAS in various materials
  - Maryland-specific investigations such as "unique food sources of consumption patterns in Marylanders (blue crabs, striped bass); the impact of the freshwater, estuarine, saltwater "gradient" The report for this Roundtable can be found at https://mde.maryland.gov/programs/Water/water_supply/Documents/PFAS-Roundtable2020-10-05.pdf

Funding

- Funding for PFAS projects has been through several different programs:
  - the Watershed Protection, Restoration, and Planning Program
  - Water Supply Program
  - Land and Materials Administration
  - Fish Consumption Advisory/Public Health Program
- There is a Multipurpose EPA Grant used for our more recent studies
- The Fish Consumption Advisory Program temporarily repurposed PCB/Hg monitoring to allocate to PFAS monitoring.

St. Mary's River Pilot Study of PFAS Occurrence in Surface Water and Oysters

- March 2020- public concerns were raised at a Navy sponsored information meeting about potential PFAS compounds reaching surface waters and contaminating oysters St. Mary's River
- MDE initiated a pilot study to assess potential elevated PFAS levels in surface water and oysters in the vicinity of Webster Field Annex.
- MDE also tested water and oysters near Hog Point (located at the mouth of the Patuxent River adjacent to the PAX River Naval Air Station and across the mouth of the Patuxent River near Drum Point.
- The main objective of the pilot study is to assess the occurrence of Per- and Polyfluoroalkyl Substances (PFAS) in surface water and oysters in the study area.
- The study included a reference site in Fishing Bay.
- Sampling locations were targeted to focus on potential source areas and potential areas of concern associated with Webster Field Annex and the Patuxent River NAS.

Methods

- Given the lack of standardized, published analytical methods for non-drinking water sample media, an alternative method based on principles detailed in the EPA 500 series method was utilized by the contract laboratory. Few laboratories advertise shellfish tissue analysis for PFAS.
- The Target Analyte List (TAL) of PFAS compounds utilized in the study comprises 2 suites of PFAS compounds, consisting of 14 PFAS and 36 PFAS analytes. The analytes were chosen based on the availability of certified reference standards.
- Detection levels for PFAS in this study are standard and reasonable for this type of analysis.
- Commercial lab reporting limits are in the low parts per trillion for aqueous samples and; the low parts per billion for solids such as oyster tissue.
- Before initiating the study, MDE consulted with the Centers for Food Safety and Nutrition (CFSAN) FDA, the contract lab (Alpha Analytical), and USGS regarding sample procedures for collecting oysters and lab methods.

Collection Procedures

- Surface water samples and oyster samples were collected on separate days.
- Field blanks and trip blanks were included during all sample collections.
- Replicate samples were collected at designated locations.
- All samples were shipped following approved sample handling and storage methods and included chain of custody.
- Surface water samples were collected by boat.
- At each site, oyster collection consisted of 2 separate composites of twelve market size oysters each (shucked on the boat).
- One composite included the oyster meats and liquor and the other composite included the oyster meat only. Oyster samples were homogenized at the lab.
- All trip and field blanks were bagged and placed in their designated cooler for shipment and analysis by Alpha Analytical Laboratory.

Results

- Surface water concentrations of PFAS ranged from 2.3 to 13.5 ng/L.

- The study showed no recreational health risks from potential exposure to PFAS.
- There was no pattern in the transects of higher concentrations near the shoreline at the Webster Field Annex.
- PFAS levels were similar across the entire study area, including the reference site.
- **Oyster tissue concentrations were non-detect throughout the study area, based on this data we did not need to issue any advisory for oyster consumption** .

