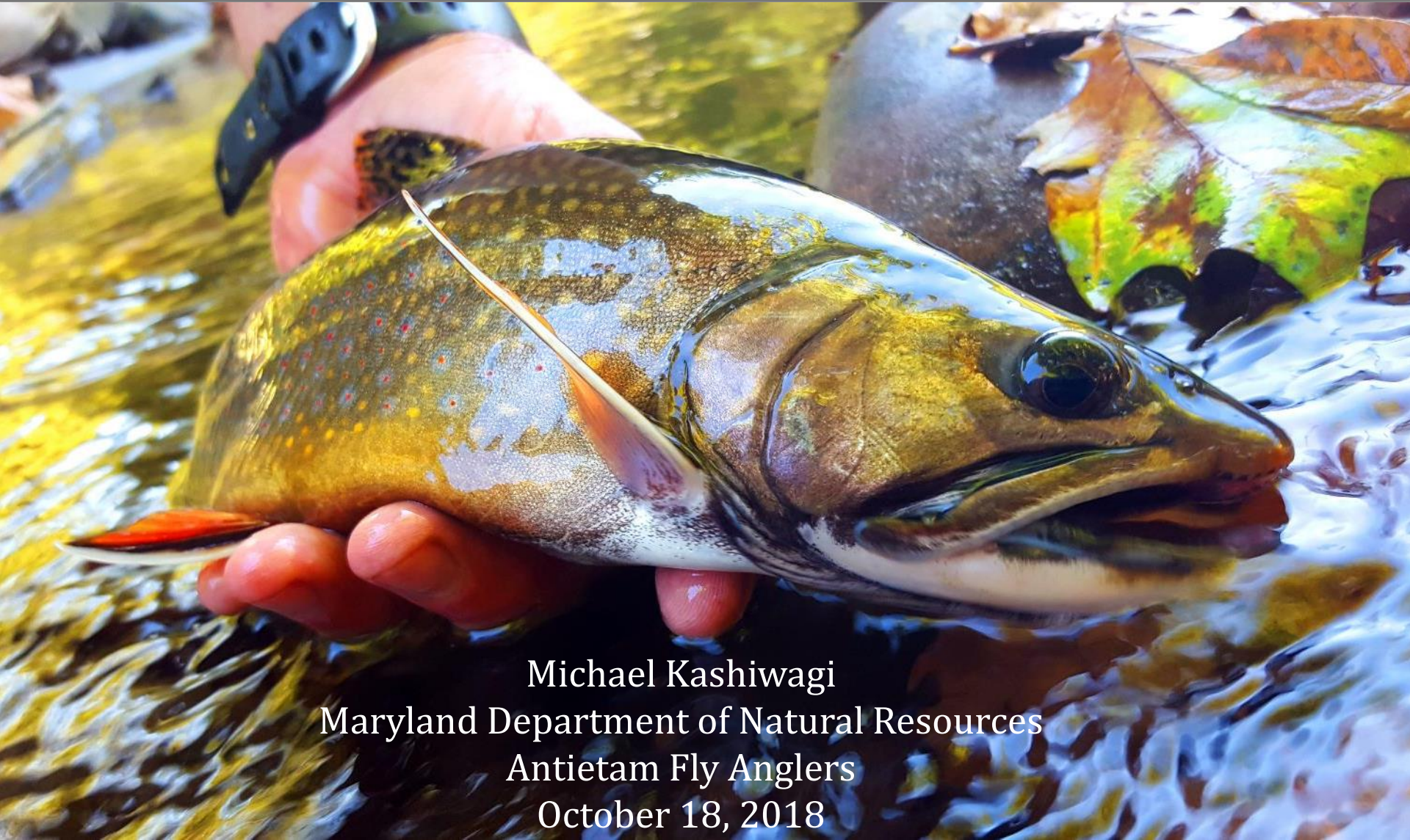


Brook Trout Distribution and Status in Central Maryland



Michael Kashiwagi
Maryland Department of Natural Resources
Antietam Fly Anglers
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Trout in Maryland

- Three species of trout occur in Maryland: brook, brown, and rainbow trout
- Brook trout are the only “native” species of trout in Maryland. Brown and rainbow trout are introduced species



Brown Trout



Rainbow Trout



Brook Trout

Wild Trout Life History

- Brook trout & brown trout spawn in the fall – mid-October to mid-November; rainbow trout spawn late winter - early spring, as early as mid-February
- Spawning areas are in cobble/gravel (marble to pea size) with upwelling flows and/or in shallow riffle areas with constant flow
- Constant flow keeps eggs oxygenated and clean of sediment - trout eggs are highly susceptible to mortality from sedimentation
- Spawning periods, egg incubation, and fry life stages are extremely sensitive and critical periods



Brook trout establishing a redd in a gravel area with adequate flow

Wild Trout Life History

- Eggs are deposited and fertilized in a redd (nest) built by the female, then buried 1"- 2" deep in gravel
- Eggs develop in the redd for a period of several months and hatching typically occurs during early spring (brook and brown trout) or late spring (rainbow trout)
- Fry emerge from the redd with a yolk sac used to sustain them until they transition to a diet of zooplankton
- The yolk sac is eventually absorbed as the fry transition to the free swimming fingerling life stage



