APPENDIX A

Stream Electrofishing Survey Data (2016)

This section of the report includes stream survey data completed by the Bureau of Freshwater Fisheries in 2016. All surveys, unless specifically noted otherwise, are sampled in accordance to the Bureau's established stream sampling protocol which is consistent with EPA's Rapid Bioassement Protocol for Wadeable Streams. The Bureau's wadeable stream survey protocol can be found in Appendix B. The Bureau also assesses in-stream and riparian conditions by performing a Habitat Assessment at the time of each survey. This assessment is consistent with the EPA Rapid Bioassessment sampling habitat assessment protocol with regional modifications (Appendix C). Basic water quality parameters are also measured.

Surveys are listed alphabetically by stream name within identified watershed areas. Each survey is identified by the specific Activity by which it was funded. It is important to note, however, the use of established stream sampling protocols permits data to be used beyond the specific Activity for which they were collected. Data provided for the purposes of this report is only a summary of the individual stream survey data collected by the DFW's Bureau of Freshwater Fisheries. All stream data collected under the Bureau's standardized sampling protocol is entered into the Division's FishTrack database.

Stream Surveys in the Upper Delaware (North) & Wallkill Region

(Shimers Brook to Paulins Kill and Wallkill River)

Beerskill Creek

Date: 08/04/2016
County: Sussex
Township: Sandyston Twp.
Drainage: Flat Brook
Project: Temperature Study - TP Streams
Location: Cemetery Road

Water Chemistry / Habitat

Water Temperature (°C):	19.2
Dissolved Oxygen (mg/L):	9.97
Specific Conductance (uS/cm):	114.6
pH:	7.79
Alkalinity (mg/L):	34
Sample Length (m):	150
Habitat Assessment Score:	169 Optimal

Fish Species	Number	Length (mm)
Bass, Largemouth	1	69 - 69
Dace, Blacknose	64	0 - 0
Darter, Tessellated	5	0 - 0
Eel, American	13	0 - 0
Lamprey, Sea	2	0 - 0
Pickerel, Redfin	6	96 - 178
Sculpin, Slimy	47	0 - 0
Trout, Brook (YOY)	13	59 - 92
Trout, Brook	14	128 - 242

Summary: Beerskill Creek is a small stream that flows out of both Highpoint State Park and Stokes State Park and ultimately into the Little Flat Brook. This tributary to the Big Flat Brook was electrofished on 8/4/2016 to assess the wild trout populations structure relative to the stream temperature regime. In 2015, 29 wild Brook Trout (8 young-of-the-year (YOY)) were found indicating that the population is moderately abundant. Previous surveys, at a site further upstream, found Brook Trout numbers of 20 in 1968, 18 in 2004, and 7 in 2013. This year, similar numbers of wild Brook Trout (soon to be designated state Special Concern) were found, a total of 27, including 13 YOY. The data from the continuous temperature monitor at this location will tell us how often and how long temperatures are a stressor for Brook Trout. Two warmwater species (Largemouth Bass and Redfin Pickerel) were found in the 2015 and 2016 surveys that were never documented in previous surveys. The competition for resources from these species on Brook Trout is a concern for the Brook Trout population. It is unknown if these warmwater species have recently moved into Beerskill Creek or if they have been at this location previously since this downstream location was first surveyed in 2015. A total of 165 individual fish representing eight different species were found in this survey. Slimy Sculpin (soon to be listed state Threatened) were also captured.

Recommendation: This survey is part of a stream temperature study that is currently being conducted on 14 *Trout Production* streams. This stream will be monitored in this section for the next 1-2 years to study the relationship of stream temperature on wild trout life cycles in New Jersey and help guide in the management of our T*rout Production* streams. (Shramko)

Big Flat Brook

Date: 08/02/2016
County: Sussex
Township: Sandyston Twp.
Drainage: Flat Brook
Project: Trout Special Regulation Area
Location: Old Police Barracks between Rt. 206 and Rt. 560

Water Chemistry / Habitat

Water Temperature (°C):	19.3
Dissolved Oxygen (mg/L):	8.99
Specific Conductance (uS/cm):	105.4
pH:	6.87
Alkalinity (mg/L):	18
Sample Length (m):	150
Habitat Assessment Score:	180 Optimal (2015)

Fish Species	Number	Length (mm)
Bass, Largemouth	1	56 - 56
Dace, Blacknose	18	0 - 0
Dace, Longnose	19	0 - 0
Darter, Tessellated	7	0 - 0
Eel, American	15	0 - 0
Madtom, Margined	2	0 - 0
Minnow, Cutlip	6	0 - 0
Pickerel, Chain	1	140 - 140
Sculpin, Slimy	24	0 - 0
Shiner, Common	3	0 - 0
Sucker, White	3	0 - 0
Sunfish, Bluegill	2	70 - 85
Sunfish, Pumpkinseed	1	77 - 77
Trout, Brook	2	161 - 204
Trout, Rainbow	1	260 - 260

Summary: Prior to 2014, special trout fishing regulations (fly fishing for most or all of the year, and harvest allowed) had been in place for over 50 years on a 4.1-mile stretch of the Big Flat Brook/Flat Brook. In 2014, year round *Catch and Release - Artificials Only (C&R)* fishing regulations were implemented. Electrofishing surveys have been conducted annually within this special regulation area since 2012 to assess the trout fishery. Described below are the results from the station located the furthest upstream of the survey stations.

Although the special regulation section is classified as *Trout Production* and is trout-stocked, relatively few trout have been encountered at the previously sampled survey locations. In 2015, one of the survey locations was moved upstream to this survey location in an effort to locate more trout. Unfortunately, more trout were not found at this new location in neither 2016 nor 2015. In 2016, one Rainbow Trout (stocked this spring) and two Brook Trout (wild) were found. During the 2015 survey, three Rainbow Trout (stocked this spring) and three Brook Trout (wild) were the only trout collected. Brook Trout are a species soon to be designated state Special Concern. Higher than average flows were present in both 2015 and 2016 making sampling difficult and had a negative effect on total trout caught in the survey as several trout in a deeper pool both years were not captured. The total trout seen and collected was still lower than anticipated after the new *C&R* regulations were instituted. A possible explanation for the lower than anticipated total trout numbers is that the trout are moving out of the *C&R* area outright. A soon to be listed state Threatened native fish species of special interest to biologists based on its low abundance statewide and high quality habitat requirements (Slimy Sculpin) was found at this location. Overall 105 individual fish were collected representing 15 different species.

Recommendation: The data from the electrofishing surveys, along with continuous water temperature and angler survey/catch data will be used to evaluate fishing regulation changes on the trout fishery. A trout movement / telemetry study is proposed to begin in 2017 to indicate if and/or when trout are moving out of the *C&R* area will also be used to evaluate fishing regulation changes on the trout fishery. (Shramko)

Big Flat Brook

Date: 07/19/2016
County: Sussex
Township: Sandyston Twp.
Drainage: Flat Brook
Project: Trout Special Regulation Area
Location: Rt. 560, downstream, off unnamed dirt road between Rt. 560 and Warner's Hole.

Fish Species	Number	Length (mm)
Dace, Blacknose	81	0 - 0
Dace, Longnose	22	0 - 0
Darter, Tessellated	7	0 - 0
Eel, American	57	0 - 0
Minnow, Cutlip	9	0 - 0
Sculpin, Slimy	4	0 - 0
Sucker, Northern Hog	1	0 - 0
Sunfish, Bluegill	1	104 - 104
Trout, Rainbow	8	242 - 383

Water Chemistry / Habitat

Water Temperature (°C): 20.4
Dissolved Oxygen (mg/L): 10.57
Specific Conductance (uS/cm): 166.2
pH: 7.33
Alkalinity (mg/L): 36
Sample Length (m): 150
Habitat Assessment Score: 156 Sub-Optimal (2015)

Summary: Prior to 2014, special trout fishing regulations (fly fishing for most or all of the year, and harvest allowed) had been in place for over 50 years on a 4.1-mile stretch of the Big Flat Brook/Flat Brook. In 2014, year round *Catch and Release - Artificials Only* (*C&R*) fishing regulations were implemented. Electrofishing surveys have been conducted annually within this special regulation area since 2012 to assess the trout fishery. Described below are the results from the station located downstream of Rt. 560 and upstream of a popular fishing location known as "Warner's Hole".

