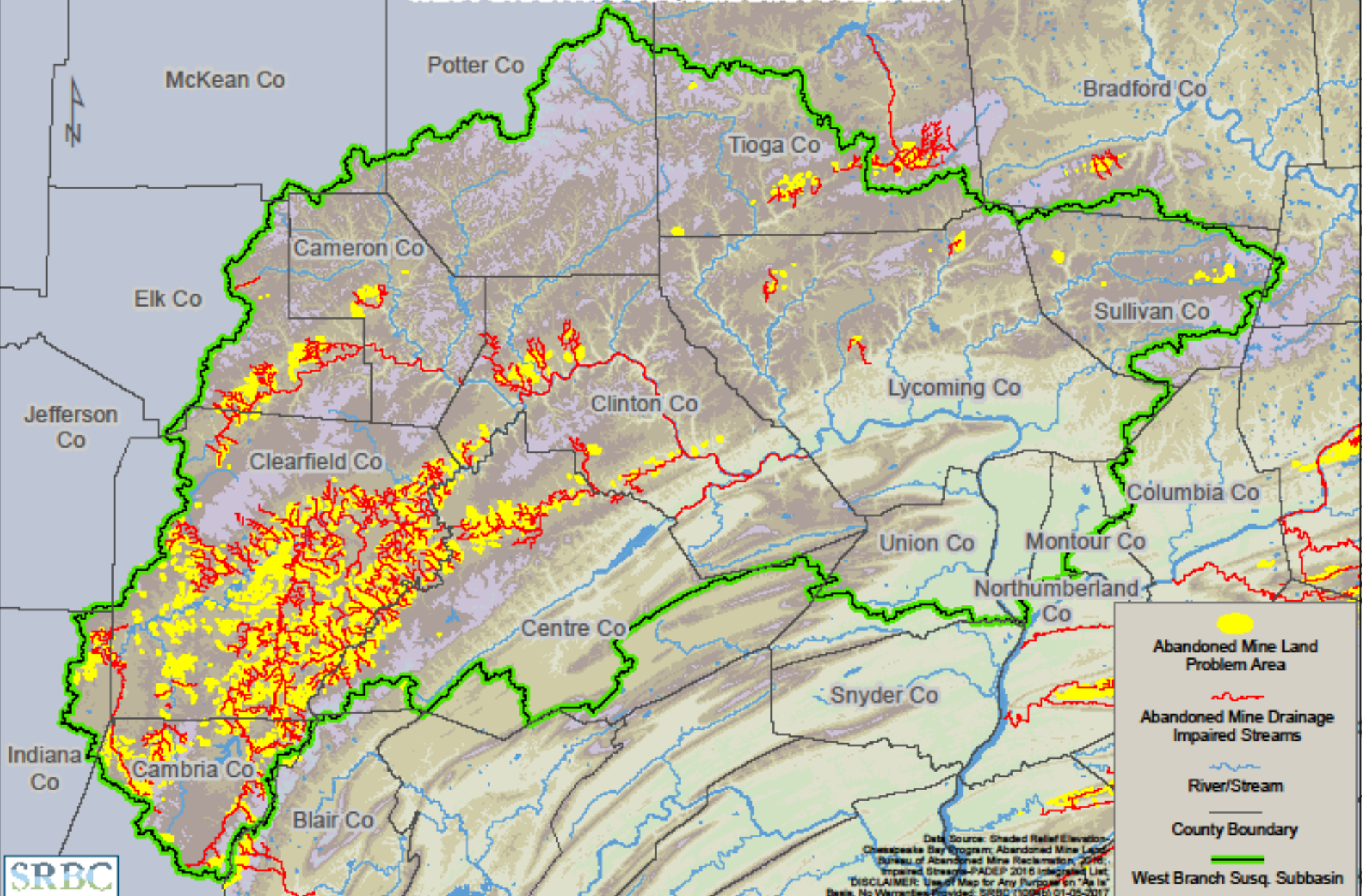


Monitoring Brown Trout Invasion into a Native Brook Trout Stream Post Mine Drainage Remediation: A Cautionary Tale