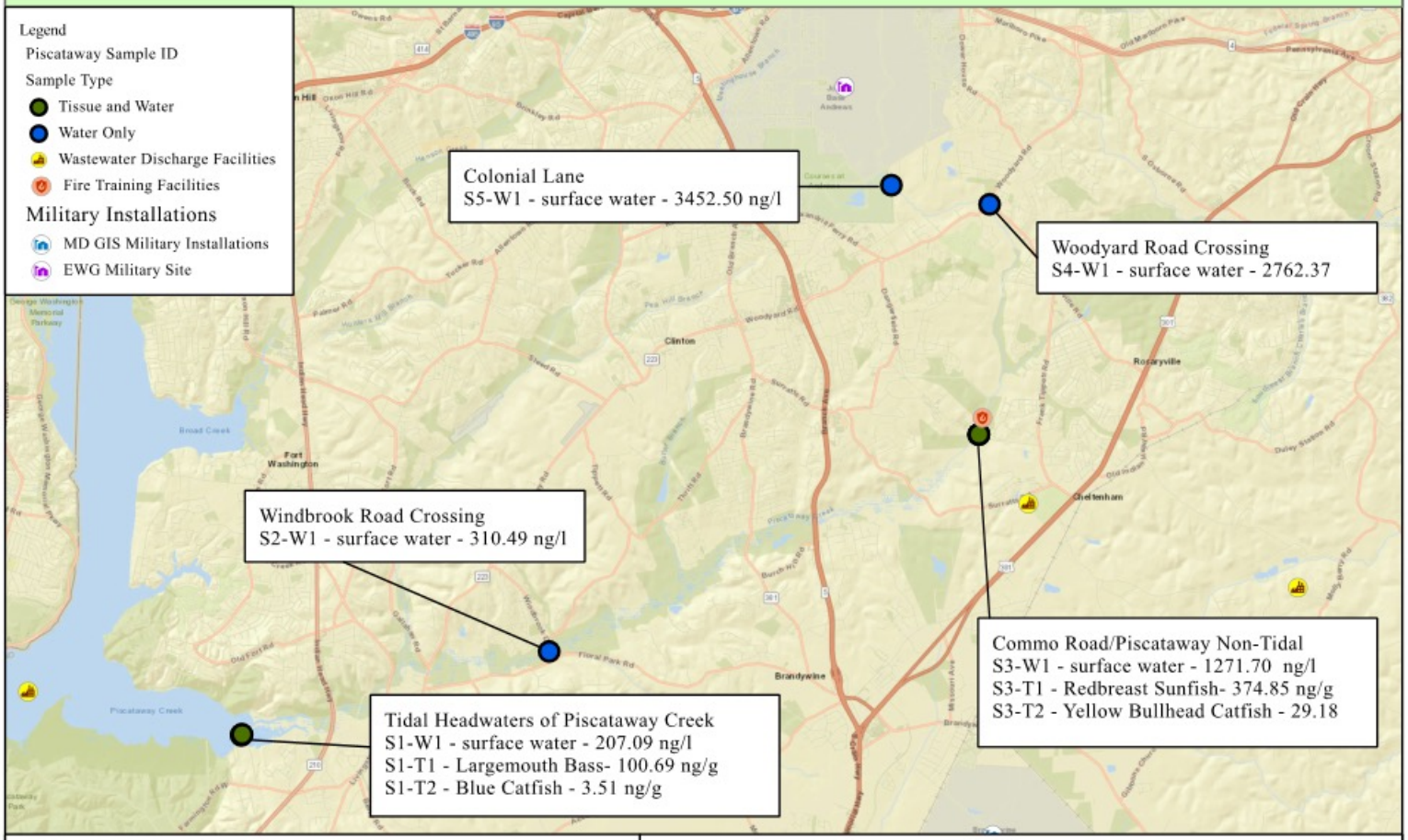
Fall 2020 Fish Tissue Monitoring

- In fall 2020, MDE began its strategic sampling of fish tissue for PFAS in the Eastern Shore Region and a discrete sampling based on potential PFAS sources in Piscataway Creek.
- Nine sites in the Eastern Shore Region were sampled and 19 fish tissue composites were collected.
- The results from the regular Fall fish collection, ranged from ND to 7.29 ng/g, and showed no levels of concern and prompted no further investigation in the Eastern Shore Region.
- It is important to note that surface water samples were not collected with fish samples in the 2020 samples. The monitoring strategy was adapted to collect surface water when collecting fish samples moving forward (after Piscataway Creek).
- While Piscataway Creek was not on the schedule, MDE scheduled to sample fish in Piscataway Creek during the 2020 routine fall collection of fish at core stations.