Although the special regulation section is classified as *Trout Production* and is trout-stocked, relatively few trout have been encountered at the previously sampled survey locations. In 2015, one of the survey locations was moved upstream to this survey location. This new sampling location is located very close to several trout stocking points that were stocked this spring. It is thought that due to the proximity to trout stocking locations, this site may produce higher than average trout numbers. The survey collected 8 Rainbow Trout (stocked this spring) which is very similar to the 2015 survey which found 10 Rainbow Trout (stocked that spring). Eight trout is an average number, but not as high as predicted. A possible reason for this is that several trout could be seen from the bank downstream from the sampling location in a deep pool known as "Warner's Hole". Some of the fish that would have been in the sampling location may have moved into the deeper hole which is unable to be sampled by stream backpack electrofishing gear. Another possible explanation is that the trout are moving out of the *C&R* area outright. Two native fish species of special interest to biologists based on their low abundance statewide and unique habitat requirements (the soon to be listed state Threatened Slimy Sculpin and the soon to be designated state Special Concern Northern Hog Sucker) were found at this location in both 2015 and 2016. Overall, 190 individual fish were collected representing 9 different species.

Recommendation: The data from the electrofishing surveys, along with continuous water temperature and angler survey/catch data will be used to evaluate fishing regulation changes on the trout fishery. A trout movement / telemetry study is proposed to begin in 2017 to indicate if and/or when trout are moving out of the *C&R* regulation area will also be used to evaluate fishing regulation changes on the trout fishery. (Shramko)

Big Flat Brook

Date: 08/02/2016
County: Sussex
Township: Sandyston Twp.
Drainage: Flat Brook
Project: Trout Special Regulation Area
Location: Blewett Tract (Station 1)

Water Chemistry / Habitat

Water Temperature (°C):	19.5
Dissolved Oxygen (mg/L):	8.72
Specific Conductance (uS/cm):	99.1
pH:	7.27
Alkalinity (mg/L):	22.5
Sample Length (m):	150
Habitat Assessment Score:	184 Optimal (2012)

Fish Species	Number	Length (mm)
Chub, Creek	14	0 - 0
Dace, Blacknose	44	0 - 0
Dace, Longnose	6	0 - 0
Darter, Shield	4	0 - 0
Darter, Tessellated	8	0 - 0
Eel, American	17	0 - 0
Fallfish	2	0 - 0
Lamprey, American Brook	1	0 - 0
Lamprey, Sea	1	0 - 0
Minnow, Cutlip	8	0 - 0
Pickerel, Redfin	2	82 - 147
Sculpin, Slimy	14	0 - 0
Shiner, Common	5	0 - 0
Sucker, White	11	0 - 0
Trout, Brook	1	176 - 176
Trout, Rainbow	1	261 - 261

Summary: Prior to 2014, special trout fishing regulations (fly fishing for most or all of the year, and harvest allowed) had been in place for over 50 years on a 4.1-mile stretch of the Big Flat Brook/Flat Brook. In 2014, year round *Catch and Release - Artificials Only* (*C&R*) fishing regulations were implemented. Electrofishing surveys have been conducted annually within this special regulation area since 2012 to assess the trout fishery. Described below are the results from the station located from the area known as the Blewett Tract.

Although the special regulation section is classified as *Trout Production* and is trout-stocked, relatively few trout have been encountered at this survey location. In the 2016 survey, only one Rainbow Trout (hatchery origin) and one Brook Trout (wild fish) were found. The 2015 survey found two Rainbow Trout (hatchery origin) and one Brook Trout (wild fish), and the 2014 survey found only two Brown Trout (wild fish). No trout were present in 2013 and only eight trout (seven wild Brook Trout and one stocked Rainbow Trout) were found in 2012. Brook Trout are a species soon to be designated state Special Concern. It is not immediately apparent why so few trout are present at this location. One hypothesis is that the trout are concentrated in nearby pools too deep to sample with standard electro-fishing equipment. As population size increases in these pools due to the new no harvest regulation, fish may distribute themselves throughout the stream and possibly into this sampling location. Another possible explanation is that the trout are moving out of the *C&R* area outright. Three native fish species of special interest to biologists based on their low abundance statewide and unique habitat requirements (the soon to be designated state Special Concern Shield Darter and soon to be listed state Threatened Slimy Sculpin) were found at this location. Overall, 140 individual fish were collected representing 17 different species.

Recommendation: The data from the electrofishing surveys, along with continuous water temperature and angler survey/catch data will be used to evaluate fishing regulation changes on the trout fishery. A trout movement / telemetry study is proposed to begin in 2017 to indicate if and/or when trout are moving out of the *C&R* regulation area will also be used to evaluate fishing regulation changes on the trout fishery. (Shramko)

Big Flat Brook (trib.) (Lk Ashroe)

Date: 07/01/2016
County: Sussex
Township: Sandyston Twp.
Drainage: Flat Brook
Project: Trout Production Re-Inventory
Location: Brook Road Bridge

Fish Species	Number	Length (mm)
Bullhead, Brown	1	95 - 95
Chub, Creek	2	0 - 0
Dace, Blacknose	80	0 - 0
Dace, Longnose	10	0 - 0
Eel, American	19	0 - 0
Lamprey, Sea	5	0 - 0
Sculpin, Slimy	13	0 - 0
Sunfish, Pumpkinseed	1	97 - 97
Trout, Brook (YOY)	40	61 - 91
Trout, Brook	16	121 - 183

Water Chemistry / Habitat

Water Temperature (°C): 16.2
Dissolved Oxygen (mg/L): 8.88
Specific Conductance (uS/cm): 108
pH: 7.37
Alkalinity (mg/L): 76
Sample Length (m): 150
Habitat Assessment Score: 162 Optimal

Summary: Big Flat Brook (trib.) (Lk Ashroe) is a small *Trout Production* stream that originates in Stokes State Forest flows through Lake Ashroe and ultimately flows into the Big Flat Brook. In 2016, this stream was surveyed to assess the fish population at a survey location located downstream of Lake Ashroe which was previously surveyed in 2005. Fifty-six wild Brook Trout (soon to be designated state Special Concern) were found of which 40 were young-of-the-year (YOY). The number of wild Brook Trout found is somewhat lower in the 2016 survey than the 2005 survey. In 2005, 110 Brook Trout were found (107 YOY). This decrease in total trout numbers is a concern, as any population decrease would be, but the increase in juvenile/adult trout in 2016 is encouraging. Trout in general hatch many offspring each year, but the large majority do not survive into their second year. The 2016 data found several fish that did make it through their first year. This actually represents a more stable population than the 2005 survey found even though overall population size was down over 40%. Water temperature readings from both surveys were within the optimal temperature regime for Brook Trout. Temperature does not seem to be a major concern for this stream even though it is found downstream of an impoundment. It is important to keep in mind that this one-time temperature reading is very limiting. To fully understand if temperature is a possible reason for the lower trout numbers found, a continuous temperature monitor would have to be deployed into the stream. A concern for this population of Brook Trout comes in the form of low flow and competition from species not typical of a historic Brook Trout stream. Rainfall this summer was very low across much of northern New Jersey. This stream was difficult to sample as flows were so low it was hard to find adequate water to use the electrofishing gear in. The low flows could be a reason for the lower than expected YOY trout numbers found. Competition for resources and predation from other non-typical Brook Trout stream fishes found (ie. American eel, Pumpkinseed Sunfish, and Brown Bullhead) could also be a factor for the lower overall trout numbers. A native fish species of special interest to biologists based on its low abundance statewide and unique habitat requirements (the soon to be listed state Threatened Slimy Sculpin) was also found at this location. A total of 187 individual fish representing 9 different species were found in this survey.

Recommendation: This stream should be periodically monitored at a minimum in accordance with the established schedule for wild Brook Trout / *Trout Production* streams. (Shramko)

Black Creek (trib.) (McAfee)

Date: 08/25/2016
County: Sussex
Township: Vernon Twp.
Drainage: Wallkill River
Project: Trout Production Re-Inventory
Location: Route 517 bridge

Fish Species	Number	Length (mm)
Trout, Brown	1	235 - 235

Water Chemistry / Habitat

Water Temperature (°C): 17.4
Dissolved Oxygen (mg/L): 9.3
Specific Conductance (uS/cm): 736
pH: 7.71
Alkalinity (mg/L): 164
Sample Length (m): 150
Habitat Assessment Score: 131 Sub-Optimal

Summary: Black Creek (trib.) (McAfee) is a small *Trout Production* stream that flows out of Pleasant Valley Lake near the old Great Gorge Golf Club and ultimately into the Wallkill River. In 2016, this stream was surveyed to assess the fish population at a survey location located nearby but slightly different than another survey done three days earlier where no Brook Trout were found (see Black Creek (trib.) (McAfee) survey from 8/22/2006). A third survey was also conducted on this day at a location downstream of these previously mentioned surveys in an attempt to locate any surviving Brook Trout (see Black Creek (trib.) (McAfee) 8/25/2016 - Great Gorge Golf Course-Water Treatment Area). This current survey site location is exactly where two previous surveys were conducted in 1970 and in 2005 to control for any possible habitat differences due to location. Unfortunately, the results of this survey were the same as the survey done on 8/22/2016, as only one adult wild Brown Trout was found. Past surveys conducted at this site found 36 Brook Trout (34 young-of-the-year (YOY)) and 1 Brown Trout (0 YOY) in 1970 and 35 Brook Trout (30 YOY) and 9 Brown Trout (0 YOY) in 2005. The other survey done on this day at a downstream location did find more trout, but still did not find any Brook Trout. After three surveys done this year, it has been concluded that Brook Trout have been extirpated from this stream. More detail about the possible reasons for the loss of Brook Trout from this stream can be found in the Black Creek (trib.) (McAfee) 8/22/2016 stream write up found in this report.