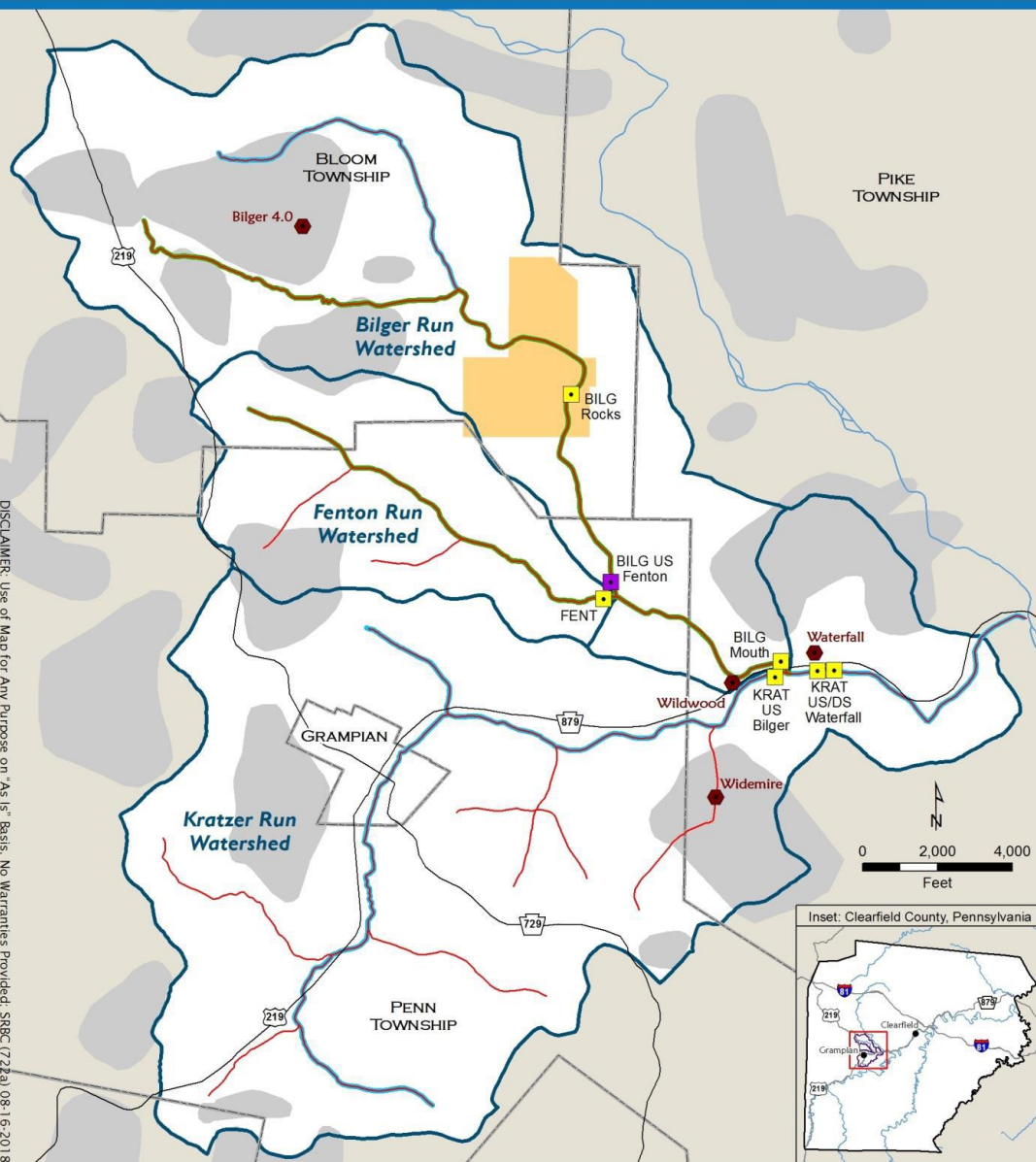
Thomas J. Clark – SRBC Mine Drainage Program Coordinator
Brianna Hutchison – SRBC Aquatic Biologist

MINE DRAINAGE IMPAIRED STREAMS AND MINE LAND PROBLEM AREAS in the WEST BRANCH SUSQUEHANNA SUBBASIN



Watershed Characteristics

- **Kratzer Run is a 15.4 square mile tributary to Anderson Creek in the West Branch Susquehanna River Subbasin.**
- **Major tributaries include:**
 - **Bilger Run (7.27 mi²)**
 - **Fenton Run (1.84 mi²)**
 - **Huey Run (1.24 mi²)**
- **Four significant mine drainage impacts:**
 - **Bilger 4.0 – acid/Al**
 - **Wildwood – acid/Fe**
 - **Waterfall – AML/acid/Al**
 - **Widemire – acid/Fe**
- **Mine drainage impacts:**
 - **Bilger Run (5.16 miles listed)**
 - **Huey Run (1.85 miles listed)**
 - **Kratzer Run (8.05 miles listed)**
- **Even though impaired, Kratzer has sections with large brook and brown trout populations.**



DISCLAIMER: Use of Map for Any Purpose on "As Is" Basis. No Warranties Provided. SRBC (722a) 08-16-2018



Mine Drainage

Coal Mining

General

Class A Wild Trout

 Streams

Trout Natural Reproduction

 Streams

Designated Streams

 Exceptional Value

 High Quality

Land Use

 Developed

 Barren

 Natural Vegetation

 Agriculture

State Owned Lands

 State Forest

 State Park

 State Gameland





SIMMS



Macroinvertebrate Communities

- Kratzer Mouth Scores*
 - 65 Individuals
 - 15 Taxa Richness
 - 4 EPT Taxa
 - 6 Becks Index (Mod.)
 - 4.66 Hilsenhoff (Good)
 - 1.94 Shannon Div (Low)
 - 20% Sensitive (Low)
 - **Not Enough to IBI**
- Bilger Mouth Scores*
 - 40 Individuals
 - 11 Taxa Richness
 - 5 EPT Taxa
 - 12 Becks Index (Clean)
 - 4.83 Hilsenhoff (Good)
 - 1.67 Shannon Div (Low)
 - 30% Sensitive
 - **Not Enough to IBI**

