Assessing Previously Unknown Brook Trout Streams in Pennsylvania.

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Pennsylvania Streams

All streams of PA have a designated use

- Huge resource
- 8,011 named tributaries: 37,386 total miles
- 54,714 un-named tributaries: 45,900 total miles
Total: 62,725 streams, 83,286 miles

Use determined by DEP

- Wetlands located in or along floodplain of wild trout streams protected as Exceptional Value Wetlands.
Pennsylvania Streams

Lack of assessment of tributary streams
- 52% of named, 2% of un-named tributaries sampled

Inadequate water quality protection
- Unassessed waters likely contain trout

Potential for expansion of wild trout waters
PFBC Unassessed Waters Initiative
PFBC Unassessed Waters Initiative

**Goal**
Proactively identify and properly classify the most at-risk streams which support naturally reproducing trout populations in order to protect, conserve and enhance those waters as wild trout streams.
PFBC Unassessed Waters Initiative

Unassessed Waters Initiative Partners

- Allegheny College
- Clarion University
- Western Pennsylvania Conservancy
- Duquesne University
- California University of Pennsylvania
- Indiana University of Pennsylvania
- Penn State University
- Juniata College
- Trout Unlimited
- Lock Haven University
- Mansfield University
- Lycoming College
- Loyalsock Creek Watershed Association
- Bucknell University
- Susquehanna University
- Kings College
- Keystone College
Methodology

Targeted Watersheds and GPS points given by PFBC to cooperators.

Cooperators trained by PFBC on standard methods.

**Basic data**
- Physical data
- Water chemistry data
- Fisheries data

**Additional Data**
- Additional fish data
- Aquatic macroinvertebrates
- Water chemistry analysis
- Trout diets
- Algal scrapings
Extent of Unassessed Waters beginning of 2009

From: R. Weber, PFBC

Surveyed Sections

Unassessed Sections
Extent of Unassessed Waters beginning of 2015

From: R. Weber, PFBC
### Unassessed Waters Initiative
**Number of Tributaries Sampled**

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Streams sampled</strong></td>
<td>303</td>
<td>742</td>
<td>868</td>
<td>1090</td>
<td>1060</td>
<td>892</td>
</tr>
<tr>
<td><strong>% Wild Trout</strong></td>
<td>54%</td>
<td>55%</td>
<td>52%</td>
<td>38%</td>
<td>48%</td>
<td>40%</td>
</tr>
<tr>
<td><strong>By partners</strong></td>
<td>86</td>
<td>437</td>
<td>606</td>
<td>766</td>
<td>724</td>
<td>522</td>
</tr>
<tr>
<td></td>
<td>(28%)</td>
<td>(59%)</td>
<td>(70%)</td>
<td>(70%)</td>
<td>(68%)</td>
<td>(59%)</td>
</tr>
<tr>
<td><strong>By Susquehanna U</strong></td>
<td>n/a</td>
<td>83</td>
<td>66</td>
<td>192</td>
<td>172</td>
<td>104</td>
</tr>
<tr>
<td></td>
<td>(11%)</td>
<td>(8%)</td>
<td>(18%)</td>
<td>(16%)</td>
<td>(12%)</td>
<td></td>
</tr>
</tbody>
</table>

**6 Year Total** – 4,955 tributaries Sampled

Since 2010, 667 new tributaries added to the wild trout list (1,741 miles)

From: R. Weber, PFBC
Susquehanna University
Unassessed Waters Sampled 2011-2015

Presence of trout

Total N = 617
N = 194
N = 320
N = 103

- Yellow: Dry
- Green: Trout Present
- Red: No trout

- Total N = 617
- N = 194: Trout Present
- N = 320: No trout
- N = 103: Dry
Locations of trout species (brook and brown) found in unassessed waters sampled from 2011-2015.
Susquehanna University
Unassessed Waters Sampled 2011-2015

Trout Species

Total N = 320

N= 101
Only Brook Trout

N= 192
Only Brown Trout

N= 27
Brook + Brown
PFBC Wild trout listing procedures

Step 1. Considered for inclusion (listed publicly)
   - Updated every month

Step 2. Officially proposed (listed publicly)
   - Submitted quarterly by PFBC staff to PFBC commissioners

Step 3. Reviewed by PFBC Commissioners at quarterly meeting

Step 4. Officially added to the wild trout list (listed publicly)
   - Managed by PFBC
   - Use maintained by PA DEP
Since 2010, 667 new streams went thru process and have been added to the wild trout list.

- 48 streams sampled by SU of the 667 streams (7.2%) added to wild trout waters list over last 5 years.

Currently 630 streams are on the considered for inclusion list (Step 1).

- 146 streams sampled by SU are of the 630 streams (23.2%) considered for inclusion.

Currently 98 streams are on the new officially proposed list submitted for quarterly meeting on 3/30/2016 (Step 2).

- 0 streams sampled by SU of the 98 streams
351 of the 617 streams sampled by SU were Un-named tributaries.

Previous lack of assessment of this important aquatic habitat.

Over 53,000 Un-named tributaries left to assess across PA
Un-named tributaries
Susquehanna University
Un-named Tributaries Sampled 2011-2015

Un-named Tributaries Presence of Trout

Total N = 351
N = 119
N = 78
N = 154

- Yellow: Dry
- Green: Trout Present
- Red: No trout

Total N = 351
Susquehanna University
Un-named tributaries Sampled 2011-2015

Trout Species

- Only Brook Trout
- Only Brown Trout
- Brook + Brown

Total N = 154
- N= 101
- N= 47
- N= 6
Results

Un-named tributaries are important habitat for brook trout.
- 42% of Un-named tributaries contained brook trout

High quality brook trout streams may exist at high levels in Un-named tributaries across landscape.

Brook Trout Densities
Average 0.16 /m^2
Range 0.01/m^2 to 1.29/m^2
Modeling/Tool for prediction of brook trout in Un-named tributaries

Is there a way to predict probability of occurrence of brook trout in the 53,000+ Un-named tributaries left?
- Approximately 20% are dry, gullies, lack flow
- Many located outside native range of trout

Combine sampling data plus other aspects using GIS at stream reach
- Geology
- Land Cover
- Slope
- Aspect
- Watershed Size
- Length of Un-named tributaries
Modeling/ Tool for prediction of brook trout in Un-named tributaries

Using GIS and multivariate analysis in R

Total of 21 different landscape variables were analyzed to see which ones best predicted brook trout presence and populations.

Initial model used 55 streams in 2 watersheds.
Modeling/ Tool for prediction of brook trout in Un-named tributaries

Initial model predicted the following variables:
- Watershed area
- Soils derived from glacial material
- Agricultural land uses
- Slope
- Aspect

Initial model is able to predict stream reaches with and without fish with a success rate of 86% P = 0.096
Next steps for finding unknown trout streams

• Currently unassessed streams to be surveyed
  - 684 named tributaries
  - 52,925 un-named tributaries

• Accelerated listing of streams by PFBC

• Program to re-survey previously assessed

• Un-named tributary modeling
  Test model with more streams with greater diversity of land use types
  • Mining data
  • Gas well drill sites
  • Roads near tributary mouth
  • Climate information
Next steps for finding unknown trout streams

- Using new high resolution land cover data (1m$^2$) for targeted restoration in Susquehanna River basin with conservation partners.
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Landowners
Questions