Recommendation: This steam should be periodically surveyed in an attempt to find Brook Trout again, but after three surveys done this year without the presence of Brook Trout it appears that Brook Trout have been extirpated from the stream. (Shramko)

Black Creek (trib.) (McAfee)

Date: 08/22/2016
County: Sussex
Township: Vernon Twp.
Drainage: Wallkill River
Project: Brook Trout Assessment
Location: Unnamed Great Gorge Golf Club Access Road

Fish Species	Number	Length (mm)
Trout, Brown	1	213 - 213

Water Chemistry / Habitat

Water Temperature (°C): 18.7
Dissolved Oxygen (mg/L): 8.62
Specific Conductance (uS/cm): 758
pH: 7.77
Alkalinity (mg/L): 157
Sample Length (m): 150
Habitat Assessment Score: 123 Sub-Optimal

Summary: Black Creek (trib.) (McAfee) is a small *Trout Production* stream that flows out of Pleasant Valley Lake near the old Great Gorge Golf Club and ultimately into the Wallkill River. In 2016, this stream was surveyed to assess the fish population at a survey location located just downstream of an area sampled in 2005 and 1970. Unfortunately, only one adult wild Brown Trout was found indicating that this stream is in very poor health. Previous surveys conducted found 36 Brook Trout (34 young-of-the-year (YOY)) and 1 Brown Trout (0 YOY) in 1970 and 35 Brook Trout (30 YOY) and 9 Brown Trout (0 YOY) in 2005. The apparent loss of Brook Trout from this stream is very concerning, but is also unfortunately a trend seen over much of the Brook Trout's historical native range. Brook Trout have been extirpated from 79 of the 125 historical sub-watersheds (HUC 12 classification) in New Jersey or 63% of the historical New Jersey native range. In the remaining 46 sub-watersheds or 37% of New Jersey's historical Brook Trout range, Brook Trout have been lost from at least 50% of each of these sub-watersheds. Stream temperature in the 2016 survey was 17.4°C. This temperature is within the optimal temperature for Brook Trout, but the 2005 survey the temperature was 21.7°C which is above the optimal temperature for Brook Trout and near the upper limits of Brook Trout survival. The one-time temperature reading of a warmer than optimal temperature is a concern as it indicates that temperature is for at least that one day (but likely more than just the one day) a stressor to Brook Trout survival. The likelihood that temperature is a formidable stress to Brook Trout is high due to this one time reading and the fact that Pleasant Valley Lake is located upstream of this survey location. Lakes have been shown to impact stream temperatures as solar radiation warms surface water of a lake and if that surface water flows out of the lake it warms the stream below. To fully understand if temperature is a reason for the lower trout numbers found, a continuous temperature monitor would have to be deployed into the stream. The salinity recorded during this survey was alarmingly high (0.37ppt). It is unknown why the salinity is so high, but a hypothesis is that road salt from the previous winter could be the reason. This elevated salinity could possibly be the cause of Brook Trout loss, especially as salinity levels would drastically spike and remain much higher during the winter months. Another concern for this stream is that lack of biodiversity as total of one individual fish representing one species was found in this survey. The 1970 and 2005 surveys also found little species diversity, two species and three species respectively.

Recommendation: This steam should be periodically surveyed in an attempt to find Brook Trout again, but after three surveys done this year without the presence of Brook Trout it appears that Brook Trout have been extirpated from the stream. (Shramko)

Black Creek (trib.) (McAfee)

Date: 08/25/2016
County: Sussex
Township: Vernon Twp.
Drainage: Wallkill River
Project: Brook Trout Assessment
Location: Great Gorge Golf Course-Water Treatment area

Fish Species	Number	Length (mm)
Trout, Brown	4	181 - 231

Water Chemistry / Habitat

Water Temperature (°C):
Dissolved Oxygen (mg/L):
Specific Conductance (uS/cm):
pH:
Alkalinity (mg/L):
Sample Length (m): 60
Habitat Assessment Score: N/A

Summary: Black Creek (trib.) (McAfee) is a small *Trout Production* stream that flows out of Pleasant Valley Lake near the old Great Gorge Golf Club and ultimately into the Wallkill River. In 2016, this stream was surveyed to assess the fish population at a survey location located nearby to two other surveys done in 2016. This is the third survey done this year in an attempt to locate any surviving Brook Trout in Black Creek (trib.) (McAfee) (see Black Creek (trib.) (McAfee) 8/22/2016 and Black Creek (trib.) (McAfee) 8/25/2016) as the first two surveys done did not find any Brook Trout in this historically wild Brook Trout stream. This current survey site is located closer to the confluence with Black Creek, but is not a full standardized survey as only 60 m of a severely altered section of the stream was surveyed. This survey location was selected mainly for the pool habitat found near a golf course cart path bridge crossing as a likely location to find surviving Brook Trout. This site did produce four Brown Trout, but did not find any Brook Trout. After three surveys done this year, it has been concluded that Brook Trout have been extirpated from this stream. More detail about the possible reasons for the loss of Brook Trout from this stream can be found in the Black Creek (trib.) (McAfee) 8/22/2016 stream write up found in this report.

Recommendation: This steam should be periodically surveyed in an attempt to find Brook Trout again, but after three surveys done this year without the presence of Brook Trout it appears that Brook Trout have been extirpated from the stream. (Shramko)

*******NON – STANDARDIZED SURVEY*******

Flat Brook

Date: 07/19/2016
County: Sussex
Township: Sandyston Twp.
Drainage: Flat Brook
Project: Trout Special Regulation Area
Location: Three Bridges (Flatbrook WMA)

Water Chemistry / Habitat

Water Temperature (°C):	18.6
Dissolved Oxygen (mg/L):	9.43
Specific Conductance (uS/cm):	302.9
pH:	7.28
Alkalinity (mg/L):	89
Sample Length (m):	150
Habitat Assessment Score:	167 Optimal (2015)

Fish Species	Number	Length (mm)
Bass, Largemouth	1	124 - 124
Chub, Creek	20	0 - 0
Dace, Blacknose	115	0 - 0
Dace, Longnose	11	0 - 0
Darter, Shield	3	0 - 0
Darter, Tessellated	49	0 - 0
Eel, American	70	0 - 0
Lamprey, Sea	1	0 - 0
Minnow, Cutlip	27	0 - 0
Sculpin, Slimy	10	0 - 0
Shiner, Common	11	0 - 0
Shiner, Spottail	1	0 - 0
Sucker, White	11	0 - 0
Trout, Brook	1	238 - 238
Trout, Rainbow	7	270 - 441

Summary: Prior to 2014, special trout fishing regulations (fly fishing for most or all of the year, and harvest allowed) had been in place for over 50 years on a 4.1-mile stretch of the Big Flat Brook/Flat Brook. In 2014, year round *Catch and Release - Artificials Only* (*C&R*) fishing regulations were implemented. Electrofishing surveys have been conducted annually within this special regulation area since 2012 to assess the trout fishery. Described below are the results from the station located the furthest downstream of the survey stations.

Although the special regulation section is classified as *Trout Production* and is trout-stocked, relatively few trout have been encountered at the previously sampled survey locations. In 2015, one of the survey locations was moved upstream to this new survey location. Of the four survey locations from this year, this location produced the most fish in both 2015 and 2016 and shows that fishing is still excellent well past the spring stocking season. Even though only 8 trout were actually collected and measured, an estimated 35 - 50 other trout were seen in a deeper hole within the survey area. The total trout seen and collected in 2016 is very similar to the 47 stocked Rainbow Trout and 1 wild Brook Trout (soon to be designated state Special Concern) that were collected in 2015, when water levels were lower at the time of the survey and the deeper hole mentioned above was able to be sampled. Two native fish species of special interest to biologists based on their low abundance statewide and unique habitat requirements (the soon to be designated state Special Concern Shield Darter and the soon to be listed state Threatened Slimy Sculpin) were found at this location. Overall, 340 individual fish were collected representing 15 different species.