Piscataway Creek Intensive Sampling

- In late 2020 and early 2021, the Maryland Department of the Environment (MDE) initiated a targeted study of the occurrence of PFAS compounds in surface water and fish tissue in the Piscataway Creek area.
- MDE added two fish tissue sample locations in Piscataway Creek for two reasons: there is a known source PFAS at Joint Base Andrews which is located adjacent to the upper reaches of Piscataway Creek, and the area near the mouth of the Piscataway, where it meets the Potomac River, is popular for recreational fishing.
  - MDE was also aware of a discharge of firefighting foam and the resulting fish kill investigation (on July 31, 2020, from Joint Base Andrews) and data concerning PFAS releases to surface water discussed in the 2018 Site Inspection Report of the Fire Fighting Foam usage at Joint Base Andrews.
- The Piscataway Creek PFAS study included monitoring for PFAS in surface waters and fish tissue in the tidal and non-tidal waters of Piscataway Creek, and Nanjemoy Creek (a reference site with tidal and non-tidal sampling locations similar to and south of Piscataway Creek with no known PFAS sources).

Piscataway Creek PFAS Sampling Project
Piscataway Creek, Potomac River, Prince George's County
Water and Fish Tissue Sampling Results



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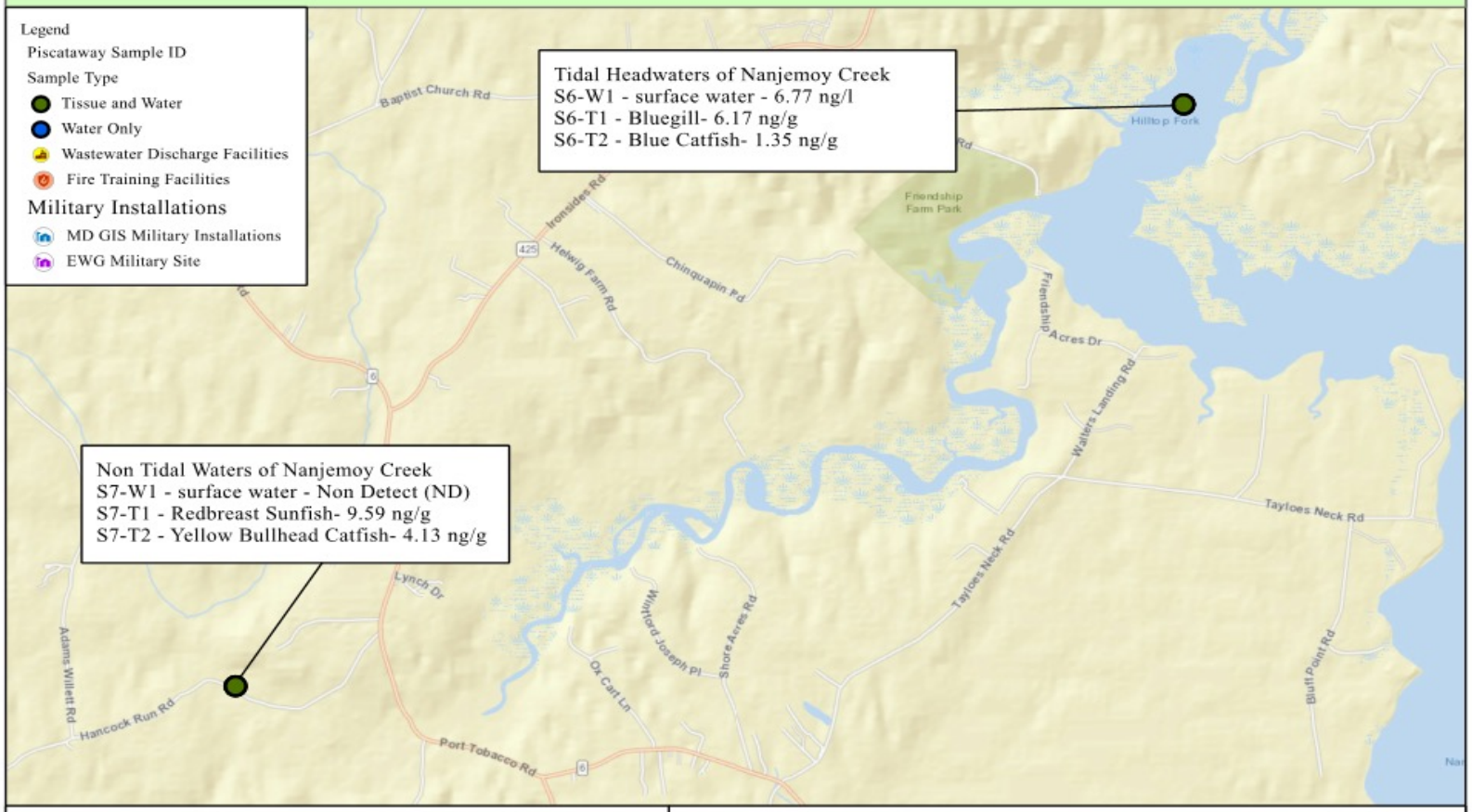
Piscataway Creek PFAS Sampling Project - Reference Site
Nanjemoy Creek, Potomac River, Prince George's County
Water and Fish Tissue Sampling Results