Developing eggs



Fry with yolk sac



Fingerling stage

The Maryland Department of the Environment Use III (non-tidal coldwater) stream closure period (October 1 - April 30) was established to protect these critical life stages: COMAR 26.17.04.11

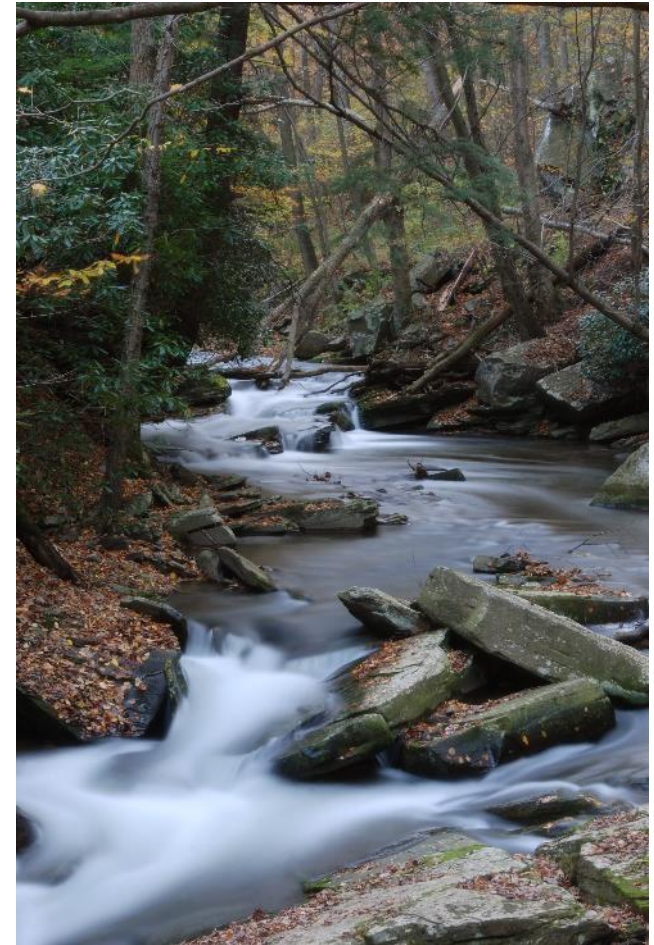
Wild Trout Life History



	Brook Trout	Brown Trout	Rainbow Trout
Life Span	Up to 8 years, but typically 4-5 years	Up to 10 years	Typically 5-7 years
Size	Up to 14", but typically 4"-10"	Up to 25", larger fish typically in larger rivers	Up to 25", larger fish typically in larger rivers
Diet	Primarily insects in all life stages	Primarily insects as young trout; insects, fish and small mammals as adult trout	Primarily insects, but large adult trout may prey on other fish

Habitat Requirements

- Trout are a “**Coldwater**” species that require specific habitat conditions
- **Primary importance is cold water year round.** In general, trout prefer water temperatures $<20^{\circ}\text{C}$ (68°F)



Habitat Requirements



- Clean substrate that includes cobble and gravel areas with flow – supports insect life (trout food) and needed spawning areas for egg incubation
- Streambed complexity – a mix of riffles, runs, and shallow and deep pools (provides habitat for different seasonal and life stage needs)
- Physical structure – boulders, falls, undercut banks, root wads, and in-stream woody debris (provides habitat for different seasonal and life stage needs)



Water Quality Requirements

- High dissolved oxygen levels (>8 parts per million)
- Low turbidity - related to low sediment loading and nutrient levels
- pH ranging from 5.5 to 8.5 (pH of 7 is neutral);
Brook trout - pH from 5.5 - 8.0, the most acid tolerant trout species;
Brown trout - pH from 6.5 - 8.5, prefer neutral to slightly alkaline waters;
Rainbow trout - pH from 6.5 - 8.5, prefer more alkaline waters



Social Benefits

- Important angling resource - provides recreational opportunity around the state. 70% of Maryland trout anglers fish for wild trout at least some of the time.
- Locations where wild trout occur are typically more natural, wild areas, which adds value to these areas and angling.
- Presence of wild trout fosters a connection to the past and how environmental conditions used to be. This encourages and promotes conservation.
- Provides a self sustaining resource. No stocking needed = maximize resource and return to economy.



Economic Benefits

2016 Maryland Non-Tidal Angler Survey



Participation: 44% of freshwater anglers in Maryland fish for trout (53,000 anglers)

Effort: 27% of trips were for trout (689,000 trips)