Recommendation: The data from the electrofishing surveys, along with continuous water temperature and angler survey/catch data will be used to evaluate fishing regulation changes on the trout fishery. A trout movement / telemetry study is proposed to begin in 2017 to indicate if and/or when trout are moving out of the *C&R* regulation area will also be used to evaluate fishing regulation changes on the trout fishery. (Shramko)

Forked Brook

Date: 08/04/2016
County: Sussex
Township: Sandyston Twp.
Drainage: Flat Brook
Project: Temperature Study - TP Streams
Location: Grau Road

Fish Species	Number	Length (mm)
Chub, Creek	3	0 - 0
Dace, Blacknose	70	0 - 0
Eel, American	1	0 - 0
Trout, Brook (YOY)	3	65 - 69
Trout, Brook	10	111 - 201

Water Chemistry / Habitat

Water Temperature (°C): 16.9
Dissolved Oxygen (mg/L): 9.13
Specific Conductance (uS/cm): 101.7
pH: 7.32
Alkalinity (mg/L): 26
Sample Length (m): 150
Habitat Assessment Score: 179 Optimal (2015)

Summary: Forked Brook is a small stream that flows through the forested habitat of Stokes State Forest and its habitat is comprised of small plunge pools, runs, and an intermixing of many large boulders and cobble. This tributary to the Big Flat Brook was electrofished on 8/4/2016 to assess the wild trout populations structure relative to the stream temperature regime. This is the second time in two years that this exact location was sampled as part of this study. Interestingly enough, the same number of Brook Trout was captured this year (13) as last year (13). In 2016 Brook Trout lengths ranged from 65 – 201 mm (2.5 – 7.9 in) and included three young-of-the-year. At the time of the survey there was very low water and a good amount of silt in the stream. Habitat here was dominated by boulder and cobble layering. Much of the cobble looks to have been pushed downstream, so much that it has caused a large blockage at its confluence with the Big Flat Brook. It is possible that this blockage causes a large impediment to immigration or emigration of any fish species.

Recommendation: This survey is part of a stream temperature study that is currently being conducted on 14 *Trout Production* streams. This stream will be monitored in this section for the next 1-2 years to study the relationship of stream temperature on wild trout life cycles in New Jersey and help guide in the management of our *Trout Production* streams. (Shramko)

Little Flat Brook

Date: 08/09/2016
County: Sussex
Township: Sandyston Twp.
Drainage: Flat Brook
Project: Trout Production Re-Inventory
Location: Layton - Hainesville Rd.

Water Chemistry / Habitat

Water Temperature (°C):	20.1
Dissolved Oxygen (mg/L):	8.83
Specific Conductance (uS/cm):	356.2
pH:	7.87
Alkalinity (mg/L):	109.5
Sample Length (m):	150
Habitat Assessment Score:	160 Optimal

Fish Species	Number	Length (mm)
Bass, Largemouth	3	62 - 90
Dace, Blacknose	33	0 - 0
Dace, Longnose	20	0 - 0
Darter, Tessellated	42	0 - 0
Eel, American	33	0 - 0
Lamprey, Sea	3	0 - 0
Minnow, Cutlip	52	0 - 0
Pickerel, Chain	9	82 - 176
Pickerel, Redfin	4	84 - 186
Shiner, Common	16	0 - 0
Sucker, White	3	0 - 0
Sunfish, Pumpkinseed	4	101 - 151
Sunfish, Redbreast	1	141 - 141
Trout, Brook	4	162 - 205

Summary: The Little Flat Brook is a small *Trout Production* stream originating in High Point State Park and flows into the Big Flat Brook in Sussex Co. In 2016, this stream was surveyed to assess the fish population at a survey location in the general area of a survey done in 1988 and another in 1968. Even though we assumed that Brook Trout use the Little Flat Brook, this survey was the first time wild Brook Trout (soon to be designated state Special Concern) were officially documented in the stream. A total of 4 wild Brook Trout (0 young-of-the-year) were found. Previous surveys were done in 1968 and in 1988 at a survey location just upstream of this survey location found wild Brown Trout (1 in 1968 and 6 in 1988), but no Brook Trout.

Stream temperature in the 2016 survey was 20.1°C. This compares very closely with the water temperatures taken during the 1968 survey (20°C) and the 1988 survey (22°C). These temperatures are above the optimal temperature for Brook Trout and the stress from these warmer than optimal temperatures are a concern and possibly a factor in why Brook Trout are not found in high numbers in the Little Flat Brook. It is important to keep in mind that these three one-time temperature readings are very limiting. To fully understand if temperature is a reason for the lower trout numbers found, a continuous temperature monitor would have to be deployed into the stream. Several warmwater species (Redfin Pickerel, Chain Pickerel, Largemouth Bass, and Pumpkinseed Sunfish) were found in the 2016 survey. The competition for resources from these species on Brook Trout is also a concern for the Brook Trout population. These warmwater species were also found in both the 1968 and 1988 surveys indicating that these warmwater fish have been a part of the Little Flat Brook system at this location for over 50 years. A native fish species of special interest to biologists based on its low abundance statewide and unique habitat requirements (the soon to be listed state Endangered Bridle Shiner) was found at this location, but just outside of the 150-meter survey area. Bridle Shiners have been documented in the Little Flat Brook system in the past, but not this far upstream. A total of 227 individual fish representing 14 different species were found in this survey.

Recommendation: This stream should be periodically monitored at a minimum in accordance with the established schedule for wild Brook Trout / *Trout Production* streams. (Shramko)

Little Flat Brook

Date: 08/09/2016
County: Sussex
Township: Sandyston Twp.
Drainage: Flat Brook
Project: Trout Production Re-Inventory
Location: Near confluence with Big Flat Brook

Water Chemistry / Habitat

Water Temperature (°C):	16.0
Dissolved Oxygen (mg/L):	10.49
Specific Conductance (uS/cm):	427.2
pH:	8.25
Alkalinity (mg/L):	161.5
Sample Length (m):	150
Habitat Assessment Score:	187 Optimal

Fish Species	Number	Length (mm)
Chub, Creek	22	0 - 0
Dace, Blacknose	130	0 - 0
Dace, Longnose	48	0 - 0
Darter, Shield	10	0 - 0
Darter, Tessellated	109	0 - 0
Eel, American	50	0 - 0
Lamprey, Sea	4	0 - 0
Minnow, Cutlip	19	0 - 0
Pickerel, Redfin	1	104 - 104
Sculpin, Slimy	104	0 - 0
Shiner, Common	11	0 - 0
Sucker, White	27	0 - 0
Trout, Rainbow	1	308 - 308

Summary: The Little Flat Brook is a small *Trout Production* stream originating in High Point State Park and flows into the Big Flat Brook in Sussex Co. In 2016, this stream was surveyed to assess the fish population at a survey location in the general area of a survey done in 1988 and another in 1968. This survey location is located in close proximity to a trout stocking location and is likely the reason why a stocked Rainbow Trout was collected in this survey. No wild trout were found in 2016. Previous surveys found zero trout (1968) or a low / struggling trout population (seven Brown Trout – two young-of-the-year in 1988). It is not clear as to why trout numbers are low or non-existent at this location as the habitat assessment score and temperature during the 2016 survey was within the optimal range for Brook Trout. Temperatures taken during the 1968 and 1988 surveys were 18.9°C in 1968 and 22°C in 1988. This range of temperature difference between surveys emphasizes the problem and limitations with a one-time temperature reading. To fully understand if temperature is a reason for the lower trout numbers found, a continuous temperature monitor would have to be deployed into the stream. Two native fish species of special interest to biologists based on their low abundance statewide and unique habitat requirements (the soon to be designated state Special Concern Shield Darter and the soon to be listed state Threatened Slimy Sculpin) were found at this location. A total of 229 individual fish representing 11 different species were found in this survey.