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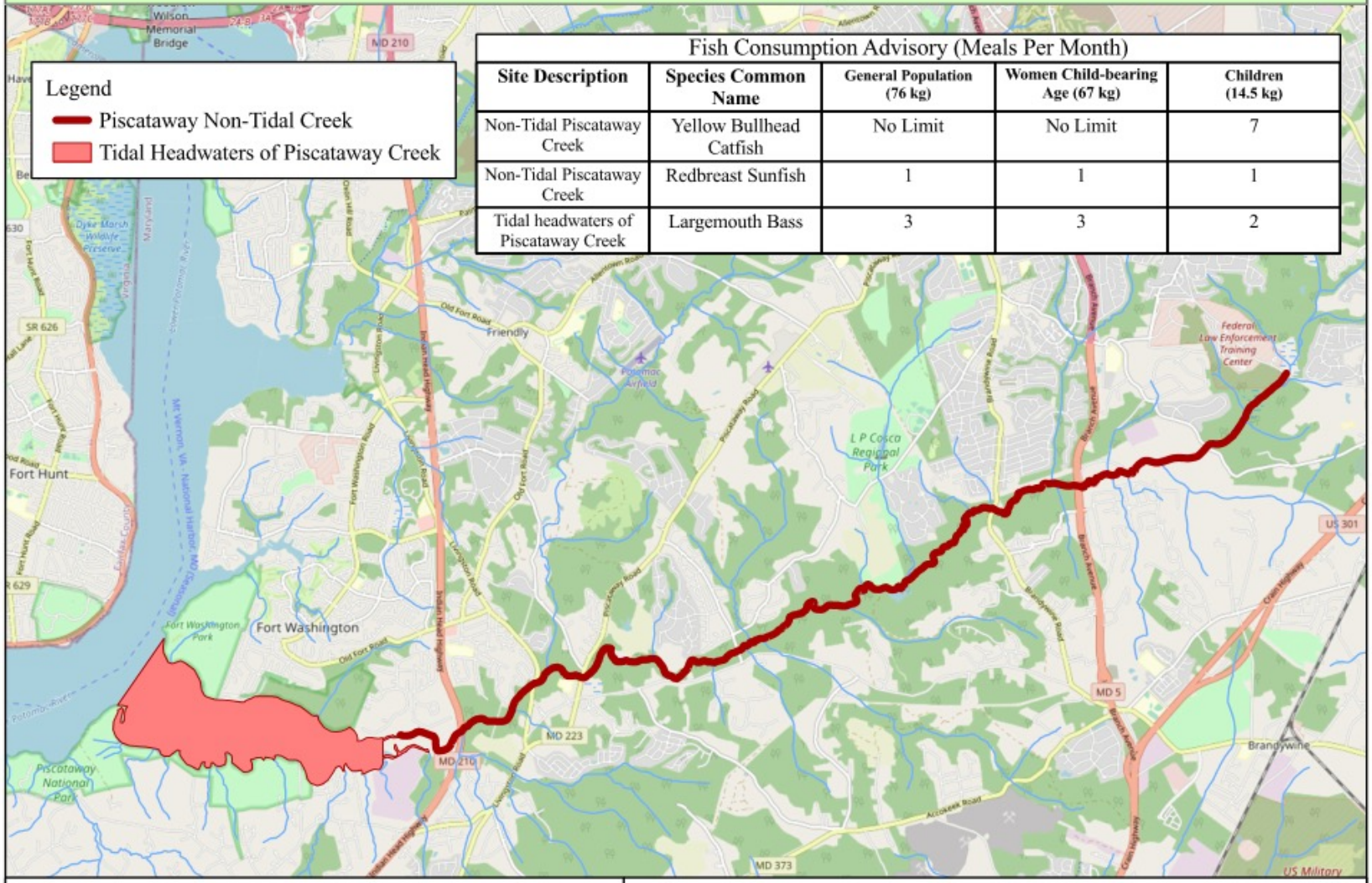
Results – Surface Water