Trip Expenditures: \$81 mean; \$30 median; Total - ***\$56,000,000 annually***

Stocked Trout



Participation: 39%; 47,000 anglers

Effort: 13% of trips; 345,000 trips

Trip Expenditures: \$79 mean; \$30 median; Total = \$27,000,000

Brown Trout



Participation: 17%; 20,000 anglers

Effort: 5% of trips; 139,000 trips

Trip Expenditures: \$113 mean; \$65 median; Total = \$16,000,000

Brook Trout



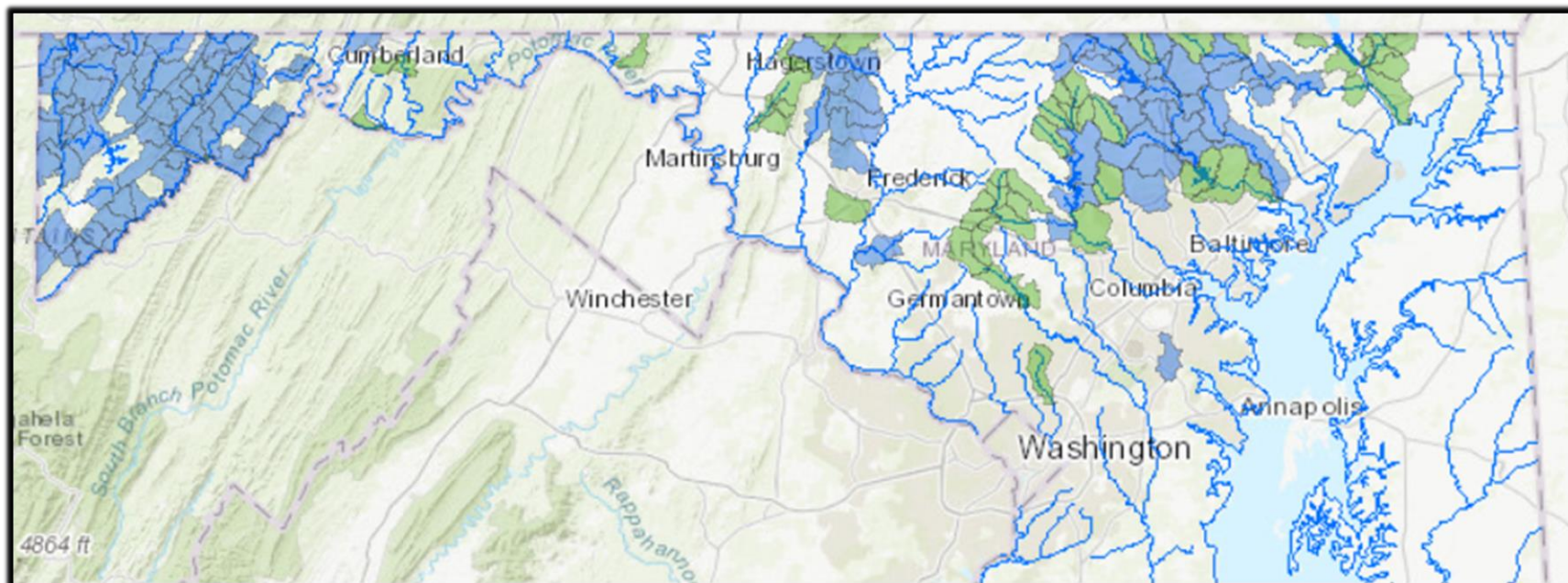
Participation: 18%; 22,000 anglers

Effort: 3% of trips; 74,000 trips

Trip Expenditures: \$131 mean; \$84 median; Total = \$10,000,000

Status in Maryland

- Wild trout populations occur in 11 of Maryland's 24 counties
- 132 watersheds support wild trout: brown trout (97), brook trout (93), and rainbow trout (12) (some watersheds > 1 species present)