Recommendation: This stream should be periodically monitored at a minimum in accordance with the established schedule wild Brook Trout / *Trout Production* streams. (Shramko)

Mud Pond Outlet Stream

Date: 08/22/2016
County: Sussex
Township: Hardyston Twp.
Drainage: Wallkill River
Project: Trout Production Re-Inventory
Location: Mountain Road

Fish Species	Number	Length (mm)
Dace, Blacknose	5	0 - 0
Mudminnow, Eastern	6	0 - 0
Trout, Brook	4	176 - 242

Water Chemistry / Habitat

Water Temperature (°C): 17.1
Dissolved Oxygen (mg/L): 6.77
Specific Conductance (uS/cm): 142.8
pH: 7.68
Alkalinity (mg/L): 69
Sample Length (m): N/A
Habitat Assessment Score: N/A

Summary: Mud Pond Outlet Stream is a small stream that flows out of Hamburg Mountain and ultimately into the Wallkill River. In 2016, this stream was surveyed to assess the fish population at a survey location previously surveyed in 1998. A standardized survey of 150m could not be conducted at this site in 2016 due to extreme low flow conditions. The deeper pool below the road bridge was the only water that was sampled. In 1998, the pool below the bridge and two other pools were also the only water sampled. It is unknown why the 1998 surveys only sampled deeper pools, but it is likely also due to low summertime flow conditions. Interestingly, both surveys found wild Brook Trout (soon to be designated state Special Concern). The 2016 survey found four wild Brook Trout (zero young-of-the-year (YOY)), while the 1998 survey found 17 wild Brook Trout (13 *C&R*). The low numbers of Brook Trout found seems to be limited by the little habitat and low flow conditions at this survey location, but further sampling at different locations or during higher flows is needed to make accurate predictions on the streams ability to support a larger population of wild Brook Trout. What we can conclude is that the stream itself does have some wild Brook Trout surviving in the stream from at least as early as 1998 into 2016. Stream temperatures in both the 2016 survey and the 1998 surveys found the water temperature within the optimal Brook Trout temperature range. The 2016 water temperature was 17.1°C, while the 1998 survey found the water temperature to be 14.4°C. It is important to keep in mind that this one-time temperature reading each year is very limiting. To fully understand the streams water temperature ranges, a continuous temperature monitor would have to be deployed into the stream. A total of 15 individual fish representing three different species were found in the one small pool surveyed.

Recommendation: This stream should be periodically monitored at a minimum in accordance with the established schedule for wild Brook Trout / *Trout Production* streams. (Shramko)

*******NON – STANDARDIZED SURVEY*******

Paulins Kill

Date: 07/07/2016
County: Warren
Township: Blairstown Twp.
Drainage: Paulins Kill
Project: Paulins Kill Restoration Assessment
Location: Route 94, off Paulins Kill Trail

Water Chemistry / Habitat

Water Temperature (°C):	25.6
Dissolved Oxygen (mg/L):	8.43
Specific Conductance (uS/cm):	426
pH:	8.16
Alkalinity (mg/L):	146
Sample Length (m):	150
Habitat Assessment Score:	N/A

Fish Species	Number	Length (mm)
Bass, Largemouth	1	130 - 130
Bass, Rock	2	93 - 157
Bass, Smallmouth	15	102 - 538
Bullhead, Yellow	1	200 - 200
Darter, Shield	10	0 - 0
Darter, Tessellated	5	0 - 0
Eel, American	39	0 - 0
Madtom, Margined	4	0 - 0
Mudminnow, Eastern	1	0 - 0
Sucker, White	38	0 - 0
Sunfish, Bluegill	2	88 - 171
Sunfish, Redbreast	7	52 - 185
Trout, Rainbow	21	265 - 313

Summary: Beginning in 2015 and continuing into 2016, the NJDFW's Bureau of Freshwater Fisheries began sampling the Paulins Kill to document current fish assemblages prior to the proposed removal of the Columbia Lake Dam. The Columbia Lake Dam is located approximately 1/2 mile from the confluence with the Delaware River and acts as a major barrier to fish movement. Anadromous fish such as American Shad and Blueback Herring have been documented below the dam, but not above the dam. In addition to the restricted movement of these anadromous fish, restricted / impacted movement of American Eel by the Columbia Lake Dam has also been documented. This survey is one of seven total stream surveys done upstream of the Columbia Lake Dam in 2015 and 2016 documenting such restrictions.

This two backpack and barge electrofishing survey found 144 individual fish from 13 different fish species. This survey found 0 American Shad, 0 Blueback Herring, and 39 American Eel (0 smaller than 200mm). The fish species and numbers documented in this survey, and the six other surveys completed since 2015, demonstrate the impacts to fish movement that the Columbia Lake Dam is having on the Paulins Kill. A native fish species of special interest to biologists based on its low abundance statewide and unique habitat requirements (the soon to be designated state Special Concern Shield Darter) was found at this location. All of the Rainbow Trout found were likely stocked by the NJ Division of Fish and Wildlife's Pequest Trout Hatchery this spring.

Recommendation: Additional sampling is planned upstream of Columbia Lake, following the proposed removal of the Columbia Lake Dam. (Shramko)

*******NON – STANDARDIZED SURVEY*******

Paulins Kill

Date: 07/07/2016
County: Warren
Township: Blairstown Twp.
Drainage: Paulins Kill
Project: Paulins Kill Restoration Assessment
Location: Lambert Road Bridge

Water Chemistry / Habitat

Water Temperature (°C):	25.6
Dissolved Oxygen (mg/L):	8.88
Specific Conductance (uS/cm):	415.1
pH:	8.22
Alkalinity (mg/L):	142
Sample Length (m):	150
Habitat Assessment Score:	N/A

Fish Species	Number	Length (mm)
Bass, Rock	1	220 - 220
Bass, Smallmouth	1	217 - 217
Bullhead, Yellow	5	92 - 125
Dace, Blacknose	9	0 - 0
Darter, Shield	2	0 - 0
Darter, Tessellated	15	0 - 0
Eel, American	4	0 - 0
Shiner, Satinfin	3	0 - 0
Sucker, White	1	0 - 0
Sunfish, Bluegill	1	102 - 102
Sunfish, Redbreast	4	81 - 148
Trout, Rainbow	1	277 - 277

Summary: Beginning in 2015 and continuing into 2016, the NJDFW's Bureau of Freshwater Fisheries began sampling the Paulins Kill to document current fish assemblages prior to the proposed removal of the Columbia Lake Dam. The Columbia Lake Dam is located approximately 1/2 mile from the confluence with the Delaware River and acts as a major barrier to fish movement. Anadromous fish such as American Shad and Blueback Herring have been documented below the dam, but not above the dam. In addition to the restricted movement of these anadromous fish, restricted / impacted movement of American Eel by the Columbia Lake Dam has also been documented. This survey is one of seven total stream surveys done upstream of the Columbia Lake Dam in 2015 and 2016 documenting such restrictions.

This three-backpack electrofishing survey found 47 individual fish from 12 different fish species. This survey found zero American Shad, zero Blueback Herring, and only four American Eel (zero smaller than 200mm). The fish species and numbers documented in this survey, and the six other surveys completed since 2015, demonstrate the impacts to fish movement that the Columbia Lake Dam is having on the Paulins Kill. A native fish species of special interest to biologists based on its low abundance statewide and unique habitat requirement (the soon to be designated state Special Concern Shield Darter) was found at this location. The Rainbow Trout found was likely stocked by the NJ Division of Fish and Wildlife's Pequest Trout Hatchery this spring.

Recommendation: Additional sampling is planned upstream of Columbia Lake, following the proposed removal of the Columbia Lake Dam. (Shramko)

*******NON – STANDARDIZED SURVEY*******

Paulins Kill

Date: 04/14/2016
County: Warren
Township: Knowlton Twp.
Drainage: Paulins Kill
Project: Paulins Kill Restoration Assessment
Location: Route 46

Water Chemistry / Habitat

Water Temperature (°C):	10.8
Dissolved Oxygen (mg/L):	10.64
Specific Conductance (uS/cm):	460.4
pH:	8.89
Alkalinity (mg/L):	76
Sample Length (m):	N/A
Habitat Assessment Score:	N/A

Fish Species	Number	Length (mm)
Bass, Smallmouth	1	205 - 205
Dace, Longnose	8	0 - 0
Darter, Shield	15	0 - 0
Darter, Tessellated	9	0 - 0
Eel, American	78	0 - 0
Fallfish	4	0 - 0
Madtom, Margined	1	0 - 0
Shad, American	2	456 - 562
Shiner, Spottail	5	0 - 0
Sucker, Northern Hog	1	0 - 0
Sucker, White	22	0 - 0
Sunfish, Redbreast	1	0 - 120

Summary: Beginning in 2015 and continuing into 2016, the NJDFW's Bureau of Freshwater Fisheries began sampling the Paulins Kill to document current fish assemblages prior to the proposed removal of the Columbia Lake Dam. The Columbia Lake Dam is located approximately 1/2 mile from the confluence with the Delaware River and acts as a major barrier to fish movement. Anadromous fish such as American Shad and Blueback Herring have been documented below the dam, but not above the dam. In addition to the restricted movement of these anadromous fish, restricted / impacted movement of American Eel by the Columbia Lake Dam has also been documented.