- Surface water concentrations of PFAS ranged from non-detect to 7 ug/L in the Nanjemoy Creek reference stations and from 207 to 3,193 ng/L in the Piscataway Creek study area. The screening values are 17,500 ng/L for PFOA+PFOS and 26,200 ng/L for PFBS for moderate use swimming and 8,770 ng/L for PFOA+PFOS and 13,100 ng/L for PFBS for intensive use swimming.
- Concentrations of PFAS were significantly greater in the Piscataway Creek area relative to the Nanjemoy Creek reference stations indicating the presence of sources of PFAS within the Piscataway Creek study area.
- The concentration of PFAS in the tidal headwaters of Piscataway Creek was 207 ng/L and the dominant PFAS compound throughout Piscataway Creek was PFOS, one of the most persistent, bioaccumulative PFAS compounds.

Results – Fish Tissue

- PFAS was detected in fish tissue and the comparisons to the risk-based site-specific screening criteria for PFOS were in excess for multiple potential exposure scenarios and consumption rates for the largemouth bass and most exposure scenarios for redbreast sunfish in the Piscataway Creek Study area.
- Consumption of yellow bullhead catfish exceeded high intensity (96 meals per year) fish consumption rates for children in the upper reaches of Piscataway Creek, but there is less risk because of several factors.
- MDE's evaluation of the fish tissue samples from Piscataway Creek includes a comparison of measured PFOS fish tissue concentrations to measured concentrations at a reference site (in Nanjemoy Creek) and to a range of MDE-calculated risk-based site-specific fish consumption screening concentrations.
- Based on the MDE fish tissue results, MDE established its first fish consumption advisory based on PFAS.

Piscataway Creek, Potomac River, Prince George's County
PFOS Fish Consumption Advisory



Fish Consumption Advisory (Meals Per Month)

Site Description	Species Common Name	General Population (76 kg)	Women Child-bearing Age (67 kg)	Children (14.5 kg)
Non-Tidal Piscataway Creek	Yellow Bullhead Catfish	No Limit	No Limit	7
Non-Tidal Piscataway Creek	Redbreast Sunfish	1	1	1
Tidal headwaters of Piscataway Creek	Largemouth Bass	3	3	2

