Potential influences of climate change on population dynamics of nonnative brook trout and native Yellowstone cutthroat trout in headwater stream networks

Bradley B. Shepard
Wildlife Conservation Society, MSU

Robert Al-Chokhachy – USGS, NoRock

Scott Opitz – MFWP
Clint Sestrich – GNF
Al Zale – USGS and MSU

Jackson Hole One Fly Foundation

Fish illustrations: J. Tomelleri
Yellowstone Cutthroat Decline
Brook Trout Stocking in Montana

Brook Trout Stocking

Number Stocked (millions)

Year


West
East

(Montana FWP database)
Species Composition – 1974 to 2003

<table>
<thead>
<tr>
<th>Year</th>
<th>Section</th>
<th>Creek</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974</td>
<td>1.1</td>
<td>Bangtail</td>
</tr>
<tr>
<td>1985</td>
<td>0.7</td>
<td>Rock</td>
</tr>
<tr>
<td>1990</td>
<td>0.15</td>
<td>Brackett</td>
</tr>
<tr>
<td>2001</td>
<td>1.1</td>
<td>M Fk Brackett</td>
</tr>
<tr>
<td>1974</td>
<td>0.06</td>
<td>Cottonwood</td>
</tr>
<tr>
<td>1990</td>
<td>0.15</td>
<td>Carrol</td>
</tr>
<tr>
<td>2001</td>
<td>3.4</td>
<td>Horse</td>
</tr>
<tr>
<td>1974</td>
<td>5.1</td>
<td>Smith</td>
</tr>
<tr>
<td>1990</td>
<td>0.15</td>
<td>S Fk Shield</td>
</tr>
<tr>
<td>2001</td>
<td>1.1</td>
<td>Mill</td>
</tr>
<tr>
<td>1974</td>
<td>0.7</td>
<td>Deep</td>
</tr>
<tr>
<td>1990</td>
<td>0.2</td>
<td>Bennett</td>
</tr>
<tr>
<td>2001</td>
<td>0.5</td>
<td>Dugout</td>
</tr>
<tr>
<td>1974</td>
<td>0.3</td>
<td>Scofield</td>
</tr>
<tr>
<td>1990</td>
<td>0.3</td>
<td>Turkey</td>
</tr>
</tbody>
</table>

Legend:
- **Cutthroat**
- **Brook**
- **Brown**
- **Rainbow**
- **Whitefish**
Species Composition – 1974 to 2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Section</th>
<th>Creek</th>
<th>Brook Trout</th>
<th>Cutthroat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974</td>
<td>1.2</td>
<td>Deep Creek</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>0.7</td>
<td>Bennett Creek</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>0.2</td>
<td>Dugout Creek</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>0.5</td>
<td>Scofield Creek</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1974</td>
<td>0.3</td>
<td>Turkey Creek</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Flows and Temperatures different in 2011 and 2012

Shields River (near mouth)

Livingston Air Temperature

Mean Flow (cfs)

Mean Temperature (C)
Brook Trout
Relative Contribution of Age-0

Dugout Creek - Brook Trout Catch

- 75+ mm
- <75 mm

Year
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012

Pass 1 Catch/100 m
- 0
- 10
- 20
- 30
- 40
- 50
- 60
- 70
- 80
Conclusions

1. Brook trout are rapidly invading and displacing cutthroat – need to act NOW

2. Climatic conditions may regulate invasion