This three backpack and barge electrofishing survey found 138 individual fish from 12 different fish species. This survey found 2 American Shad, 0 Blueback Herring, and 78 American Eels (many of which were less than 200mm). Stream flow was high (160 cubic feet per second (cfs)) making sampling very difficult and dangerous. Four other American Shad were seen, but not collected during the survey. The presence of American Shad and American Eel less than 200 mm found at this location shows that these anadromous and catadromous species are found downstream of the Columbia Lake dam. Two native fish species of special interest to biologists based on its low abundance statewide and unique habitat requirement (the soon to be designated state Special Concern Shield Darter and the soon to be designated state Special Concern Norther Hog Sucker) were also found at this location.

Recommendation: Additional sampling below the Columbia Lake Dam is planned for the spring of 2017 and subsequent years, following the proposed dam removal. (Shramko)

*******NON – STANDARDIZED SURVEY*******

Shawanni Creek

Date: 08/22/2016
County: Sussex
Township: Sandyston Twp.
Drainage: Flat Brook
Project: Brook Trout Assessment
Location: Strubble (Dimon) Road

Fish Species	Number	Length (mm)
NO FISH FOUND	0	0 - 0

Water Chemistry / Habitat

Water Temperature (°C): 18.6
Dissolved Oxygen (mg/L): 8.87
Specific Conductance (uS/cm): 23.1
pH: 4.69
Alkalinity (mg/L): 0.1
Sample Length (m): 150
Habitat Assessment Score: 184 Optimal

Summary: Shawanni Creek is a small *Trout Production* stream that flows out of Stokes State Forest and ultimately into the Big Flat Brook. In 2016, this stream was surveyed to assess the fish population at a survey location upstream of Shawanni Lake. This survey location was selected in an attempt to find a healthy wild trout population upstream of Shawanni Lake which is thought to be limiting the trout population found in Shawanni Creek by increasing summer stream temperatures. Unfortunately, no wild trout were found. In fact, no fish were found in the stream at all. The pH found was 4.69 which is extremely low. Brook trout are more tolerant of low pH than other trout species, but the optimal pH range for Brook Trout is 6.5 – 8.0 with a tolerance range of 4.0 – 9.5 (Creaser 1930; Raleigh 1982). The lower limit of survival, especially for embryos and hatchlings, was reported to be pH 4.5 (Power 1980). The extreme low pH found is likely the leading reason no fish were found. Shawanni Creek originates from a hemlock swamp which is most likely the reason the stream is so acidic.

Recommendation: This stream should be periodically monitored at a minimum in accordance with the established schedule for wild Brook Trout / *Trout Production* streams, at a more suitable water chemistry location. (Shramko)

Shawanni Creek

Date: 07/29/2016
County: Sussex
Township: Walpack Twp.
Drainage: Flat Brook
Project: Trout Production Re-Inventory
Location: Mountain Road Bridge

Fish Species	Number	Length (mm)
Dace, Blacknose	47	0 - 0
Eel, American	13	0 - 0
Trout, Brown	1	238 - 238

Water Chemistry / Habitat

Water Temperature (°C): 21.1
Dissolved Oxygen (mg/L): 8.54
Specific Conductance (uS/cm): 34.2
pH: 6.97
Alkalinity (mg/L): 11
Sample Length (m): 150
Habitat Assessment Score: 172 Optimal

Summary: Shawanni Creek is a small *Trout Production* stream that flows out of Stokes State Forest and ultimately into the Big Flat Brook. In 2016, this stream was surveyed to assess the fish population at a survey location previously surveyed in 1970 and in 2005. One wild adult Brown Trout was found in 2016. This data compares similarly to the previous two surveys where total trout numbers found were also very low. In 1970, four total trout were found (two Brook Trout (one young-of-the-year (YOY)) and two Brown Trout (zero YOY). In 2005, one Brook Trout was found (zero YOY). This survey location is located below Shawanni Lake. The lake is likely negatively impacting the creek downstream of the lake by increasing the streams summertime temperatures. During the 2016 survey, stream temperature recorded was 21.1°C. This temperature is above the optimal temperature for wild trout and the stress from this warmer than optimal temperature is a concern. It is likely one of possibly several reasons the wild trout population is suffering. This stream also suffers from very little flow. An attempt to sample this location, three weeks earlier, was canceled due to extremely low flow conditions. Although good wild trout populations have been found in low flow conditions, a low flow condition, like the one found earlier this year, would also put a high amount of stress on any wild trout residing in this stream. Extreme low flow combined with high temperatures both contribute to the low wild trout population in Shawanni Creek. A total of 61 individual fish representing three different species were found in this survey.

Recommendation: This stream should be periodically monitored at a minimum in accordance with the established schedule for wild Brook Trout / *Trout Production* streams. (Shramko)

Sparta Glen Brook

Date: 07/15/2016
County: Sussex
Township: Sparta Twp.
Drainage: Wallkill River
Project: Habitat Restoration
Location: Rt. 620 Sparta Glen Park, area of massive landslide restoration

Fish Species	Number	Length (mm)
Chub, Creek	6	0 - 0
Dace, Blacknose	254	0 - 0
Dace, Longnose	70	0 - 0
Mudminnow, Eastern	1	0 - 0
Trout, Brook	2	173 - 223

Water Chemistry / Habitat

Water Temperature (°C): 21.5
Dissolved Oxygen (mg/L): 106.4
Specific Conductance (uS/cm): 317.2
pH: 8.26
Alkalinity (mg/L): 90
Sample Length (m): 150
Habitat Assessment Score: 154 Sub-Optimal

Summary: Sparta Glen Brook Restoration project aims to restore a section of Sparta Glen Brook that was devastated by a massive landslide from a microburst in August of 2000 that dumped 16 inches of rain in a very short period of time. After a partial rebuild, the site was severely damaged by Hurricane Irene in 2011. The Fred S. Burroughs North Jersey Chapter of Trout Unlimited has partnered with the Township of Sparta to restore this section of stream back into its natural state. An electrofishing survey was done this year to determine the status of the fish assemblage and wild Brook Trout population in this stream immediately after restoration efforts that occurred in the spring of this year. Two adult/juvenile wild Brook Trout (soon to be designated state Special Concern) were found. It is too early to detect an increase in total trout biomass due to the restoration efforts which will not be fully understood for several years, but the survey shows that trout were not eliminated from the restoration area due to the high disturbance from restoration equipment. The 2016 survey and 2015 survey both found two wild Brook Trout, which also compares similarly with other surveys done in 2001 and 2009 where six wild Brook Trout and two wild Brook Trout were found respectively. These surveys give a solid baseline on the wild Brook Trout population. It will be very interesting to compare this baseline to future surveys as the trout respond to the impacts of the restoration efforts. The 2016 survey found 333 individual fish representing 5 different species.

Recommendation: Additional surveys should be completed in the restoration area for several years to monitor the restoration efforts. (Shramko)

Tillman Brook

Date: 07/29/2016
County: Sussex
Township: Walpack Twp.
Drainage: Flat Brook
Project: Trout Production Re-Inventory
Location: Tillman Road

Fish Species	Number	Length (mm)
Eel, American	1	0 - 0
Trout, Brook (YOY)	4	61 - 66
Trout, Brook	3	131 - 205

Water Chemistry / Habitat

Water Temperature (°C): 18.5
Dissolved Oxygen (mg/L): 8.73
Specific Conductance (uS/cm): 35.8
pH: 7.01
Alkalinity (mg/L): 9
Sample Length (m): 150
Habitat Assessment Score: 179 Optimal

Summary: Tillman Brook is a small *Trout Production* stream that flows out of Stokes State Forest and into the Flat Brook. In 2016, this stream was surveyed to assess the fish population at a survey location previously surveyed in 2005. Seven wild Brook Trout (soon to be designated state Special Concern) were found of which four were young-of-the-year (YOY) in 2016. The number of wild Brook Trout found is somewhat lower in the 2016 survey than the 2005 survey. In 2005, 43 Brook Trout were found (28 YOY). This decrease in total trout numbers is definitely a concern and it is not immediately apparent as to what may have caused this decline. A water temperature reading of 18.5°C was found during the survey and is within the optimal range for Brook Trout and well within the survivability range. It is important to keep in mind that this one-time temperature reading is very limiting. To fully understand if temperature is a reason for the lower trout numbers found, a continuous temperature monitor would have to be deployed into the stream. An interesting change in pH from the 2005 survey (pH was 5.8) to this year's survey (pH of 7.01) needs to be further explored as a change in water quality as the possible cause for the decreasing trout population. A total of eight individual fish representing two different species were found in this survey.