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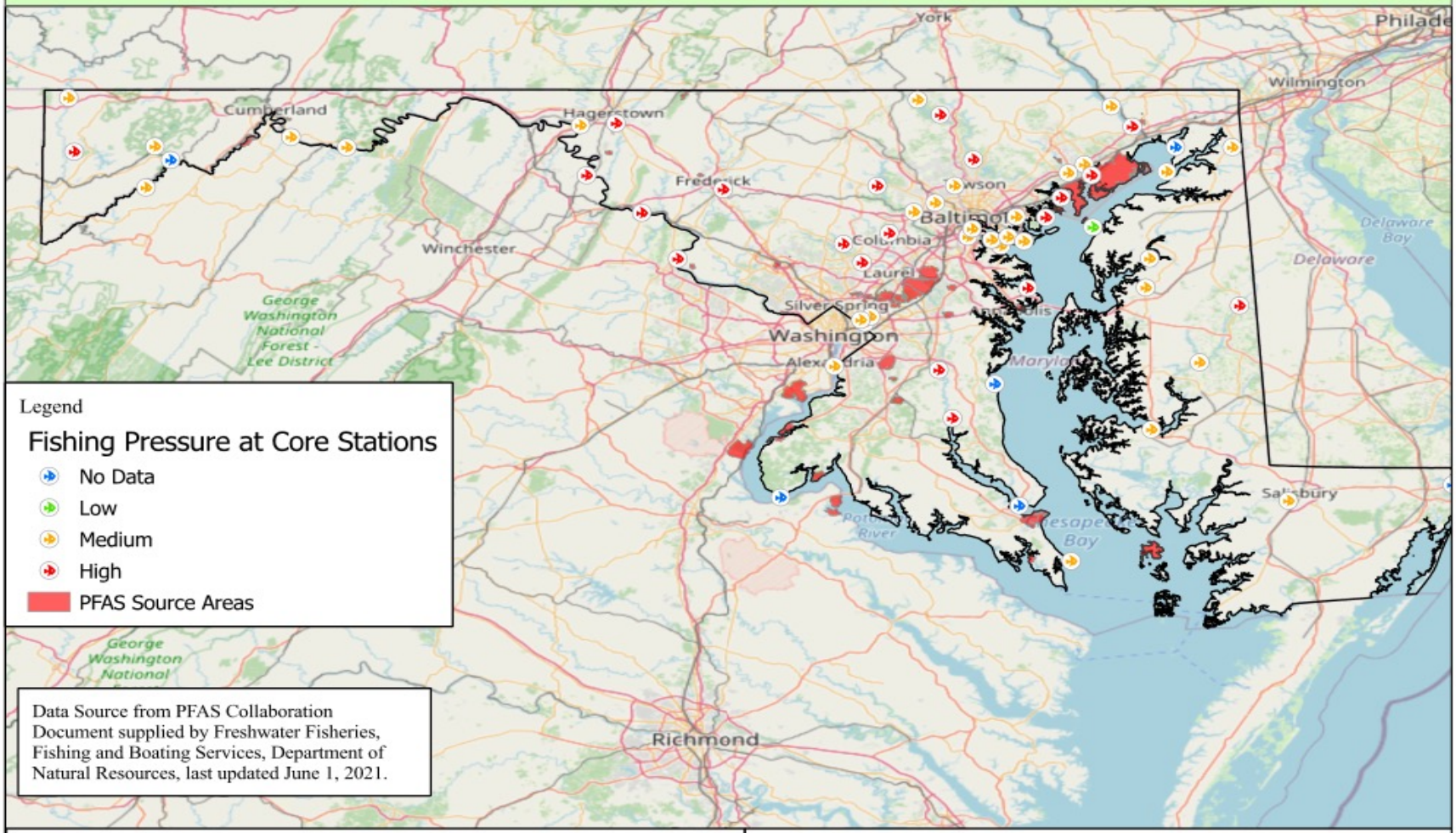
Fish Tissue and Surface Water Monitoring in 2021

- The current regional sampling areas divide the State waters into five core regions:
  - Western Maryland (fresh water) – To be sampled in Fall 2022
  - Metro (non-tidal waters in the Baltimore/Washington metro) – Sampled in Fall 2021
  - Harbors and Bays (tidal waters) – Sampled in Fall 2020
  - Western Bay Tributaries (tidal waters) – To be sampled in Fall 2022
  - Eastern Shore (tidal and nontidal waters) – Sampled in Fall 2020
- Sampling utilizes a two-tiered design: targeted and probabilistic
  - Targeted – Uses previously established monitoring stations and wells
    Probabilistic - sites are selected based on the potential PFAS sources within the area.

Site Selection Considerations

- As additional environmental and human health assessment information is derived regarding PFAS compounds, MDE will pursue updates to its strategy and action plan to ensure protection of public health and natural resources in Maryland.
- It is important to note that this design plan, including species collected, will be adapted accordingly based on early sampling results, emerging data, and public health concerns.

Fishing Pressure at Core Fish Tissue Sampling Stations and PFAS Source Areas



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By: Amy Laliberte
Date: 06/17/2021

Preliminary Results

- In fall 2021, 28 sites were sampled
  - Surface water samples were collected for each site (28 samples)
  - Trip and Field Blanks were collected at each site
  - 68 fish tissue composites were collected
- At each site one sample is to be of the target game species (one fillet from each of five fish), while the other is to be composed of fillets from an accumulator species.
  - Species collected: spot, white perch, silver perch, channel catfish, largemouth bass, blue catfish, yellow perch, bluegill, striped bass, black sea bass, white sucker, redbreast sunfish, rock bass, brown trout, northern snakehead, and pumpkinseed sunfish

Preliminary Results

- Surface water
  - Piscataway Creek Tidal – 225 ng/l
  - Eight sites with ranges 12 ng/l to 36 ng/l – Anacostia River, Patapsco River, Patuxent River, Bynum Run, Winter's Run, Jones Falls, Gwynn's Falls, Bush River
  - All other sites < 10 ng/l
- Fish Tissue
  - Piscataway (follow up sample for LMB) 65 ng/g
  - Eleven Sites with ranges from 10.1 ng/g to 29.6 ng/g - Anacostia River, Patapsco River, Bynum Run, Winter's Run, Jones Falls, Potomac River, Bush River, Gwynn's Falls, Gunpowder River, Middle River, and Choptank River
  - All other sites < 9 ng/g

What PFAS did we find?