* Kratzer Run Assessment and Cold Water Heritage Plan. 2018. Trout Unlimited

Macroinvertebrate Communities

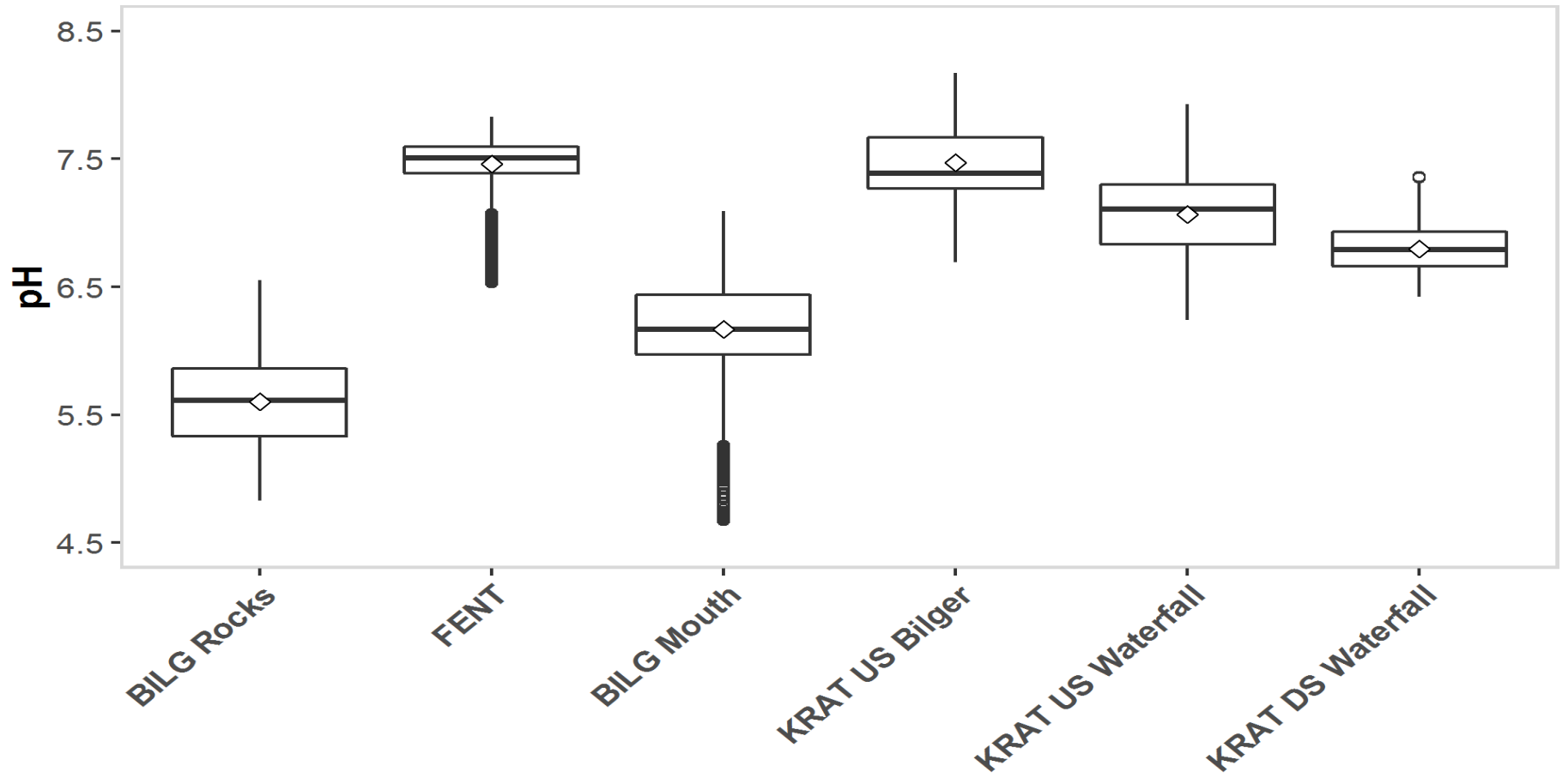
- Fenton Mouth Scores
 - 217 Individuals
 - 25 Taxa Richness
 - 13 EPT Taxa
 - 26 Becks Index (Clean)
 - 3.21 Hilsenhoff (Ex.)
 - 2.14 Shannon Div (Ave)
 - 71% Sensitive (High)
 - **75.9 IBI**
- Huey Mouth Scores
 - 225 Individuals
 - 20 Taxa Richness
 - 8 EPT Taxa
 - 16 Becks Index (Clean)
 - 2.34 Hilsenhoff (Ex.)
 - 1.94 Shannon Div (Ave)
 - 75% Sensitive (High)
 - **66.0 IBI**

* Kratzer Run Assessment and Cold Water Heritage Plan. 2018. Trout Unlimited

Water Quality Block to Brown Trout Movement

Parameters		Stations					
		BILG Rocks	FENT	BILG Mouth	KRAT US Bilger	KRAT US Waterfall	KRAT DS Waterfall
Temperature (°C)	<i>No. of Observations</i>	7176	6210	7174	7173	7174	7174
	<i>Minimum</i>	-0.60	-0.28	-0.13	-0.15	-1.45	-0.32
	<i>Maximum</i>	19.94	17.70	19.10	20.66	20.17	20.06
	<i>Mean</i>	7.05	5.67	7.78	7.47	6.79	7.26
	<i>Standard Deviation</i>	6.45	5.21	4.87	5.90	6.36	5.99
Dissolved Oxygen (mg/L)	<i>No. of Observations</i>	4489	6210	4460	7173	6522	5174
	<i>Minimum</i>	4.38	6.53	4.10	8.24	3.50	8.09
	<i>Maximum</i>	13.51	14.48	14.54	14.97	14.73	14.03
	<i>Mean</i>	9.55	11.98	11.30	11.77	11.24	11.39
	<i>Standard Deviation</i>	2.24	1.80	2.48	1.90	2.35	2.33
pH	<i>No. of Observations</i>	6444	6210	7174	7173	7174	7042
	<i>Minimum</i>	4.83	5.64	4.67	6.69	6.24	6.42
	<i>Maximum</i>	6.55	7.83	7.09	8.17	7.73	7.36
	<i>Mean</i>	5.60	7.46	6.17	7.47	7.07	6.80
	<i>Standard Deviation</i>	0.30	0.22	0.37	0.27	0.34	0.17
Specific Conductance (mS/cm)	<i>No. of Observations</i>	7176	6210	7174	7173	7174	7174
	<i>Minimum</i>	0.060	0.070	0.084	0.093	0.113	0.042
	<i>Maximum</i>	0.531	0.605	0.603	0.558	0.440	0.503
	<i>Mean</i>	0.275	0.293	0.320	0.281	0.287	0.295
	<i>Standard Deviation</i>	0.094	0.137	0.146	0.080	0.089	0.102
Turbidity (NTU)	<i>No. of Observations</i>	7176	6210	7174	7173	7174	7174
	<i>Minimum</i>	0.5	-1	1	3	0.6	1
	<i>Maximum</i>	1428	1379	1642	1271	2022	1306
	<i>Mean</i>	219	89	368	15	391	42
	<i>Standard Deviation</i>	490	224	500	33	505	169