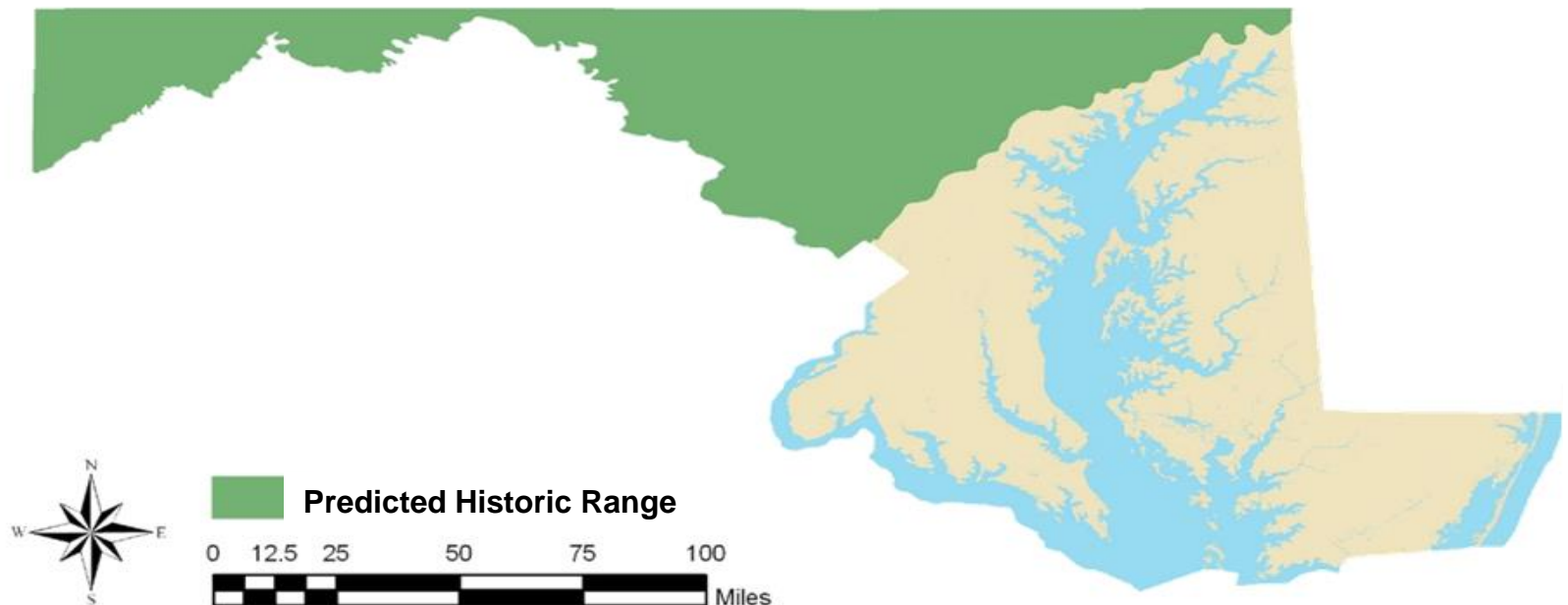


Coldwater Resources Mapping Tool:

maryland.maps.arcgis.com/apps/webappviewer/index.html?id=dc5100c0266d4ce89df813f34678944a

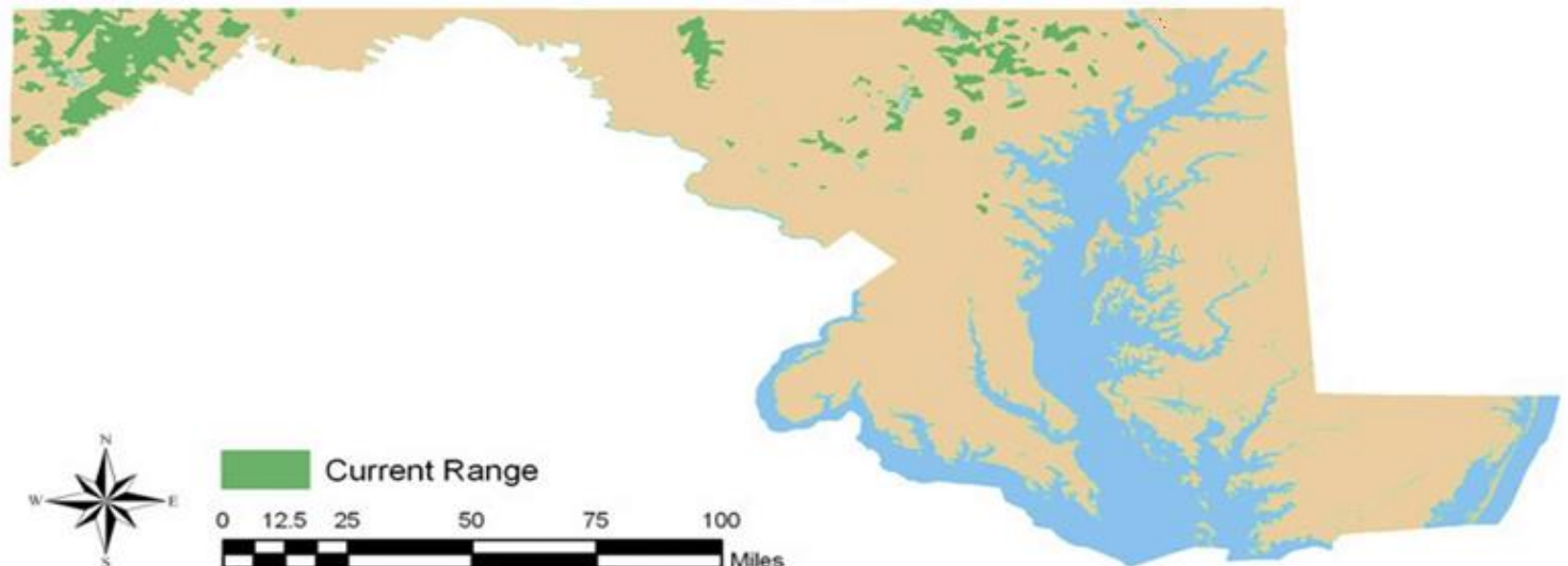
Population Trends

- Because of the stringent habitat requirements for wild trout they are under threat from disturbances to the landscape.
- The change in native brook trout distributions in Maryland starkly illustrates the challenge of maintaining and protecting wild trout populations...



Population Trends

- Because of the stringent water and habitat requirements for wild trout they are under threat from disturbances to the landscape.
- The change in native brook trout distributions in Maryland starkly illustrates the challenge of maintaining and protecting wild trout populations.