- In Surface water:
  - **Perfluorooctanesulfonic Acid (PFOS)**
  - Perfluorobutanesulfonic Acid (PFBS)
  - Perfluorohexanoic Acid (PFHxA)
  - Perfluoroheptanoic Acid (PFHpA)
  - Perfluorohexanesulfonic Acid (PFHxS)
  - Perfluorooctanoic Acid (PFOA)
  - Perfluorononanoic Acid (PFNA)
- In Fish Tissue:
  - **Perfluorooctanesulfonic Acid (PFOS)**
  - Perfluorononanoic Acid (PFNA)
  - Perfluorohexanesulfonic Acid (PFHxS)
  - Perfluorodecanoic Acid (PFDA)
  - PerfluorouND1ecanoic Acid (PFUnA)
  - Perfluorododecanoic Acid (PFDoA)
  - Perfluorotridecanoic Acid (PFTrDA)
  - Perfluorotetradecanoic Acid (PFTA)

Screening Levels

- The Department derived screening values based on the current EPA RfDs for PFOS, PFOA and any other PFAS that had peer reviewed RfDs *at the time* the data was evaluated
- Exposure assumptions to derive oyster and fish consumption screening concentrations as well as recreational surface exposure while swimming and wading were based upon MDE consumption rates, conservative exposure frequencies and site-specific factors
- Utilized a range of populations including children and women of child-bearing age

Bioconcentration

- Data appears to indicated certain PFAS, most specifically PFOS, have significant variability between fish species and do not appear to accumulate in certain mollusks and crustaceans, additional data is necessary to validate and define these cursory findings
- The dominant compound identified in fish tissue is PFOS
- Species like channel catfish had significantly less PFAS than largemouth bass, sunfish and perch, questions on species diet and food chain dynamics exist
- Mollusks have not identified concentrations of PFAS to date within the Chesapeake
- Crustacean data is in the works

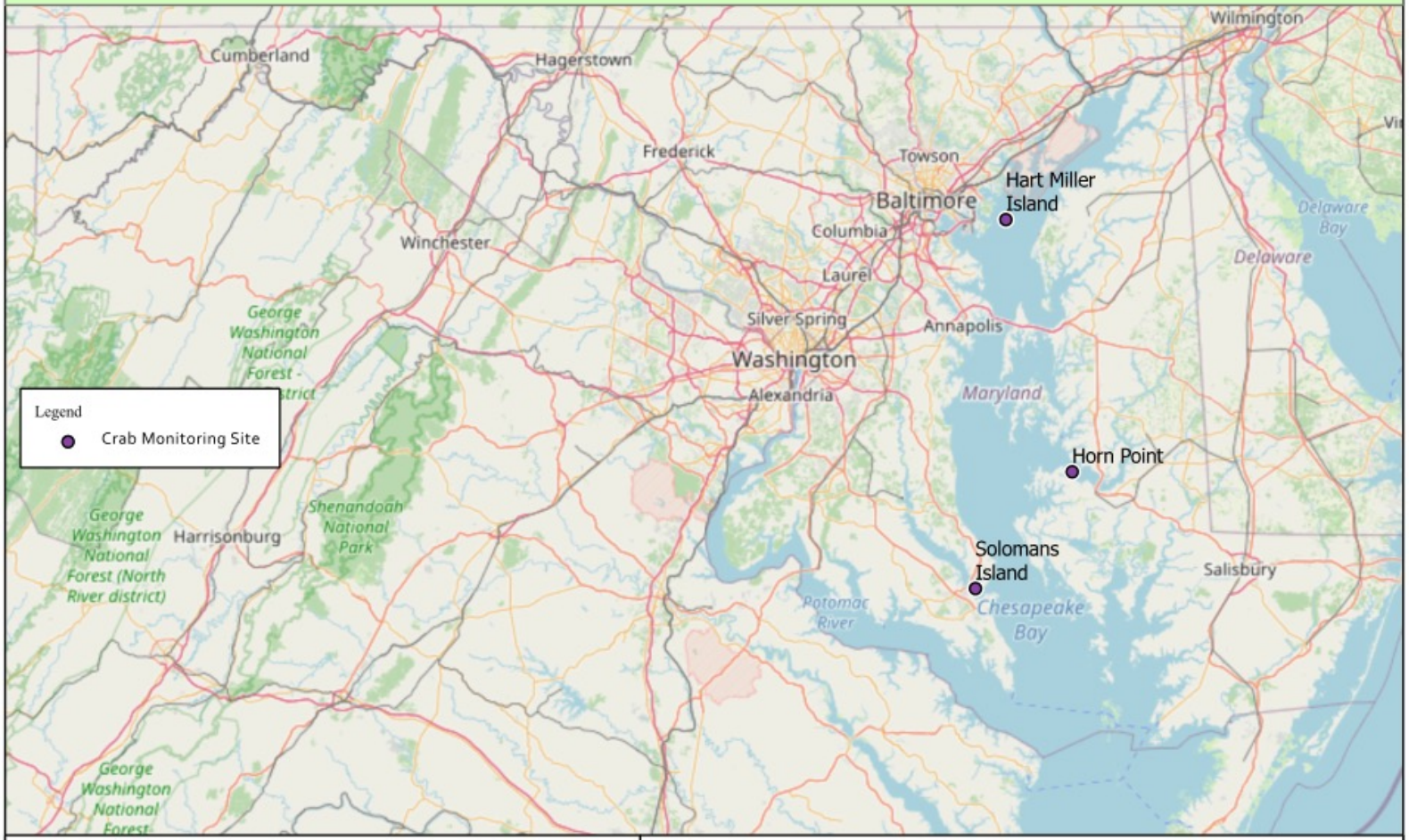
Reference Dose (RfD)