Low pH Blocking Brown Trout Expansion








Trout Tagging and Tracking



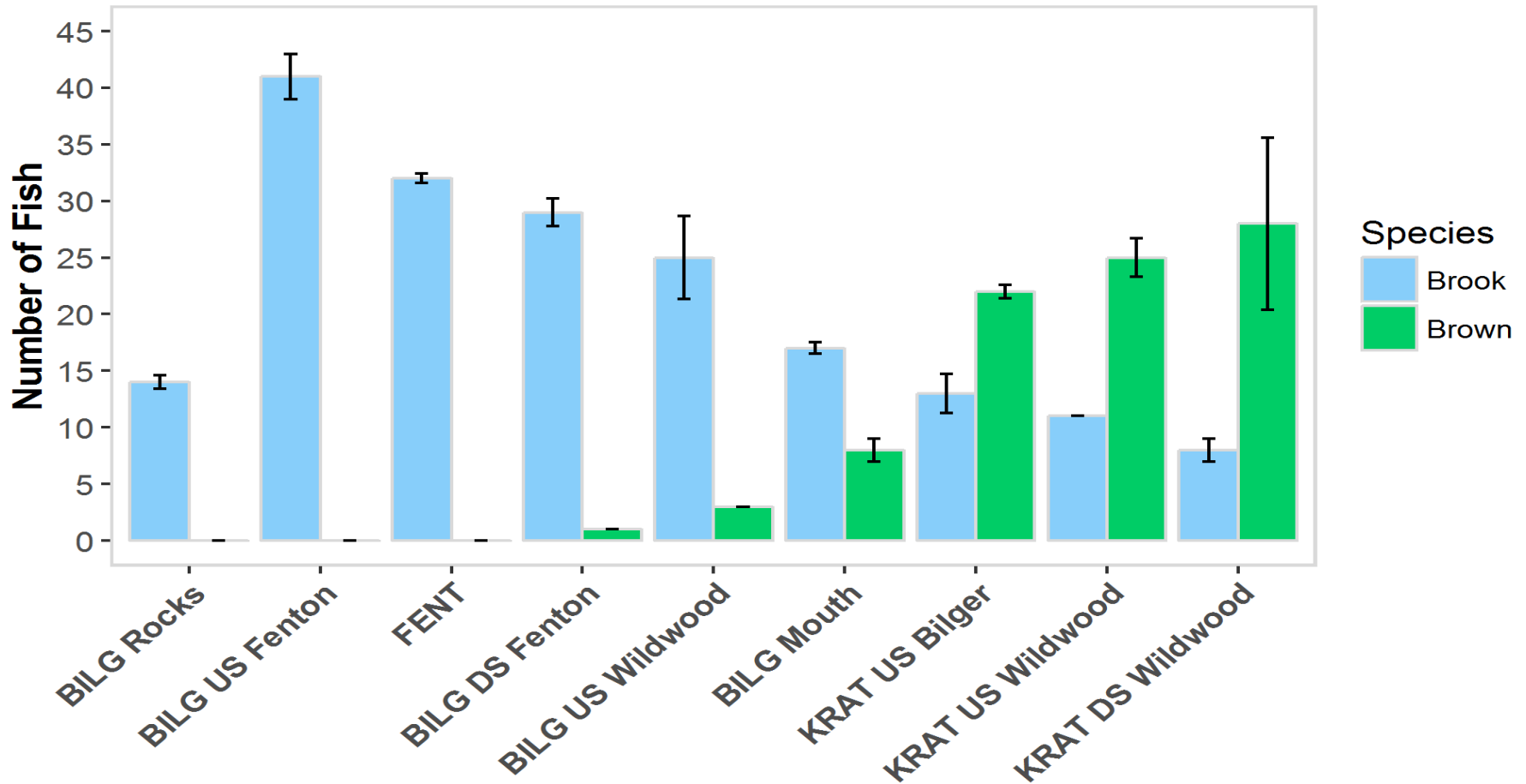




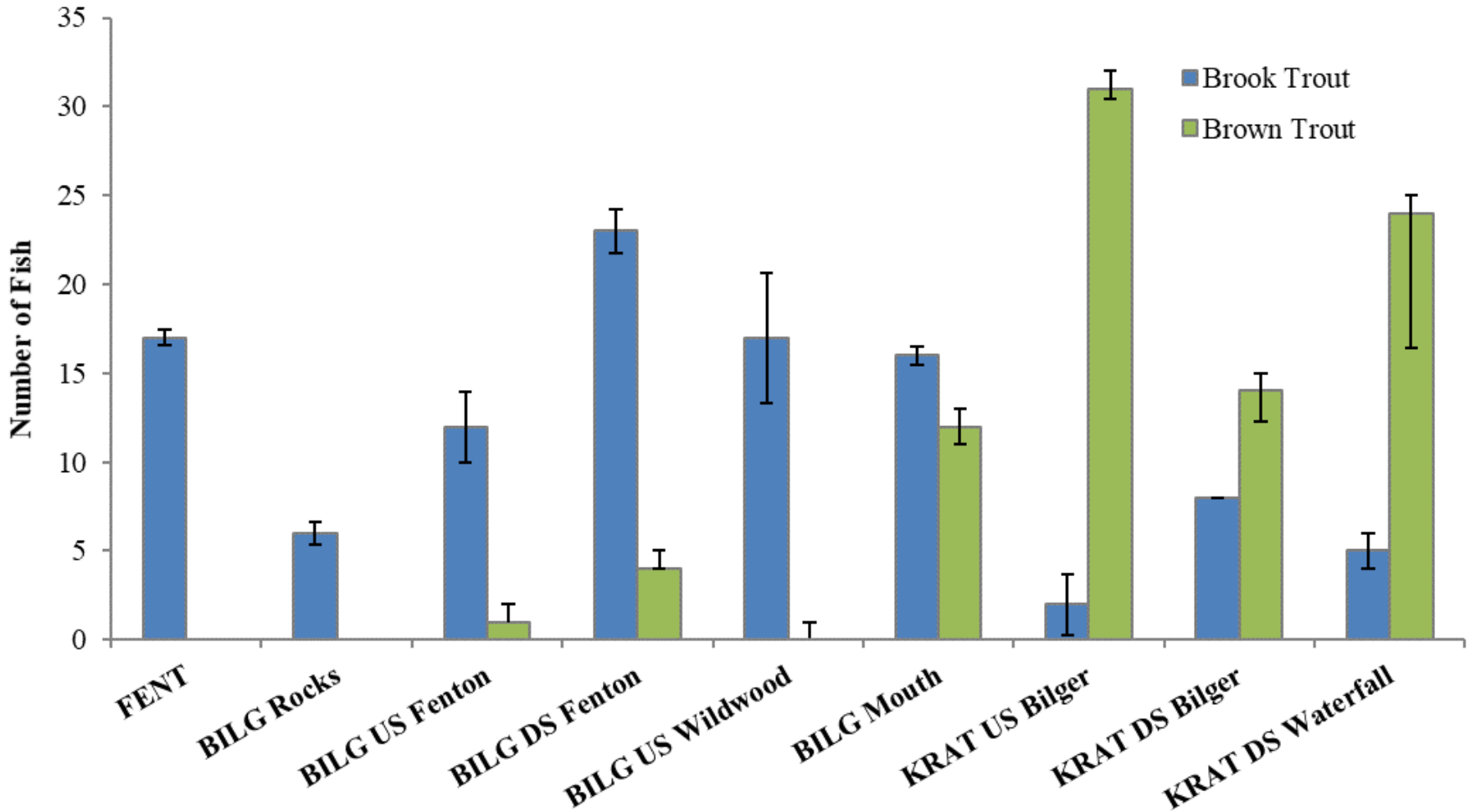