Threats to Trout and Habitat



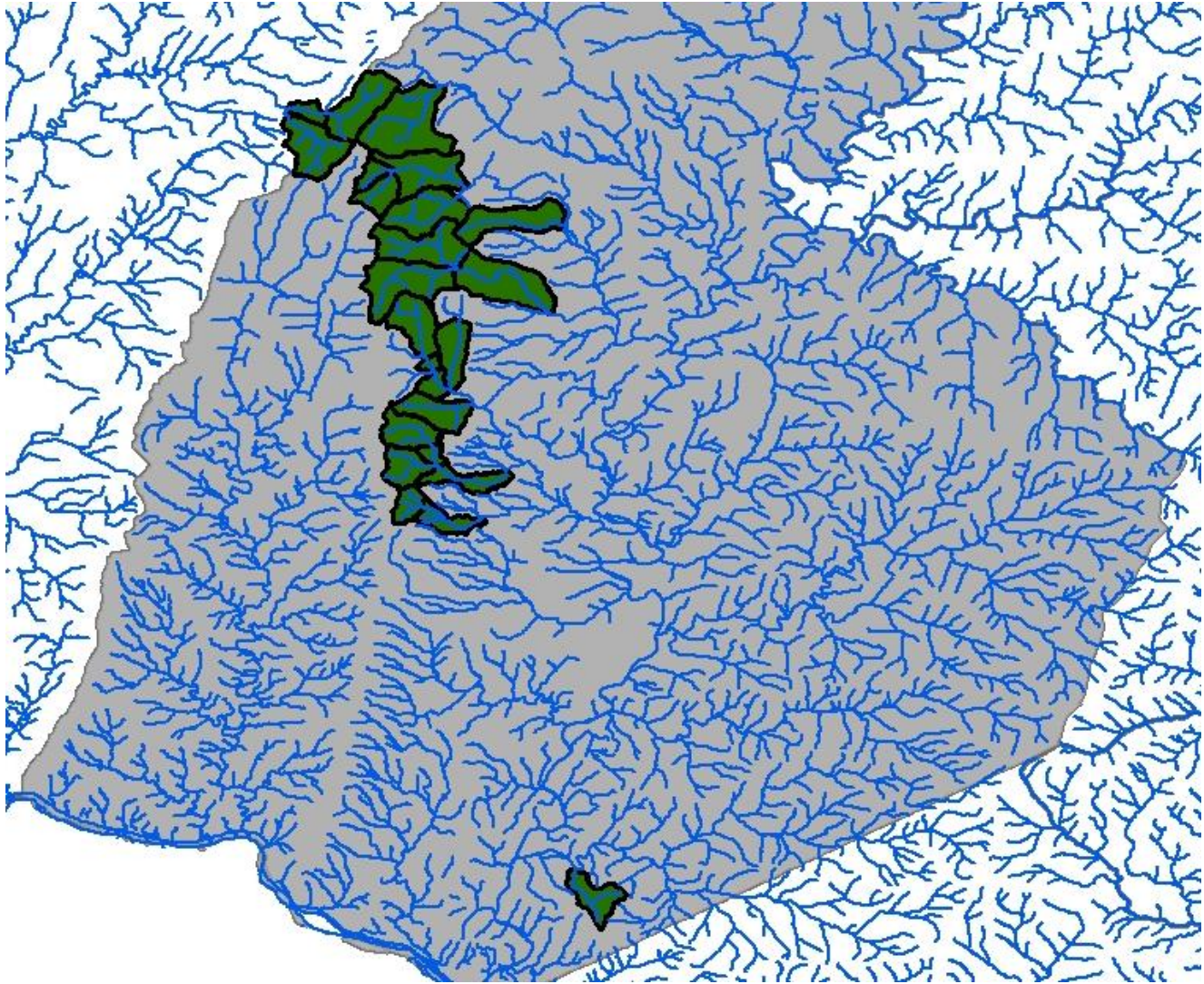
Because of their life history and cold water needs, trout are particularly vulnerable to disturbance...



Examples of Typical Threats:
Urbanization/impervious surfaces
Loss of Riparian Buffer
Warmwater Runoff
Acid Mine Drainage (AMD)
Sediment Loading
Water Withdrawals
Dam Inundation/Fragmentation



Central MD Brook Trout Watersheds



Protection of Trout and Habitat

- Special Fisheries Regulations
 - 2 fish daily creel, trophy trout, catch-and-release, artificial lures only, zero creel, etc.*
- Outreach to Decision Makers/Stakeholders
- Annual Statewide Monitoring of Wild Trout Resource Distributions
- Environmental Review