- As updates to current RfDs are advanced and new RfDs developed the MDE will update fish consumption advisories
- To date PFAS has been identified in fish tissue throughout the Chesapeake and within surface waters. Concentrations in fish tissue are below screening concentrations in most water bodies, however, the science is evolving rapidly and MDE is prepared to respond and advise accordingly

Current and Future Monitoring Plans – Spring, Summer, and Fall of 2022

- Spring 2022 – Striped Bass Collection: DNR has collected composites from (1) the Upper Bay, (2) Middle Bay (Choptank River), and (3) Lower Bay (Potomac River), in composites in two size ranges 19”– 24” and >24”. These fish will be analyzed to put out a general message on consumption safety of our state fish.
- Summer 2022 - Crab collection is tentatively proposed for (1) Solomons Island, (2) near Hart Miller Island, and (3) around Horn Point. Sampling would be for meat and hepatopancreas. If any results for crab samples are elevated, the Department would resample that location to confirm the original findings, and then develop an area-specific plan to collect more data, before applying a broad consumption advisory.
- Fall 2022 – Remaining Core Regions will be sampled, as well as any sites that were missed during previous collections. Any areas not covered by core fish site sampling (Piscataway Creek, BWI airport, Potomac River mainstem) will be sampled, after discussion of most appropriate location. Any sites with concerning results will be targeted for an intensive monitoring plan (like Piscataway Creek).

Crab Monitoring Sites for PFAS



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Where can I find the Data?

- Most of our data can be found on the MDE website at the PFAS Landing Page: https://mde.maryland.gov/PublicHealth/Pages/PFAS-Landing-Page.aspx

- EPA's Water Quality Portal (https://www.epa.gov/waterdata/water-quality-portal-data-discovery-tool)
  - All fish tissue data collected by MDE (2020 – 2021) has been uploaded and is available to the public.

Tips to other States

To States that are just starting (or thinking about) their PFAS Journey

- **Enhanced Expertise** – Gather your experts
- **Strategic Partnerships** – Talk to other states, start collaborating with Universities, local governments/counties, and sister agencies to see where your goals align
- **Find your funding** – It can take time to (1) find a lab to do analysis, (2) send the contract out bid (because of higher costs), and (3) because this is an emerging contaminant, it can take longer to write the contract/project specifications and longer for in-house review (OAG).
- **Start searching for a lab** - Most labs do not test for PFAS in Fish/Shellfish Tissue, collection procedures are different for PFAS (including transport), standard homogenization techniques vary between labs, and the holding times and storage times differ between labs.