900 2280 00269907



2017 Segregated Populations of Trout



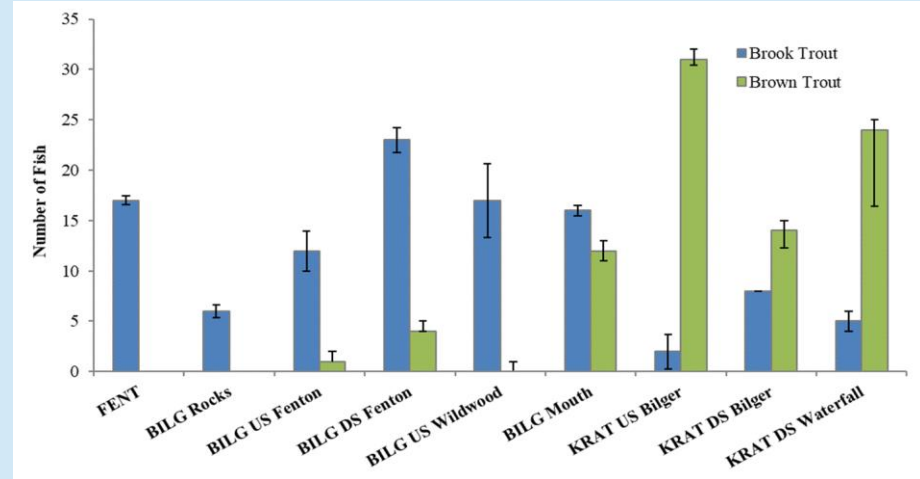
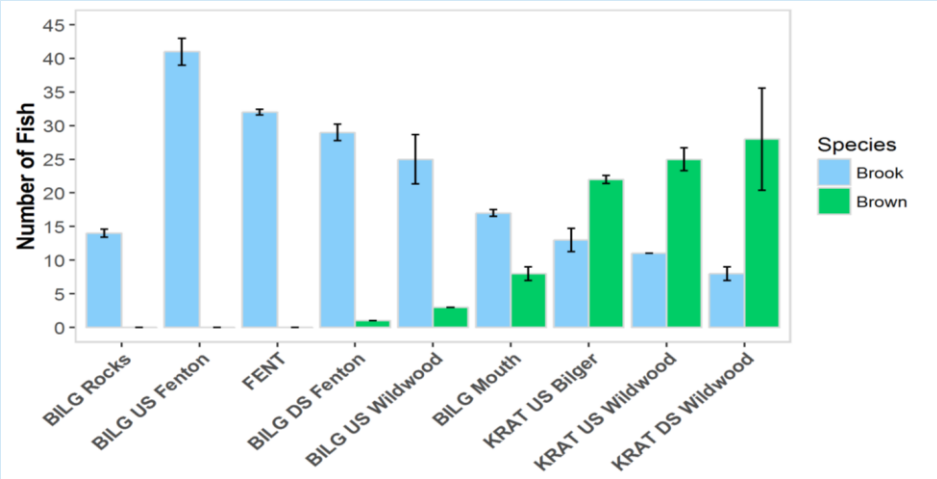
2019 – Less Segregation