Special Regulation Area



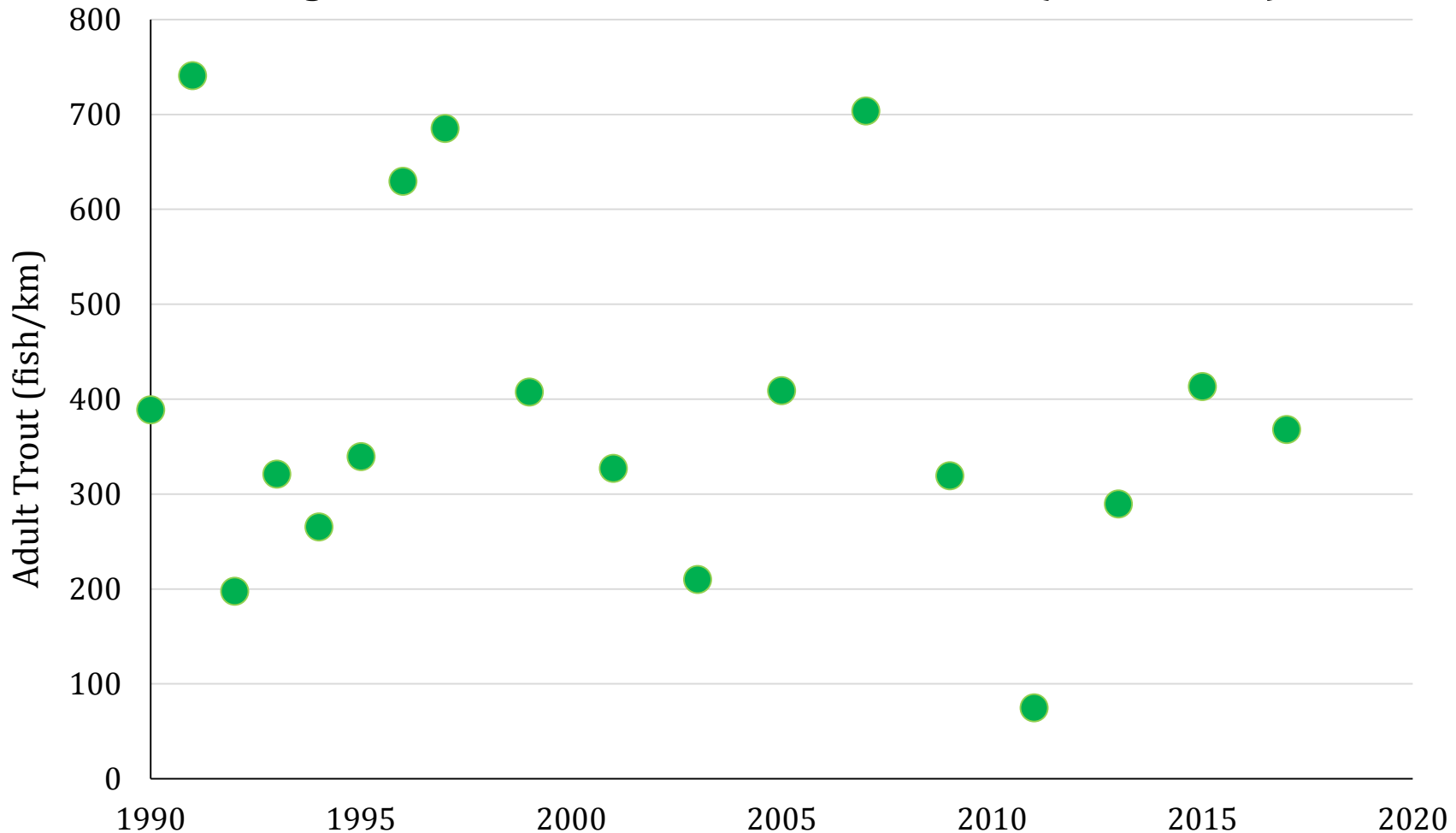
Conducting Environmental Review



Trout population Survey

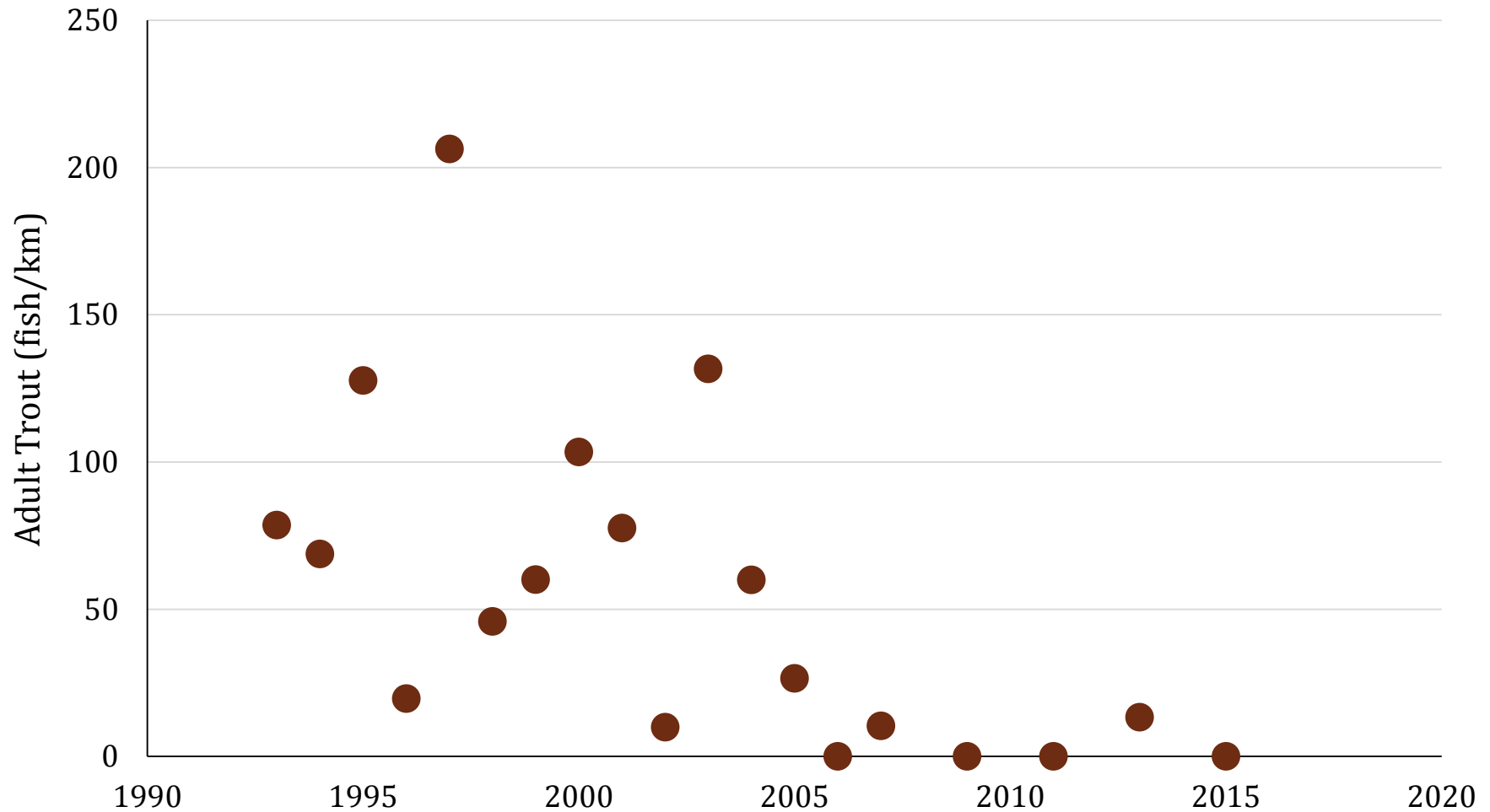
Fishing Creek

Right Fork - Adult brook trout numbers (1990-2017)



Little Hunting Creek

Manor Area - Adult brook trout numbers (1993-2017)