Recommendation: This stream should be periodically monitored at a minimum in accordance with the established schedule for wild Brook Trout / *Trout Production* streams. (Shramko)

Stream Surveys in the Upper Delaware (South) Region

(Delawanna Creek to Lockatong Creek)

Barkers Mill Brook

Date: 07/27/2016
County: Warren
Township: Independence Twp.
Drainage: Pequest River
Project: Brook Trout Assessment
Location: Barkers Mill Road Bridge, upstream of most downstream bridge

Fish Species	Number	Length (mm)
Chub, Creek	4	0 - 0
Dace, Blacknose	34	0 - 0
Eel, American	14	0 - 0
Sunfish, Bluegill	1	66 - 66
Sunfish, Pumpkinseed	9	64 - 104
Trout, Brook (YOY)	8	74 - 96
Trout, Brook	24	165 - 275

Water Chemistry / Habitat

Water Temperature (°C): 16.1
Dissolved Oxygen (mg/L): 9.27
Specific Conductance (uS/cm): 409.1
pH: 7.80
Alkalinity (mg/L): 117
Sample Length (m): 150
Habitat Assessment Score: 157 Sub-Optimal

Summary: Barkers Mill Brook, a tributary to the Pequest River, flows into the river upstream of the Pequest Trout Hatchery. The brook is classified as *Trout Production* in the state's SWQS. When this small trout-stocked stream was electrofished in 1981, 1987, and 1991 (near the Townsbury Road or Cemetery Road bridges) low numbers of trout (<10) were present each time, either wild Brook Trout and/or stocked Brown and Rainbow Trout. When surveyed in 2007 (Cemetery Road bridge) only one trout (a stocked Rainbow Trout) was encountered. In 2008 the stocking of trout was discontinued to conserve and enhance the wild Brook Trout population. A survey subsequently conducted in 2013 (Cemetery Road bridge) to assess the status of Brook Trout found only two Brook Trout, and these were of hatchery origin (based on fish size and fin wear). These stocked fish likely migrated from the Pequest River which is trout-stocked and approximately 1/3 mile downstream from the survey site. The entire brook lies within a single catchment (fine scale watershed level being used by the Eastern Brook Trout Joint Venture to assess the status of wild Brook Trout). Therefore, it is important that additional surveys be conducted to determine if wild Brook Trout have been extirpated from this catchment. Surveys were conducted 2016 at four locations to thoroughly assess the status of Brook Trout in this stream. Wild Brook Trout (and no stocked trout) were documented at all four locations and their continued presence in this stream is important because this species will soon be designated state Special Concern.

The data summarized in the tables above is from a survey conducted on 7/27/16 at a site not previously surveyed (near Barkers Mill Road) and is the most upstream of the four locations surveyed in 2016. This section was meadow-like, having several deep pools. An abundance of watercress, a cold water temperature (16.1°C), and high alkalinity strongly suggest the presence of springs in the immediate area. The combination of deep pools and cold, high alkalinity water results in the production of relatively large trout for such a small stream. A total of 32 Brook Trout (8 young-of-the-year (YOY) and 24 older than YOY) were captured. Most of the older fish were large, with 21 > 178 mm (7 in) and 6 > 228 mm (9 in). Small numbers of four other fish species were also documented (Blacknose Dace, American Eel, Pumpkinseed, and Bluegill).

Recommendation: Continue to monitor this stream in accordance with the established schedule (Note: Additional recommendations made for two survey sites near Cemetery Road). (Hamilton)

Barkers Mill Brook

Date: 07/27/2016
County: Warren
Township: Independence Twp.
Drainage: Pequest River
Project: Brook Trout Assessment
Location: Townsbury Road bridge, upstream

Fish Species	Number	Length (mm)
Chub, Creek	5	0 - 0
Dace, Blacknose	11	0 - 0
Trout, Brook (YOY)	7	82 - 102
Trout, Brook	3	167 - 207

Water Chemistry / Habitat

Water Temperature (°C): 17.5
Dissolved Oxygen (mg/L): 9.63
Specific Conductance (uS/cm): 473.6
pH: 8.05
Alkalinity (mg/L): 137
Sample Length (m): 150
Habitat Assessment Score: 140 Sub-Optimal

Summary: Barkers Mill Brook, a tributary to the Pequest River, flows into the river upstream of the Pequest Trout Hatchery. The brook is classified as *Trout Production* in the state's SWQS. When this small trout-stocked stream was electrofished in 1981(Johnson Road), 1987 (Townsbury Road), and 1991 (Cemetery Road) low numbers of trout (<10) were present each time, either wild Brook Trout and/or stocked Brown and Rainbow Trout. When surveyed again in 2007 (Cemetery Road bridge) only one trout (a stocked Rainbow Trout) was encountered. In 2008 the stocking of trout was discontinued to conserve and enhance the wild Brook Trout population. A survey subsequently conducted in 2013 (Cemetery Road bridge) to assess the status of Brook Trout found only two Brook Trout, and these were of hatchery origin (based on fish size and fin wear). These stocked fish likely migrated from the Pequest River which is trout-stocked and approximately 1/3 mile downstream from the survey site. The entire brook lies within a single catchment (fine scale watershed level being used by the Eastern Brook Trout Joint Venture to assess the status of wild Brook Trout). Therefore, it is important that additional surveys be conducted to determine if wild Brook Trout have been extirpated from this catchment. Surveys were conducted 2016 at four locations to thoroughly assess the status of Brook Trout in this stream. Wild Brook Trout (and no stocked trout) were documented at all four locations and their continued presence in this stream is important because this species will soon be designated state Special Concern.

The data summarized in the tables above is from a survey conducted on 7/27/16 (Townsbury Road), the second most upstream of the four locations surveyed in 2016. The stream is shallower at this location and fewer fish were present compared to the survey site upstream (Barkers Mill Road). Ten Brook Trout (7 young-of-the-year (YOY) and 3 older than YOY) were captured. Small numbers of two other fish species were also documented (Blacknose Dace and Creek Chub). This site was surveyed in 1987 and adult Brook Trout (6) and Brown Trout were recorded (unknown if they were wild or hatchery origin).

Recommendation: Continue to monitor this stream reach in accordance with the established schedule (Note: Additional recommendations made for two survey sites near Cemetery Road). (Hamilton)

Barkers Mill Brook

Date: 07/28/2016
County: Warren
Township: Independence Twp.
Drainage: Pequest River
Project: Brook Trout Assessment
Location: Cemetery Road bridge, just downstream

Fish Species	Number	Length (mm)
Chub, Creek	4	0 - 0
Dace, Blacknose	171	0 - 0
Dace, Longnose	58	0 - 0
Darter, Tessellated	38	0 - 0
Eel, American	27	0 - 0
Sucker, White	3	0 - 0
Trout, Brook (YOY)	5	73 - 95

Water Chemistry / Habitat

Water Temperature (°C): 18.7
Dissolved Oxygen (mg/L): 9.85
Specific Conductance (uS/cm): 421.5
pH: 8.14
Alkalinity (mg/L): 142
Sample Length (m): 150
Habitat Assessment Score: 131 Sub-Optimal

Summary: Barkers Mill Brook, a tributary to the Pequest River, flows into the river upstream of the Pequest Trout Hatchery. The brook is classified as *Trout Production* in the state's SWQS. When this small trout-stocked stream was electrofished in 1981(Johnson Road), 1987 (Townsbury Road), and 1991 (Cemetery Road), low numbers of trout (<10) were present each time, either wild Brook Trout and/or stocked Brown and Rainbow Trout. When surveyed again in 2007 (Cemetery Road bridge) only one trout (a stocked Rainbow Trout) was encountered. In 2008 the stocking of trout was discontinued to conserve and enhance the wild Brook Trout population. A survey subsequently conducted in 2013 (Cemetery Road bridge) to assess the status of Brook Trout found only two Brook Trout, and these were of hatchery origin (based on fish size and fin wear). These stocked fish likely migrated from the Pequest River which is trout-stocked and approximately 1/3 mile downstream from the survey site. The entire brook lies within a single catchment (fine scale watershed level being used by the Eastern Brook Trout Joint Venture to assess the status of wild Brook Trout). Therefore, it is important that additional surveys be conducted to determine if wild Brook Trout have been extirpated from this catchment. Surveys were conducted 2016 at four locations to thoroughly assess the status of Brook Trout in this stream. Wild Brook Trout (and no stocked trout) were documented at all four locations and their continued presence in this stream is important because this species will soon be designated state Special Concern.