2017-2019 Comparison

2017 Trout Populations

2019 Trout Populations



Population is Changing Already

2017

- 188 brook trout captured
- Total Weight 4,627 grams
- Average Weight 24.61 grams
- ~ 130mm brook trout
- 84 brown trout captured
- Total Weight 5,210
- Average Weight 62.02 grams
- ~ 190 mm brown trout

2019

- 106 brook trout captured
- Total Weight 3,085 grams
- Average Weight 29.01 grams
- ~ 145 mm brook trout
- 86 brown trout captured
- Total Weight 8,276 grams
- Average Weight 96.23 grams
- ~ 220 mm brown trout

Population Already Changing?



Legend

Mine Drainage

Coal Mining

General

AMD Stations

- Discharge
- Instream
- Other

Impaired Streams

- AMD Impairment

Abandoned Mine Lands

Points

- Priority 1
- Priority 2
- Priority 3
- Undetermined
- None

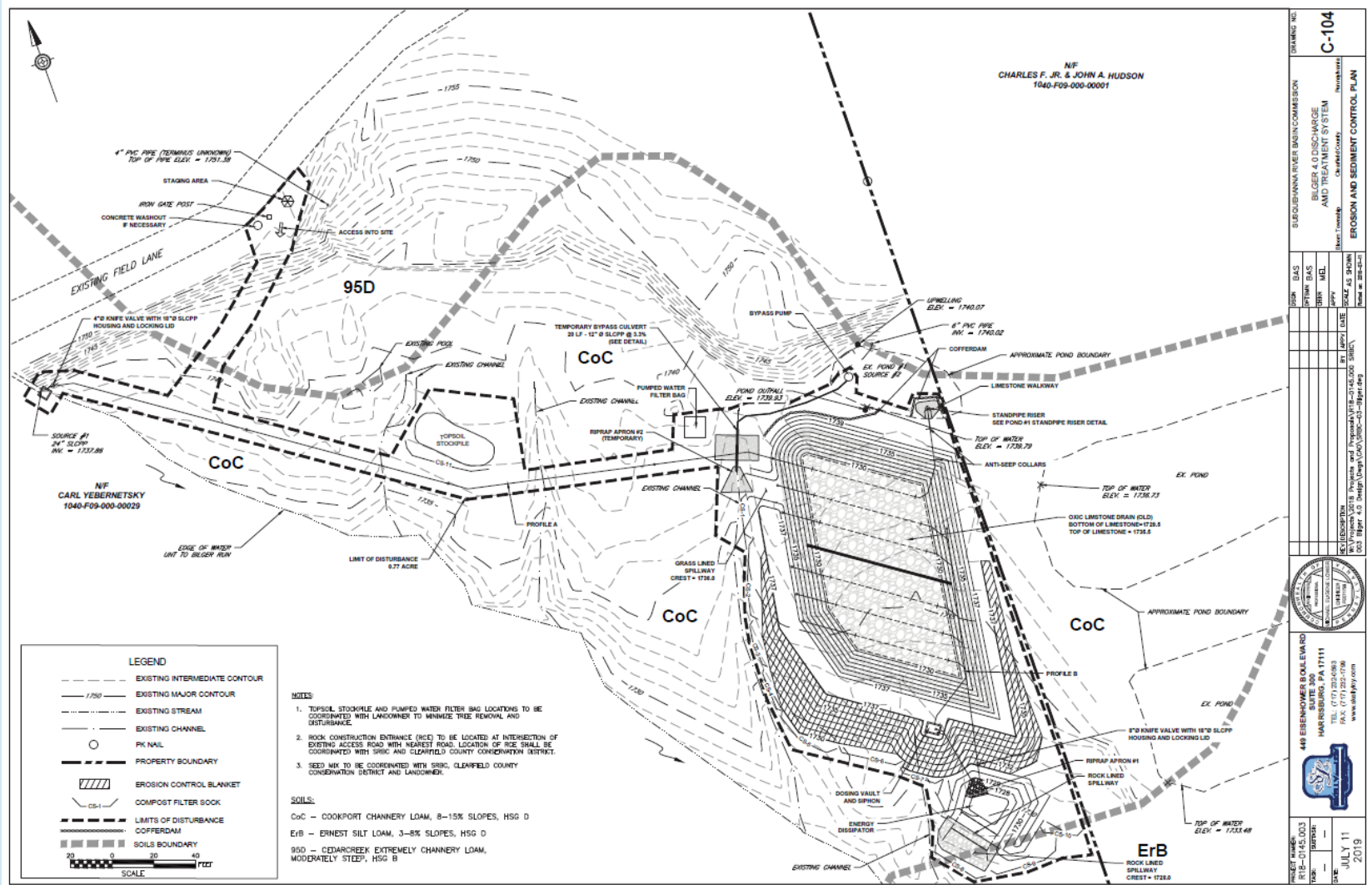
Features

- Priority 1
- Priority 2
- Priority 3
- Undetermined
- None

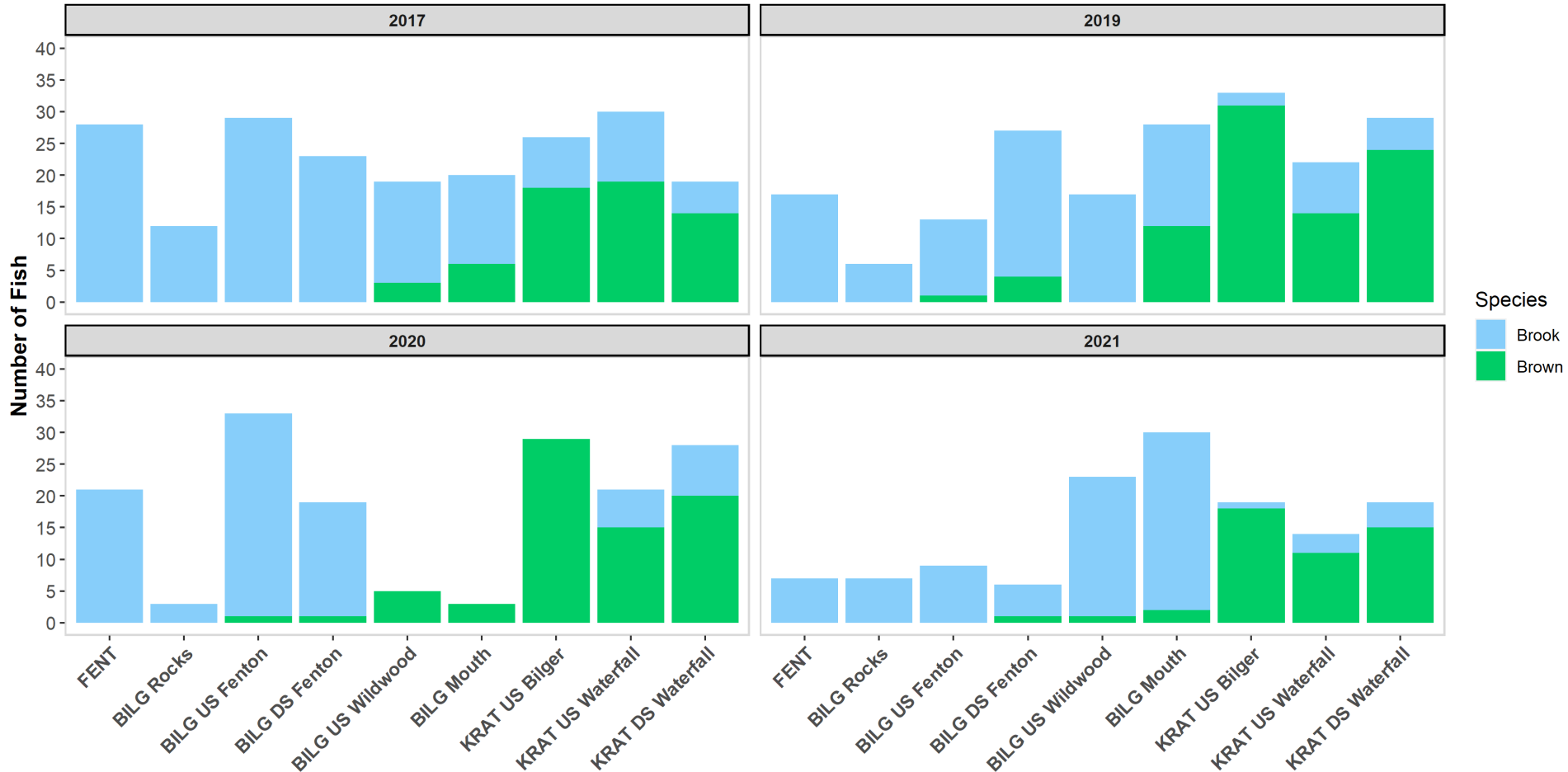
Problem Areas

- Problem Area

What Happens to Pop After Bilger 4.0?