Interspecies Competition

Multiple studies have looked at trout species interactions

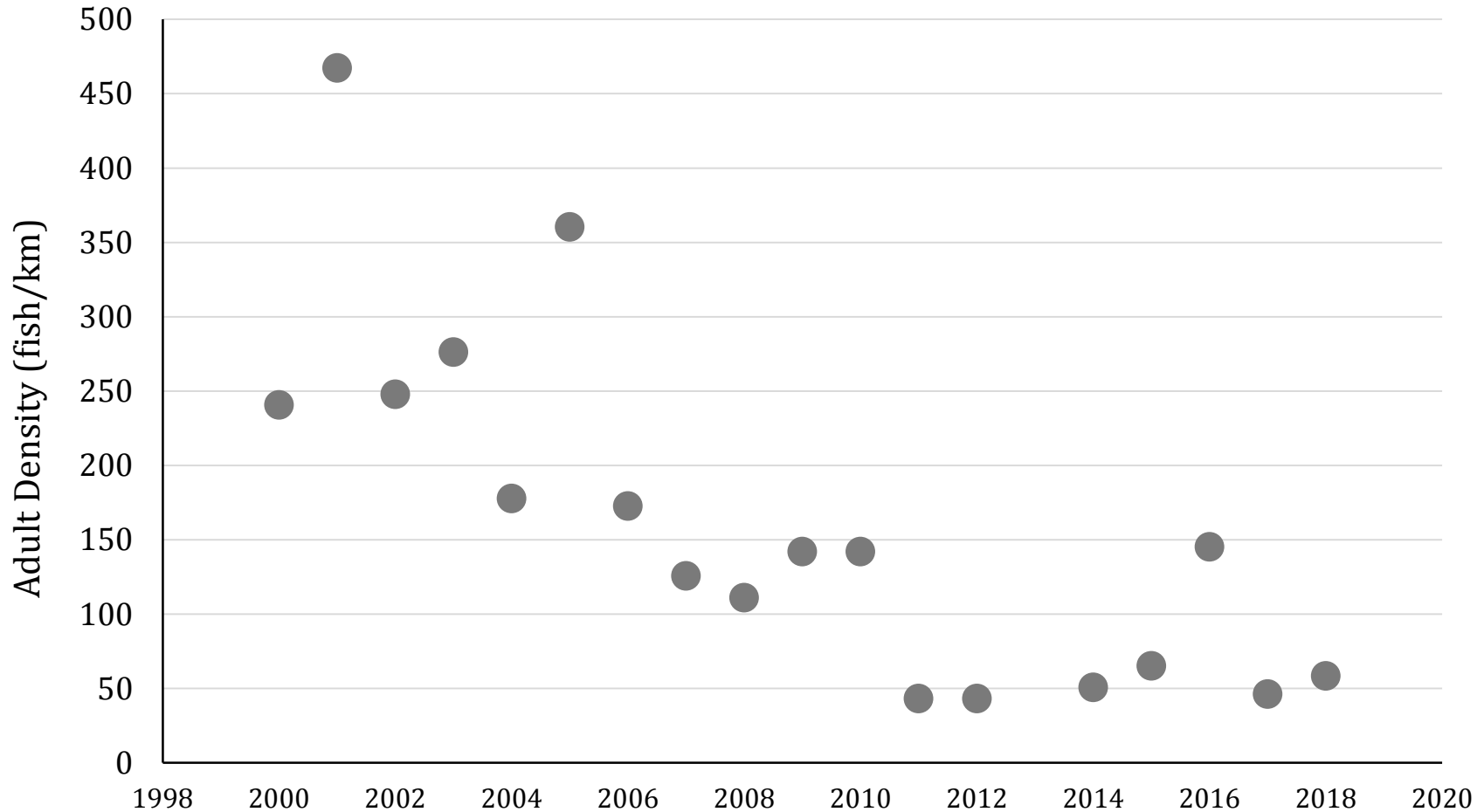
- Brown trout have competitive advantage
 - Larger size
 - Tolerate warmer temperatures
 - Occupy prime habitat locations
 - Spawning
 - Thermal refugia
- Reduction in brook trout population densities