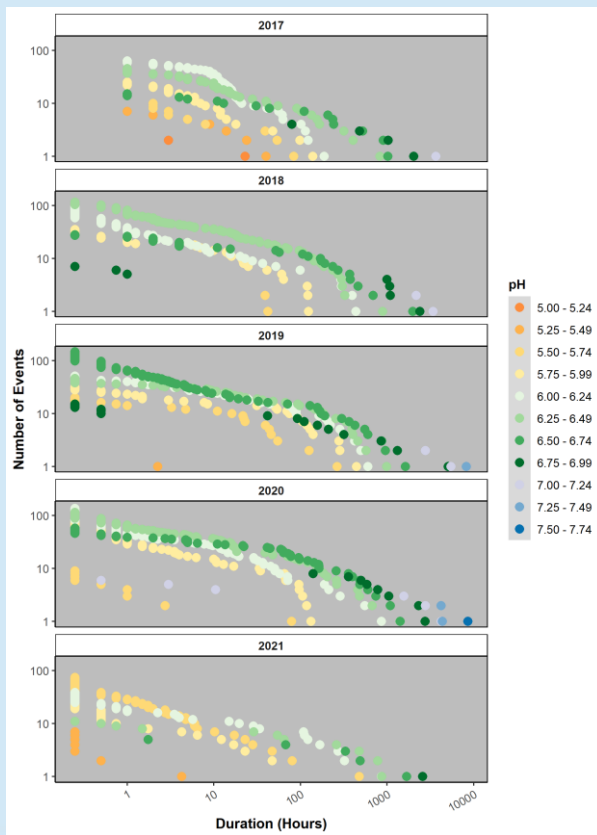


Yearly Trout Populations

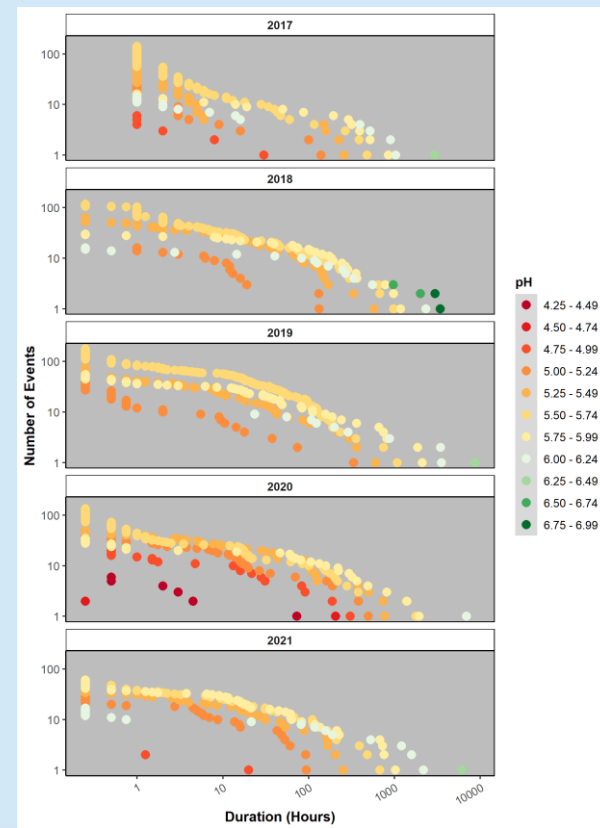


Bilger pH Changes Over Time

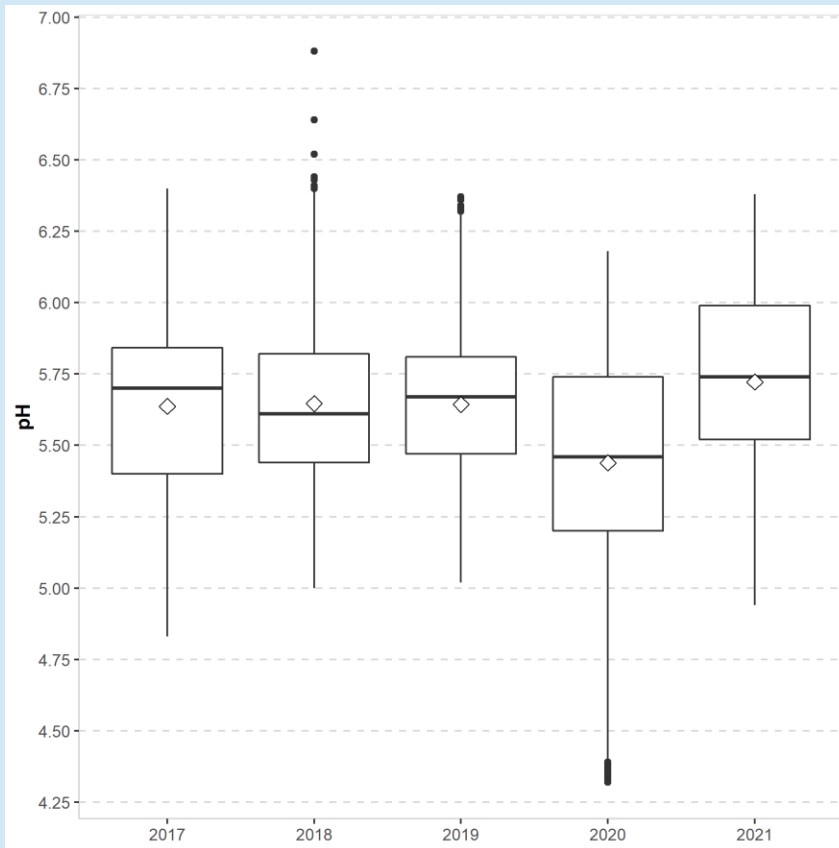
Bilger Mouth



Bilger DS 4.0 TS



Interesting Data: pH/growth



Date	Location	Length	Weight
07/05/17	Krat DS	244 mm	137 g
08/16/17	Bilg US	245 mm	144 g
08/25/17	Krat DS	246 mm	147 g
08/26/19	Krat DS	303 mm	270 g
09/22/20	Krat DS	333 mm	360 g
09/15/21	Krat DS	356 mm	471 g

Questions to be Answered

- Is there a time where fish populations should trump restoration?
- Will restoration improve both populations, or favor browns?
- If restoration favors browns, how far will they push the brookies?
- Will improving the macro community help age/size dynamics?
- Ask me back after restoration to tell you what we found.