Big Hunting Creek



Hemlock Bridge - Adult brook trout numbers (1988-2018)



Big Hunting Creek

Brown Trout Relocation Project

Collaborative effort between

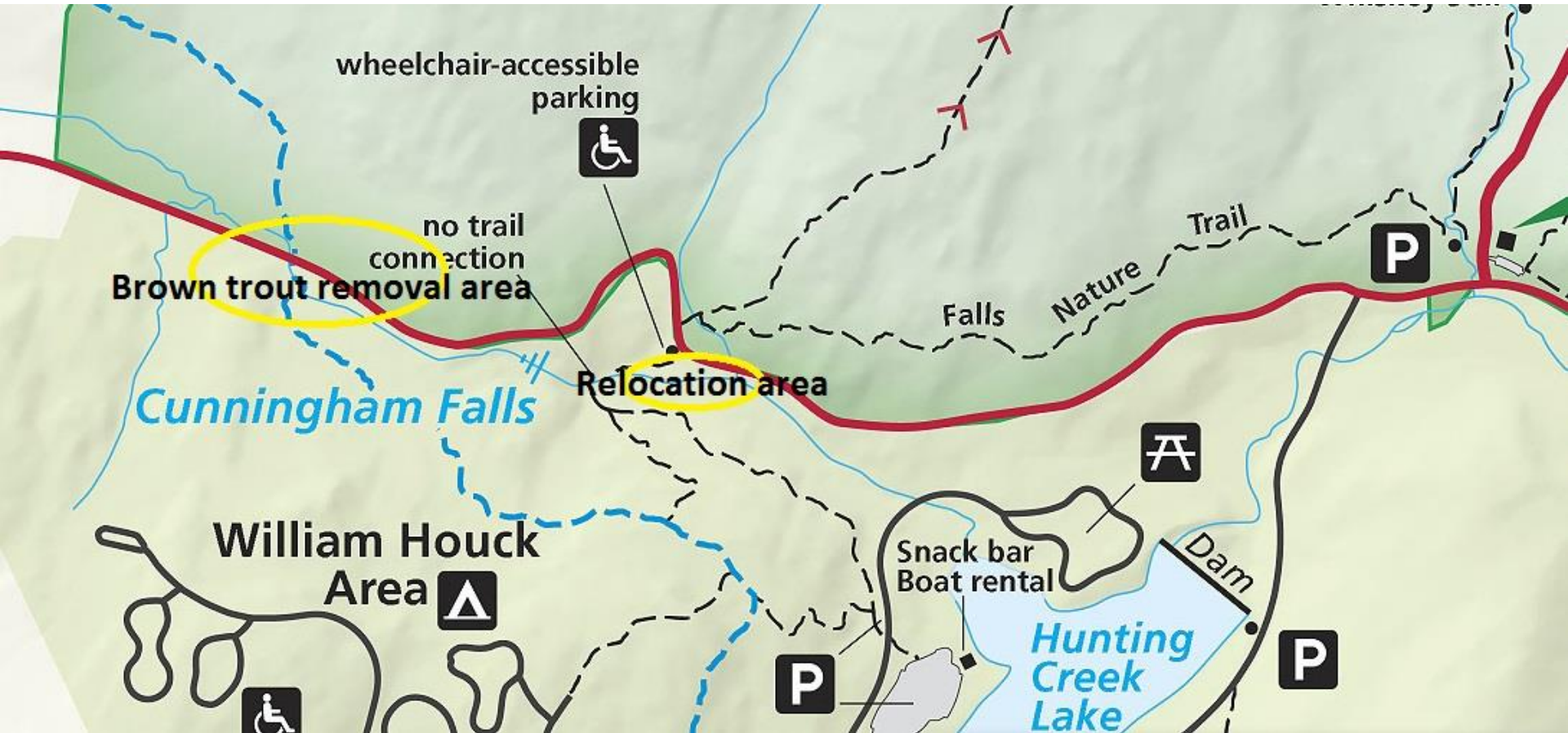
- MD DNR – Freshwater Fisheries
- USGS Leetown Science Center
- Catoctin Mountain NP

Hemlock Bridge Station

- Sampled ~ 0.6 km of stream
- Moved 230 brown trout (adult, YOY)
- Returned 50 brook trout
- Monitoring and relocation efforts will continue for next 2-3 years



Big Hunting Creek



Brook Trout Stocking

Identify potential locations that could be stocked with brook trout

- Stocking criteria
 - Temperature conditions (<20°C)
 - Watershed land use (<3% impervious surface)
 - Benthic insect community
- Property
 - Public/private
 - Angler access
- Continue looking for existing wild brook trout populations



Questions



Maryland DNR – Freshwater Fisheries

Michael Kashiwagi

Michael.kashiwagi@Maryland.gov

301-898-5443