The data summarized in the tables above is from a survey conducted on 7/28/16 (Cemetery Road), the third lowermost of the four locations surveyed in 2016. When previously surveyed in 2007 only one trout, a stocked Rainbow Trout, was present. At this location a farm is present and the stream begins to flow through a pasture having a poorly vegetated riparian zone, reflected in a lower habitat assessment score (131) compared to the 2 uppermost survey sites (157 and 140). Five young-of-the-year Brook Trout were captured and six other species were present (Blacknose Dace, Longnose Dace, Creek Chub, American Eel, White Sucker, and Tessellated Darter).

Recommendation: The stream reach that flows through the pasture before entering the Pequest River (approximately 500 m) would be an ideal candidate for riparian restoration to improve streamside shading and cooler summer water temperatures. Continuous temperature monitoring stations should be established to provide baseline information that could be used to assess the success of a riparian restoration project. Continue to monitor this stream reach in accordance with the established schedule, or more frequently if a restoration project is undertaken. (Hamilton)

Barkers Mill Brook

Date: 07/28/2016
County: Warren
Township: Independence Twp.
Drainage: Pequest River
Project: Brook Trout Assessment
Location: Cemetery Road, near confluence with Pequest River

Fish Species	Number	Length (mm)
Chub, Creek	30	0 - 0
Dace, Blacknose	77	0 - 0
Dace, Longnose	3	0 - 0
Darter, Tessellated	33	0 - 0
Eel, American	31	0 - 0
Killifish, Banded	28	0 - 0
Lamprey, Sea	1	0 - 0
Sucker, White	64	0 - 0
Trout, Brook (YOY)	1	71 - 71
Trout, Brook	1	173 - 173

Water Chemistry / Habitat

Water Temperature (°C): 24.2
Dissolved Oxygen (mg/L): 9.98
Specific Conductance (uS/cm): 478.6
pH: 8.32
Alkalinity (mg/L): 138
Sample Length (m): 150
Habitat Assessment Score: 93 Marginal

Summary: Barkers Mill Brook, a tributary to the Pequest River, flows into the river upstream of the Pequest Trout Hatchery. The brook is classified as *Trout Production* in the state's SWQS. When this small trout-stocked stream was electrofished in 1981(Johnson Road), 1987 (Townsbury Road), and 1991 (Cemetery Road) low numbers of trout (<10) were present each time, either wild Brook Trout and/or stocked Brown and Rainbow Trout. When surveyed again in 2007 (Cemetery Road bridge) only one trout (a stocked Rainbow Trout) was encountered. In 2008 the stocking of trout was discontinued to conserve and enhance the wild Brook Trout population. A survey subsequently conducted in 2013 (Cemetery Road bridge) to assess the status of Brook Trout found only two Brook Trout, and these were of hatchery origin (based on fish size and fin wear). These stocked fish likely migrated from the Pequest River which is trout-stocked and approximately 1/3 mile downstream from the survey site. The entire brook lies within a single catchment (fine scale watershed level being used by the Eastern Brook Trout Joint Venture to assess the status of wild Brook Trout). Therefore, it is important that additional surveys be conducted to determine if wild Brook Trout have been extirpated from this catchment. Surveys were conducted 2016 at four locations to thoroughly assess the status of Brook Trout in this stream. Wild Brook Trout (and no stocked trout) were documented at all four locations and their continued presence in this stream is important because this species will soon be designated state Special Concern.

The data summarized in the tables above is from a survey conducted on 7/28/16 close to the tributary's confluence with the Pequest River (not previously surveyed). This site was the lowermost of the four sites surveyed in 2016. At this location the stream has flowed more than halfway through an open pasture, as reflected by the high water temperature (24.2°C) and low habitat assessment score (93, marginal), the lowest score among the four sites surveyed. Not surprisingly, only two Brook Trout (one young-of-the-year and one older) were encountered. Eight other species were present (Blacknose Dace, Longnose Dace, Creek Chub, American Eel, White Sucker, Tessellated Darter, Banded Killifish, and Sea Lamprey). Species richness at this location was the highest (9) of the four sites due to degraded habitat and water quality, and proximity to the Pequest River (fish moving freely between river and brook).

Recommendation: The stream reach that flows through the pasture before entering the Pequest River (approximately 500 m) would be an ideal candidate for riparian restoration to improve streamside shading and cooler summer water temperatures. Continuous temperature monitoring stations should be established to provide baseline information that could be used to assess the success of a riparian restoration project. Continue to monitor this stream reach in accordance with the established schedule, or more frequently if a restoration project is undertaken. (Hamilton)

Beaver Brook (trib.) (E. of Manunka Chunk)

Date: 08/15/2016
County: Warren
Township: White Twp.
Drainage: Pequest River
Project: Brook Trout Assessment
Location: Upper Sarepta Rd/Beaver Brook WMA

Fish Species	Number	Length (mm)
Chub, Creek	74	0 - 0
Dace, Blacknose	117	0 - 0
Eel, American	3	0 - 0

Water Chemistry / Habitat

Water Temperature (°C): 18.7
Dissolved Oxygen (mg/L): 9.18
Specific Conductance (uS/cm): 183.9
pH: 7.67
Alkalinity (mg/L): 54
Sample Length (m): 150
Habitat Assessment Score: 140 Sub-Optimal

Summary: This tributary flows through the Beaver Brook WMA and is currently classified *Non-Trout* (by default). It was first surveyed 10 years ago when NJDFW became the landowner. In 2006 only two fish species were documented (Creek Chub and Blacknose Dace) the water temperature was 19.2°C, and the Habitat Assessment Score was 150 (optimal). Given of the presence of the two trout associated species (and absence of non-native Brown and Rainbow Trout), a water temperature <21°C, and optimal habitat score this stream may be a good candidate for wild Brook Trout restoration, a species soon to be designated state Special Concern. On 8/15/16 this tributary was re-surveyed to obtain current data. A third species (American Eel) was documented (in addition to Creek Chub and Blacknose Dace), the water temperature was 18.7°C, and the habitat score (140) was slightly lower.

Recommendation: This tributary may be a good candidate for a wild Brook Trout restoration project. Water temperature during the summer should be continuously monitored to obtain data that can be used to determine if temperatures are suitable for wild Brook Trout. The flow path of the tributary, in relation to the nearby railroad tunnel and abandoned right-of-way, should also be investigated to assess connectivity between the tributary and the mainstem of Beaver Brook. (Hamilton)

Buckhorn Creek

Date: 08/23/2016
County: Warren
Township: White Twp.
Drainage: Delaware River (1)
Project: Wild Trout Stream Assessment
Location: Route 519

Water Chemistry / Habitat

Water Temperature (°C):	18.3
Dissolved Oxygen (mg/L):	10.6
Specific Conductance (uS/cm):	206.2
pH:	7.63
Alkalinity (mg/L):	43
Sample Length (m):	150
Habitat Assessment Score:	126 Sub-Optimal

Fish Species	Number	Length (mm)
Chub, Creek	9	0 - 0
Dace, Blacknose	115	0 - 0
Dace, Longnose	8	0 - 0
Darter, Tessellated	14	0 - 0
Eel, American	22	0 - 0
Madtom, Margined	3	0 - 0
Sunfish, Green	3	87 - 127
Sunfish, Pumpkinseed	1	95 - 95
Trout, Brook (YOY)	10	59 - 78
Trout, Brook	10	110 - 195
Trout, Brown (YOY)	1	75 - 75

Summary: This *Trout Production* stream flows directly into the Delaware River and the main stem is stocked with trout. In past surveys Wild Brook Trout have been documented in tributaries, and small numbers of wild Brown Trout have been documented the main stem. Four surveys were conducted in this creek's watershed in 2016 (two on the main stem and two tributaries) to assess the wild trout fishery for regulation development or to assess the status and distribution of wild Brook Trout. Brook Trout is a species that will soon be designated as state Special Concern.

The data summarized in the tables above is from the survey conducted on 8/23/16 near the Rt. 519 bridge (a site not previously surveyed). Wild Brook and Brown trout were present with Brook Trout more numerous (only one Brown Trout, a young-of-the-year, was present). None of the trout collected were stocked fish. Eight other fish species were also collected, including Creek Chub, Blacknose Dace, Longnose Dace, Tessellated Darter, American Eel, Margined Madtom, Pumpkinseed, and Green Sunfish (an invasive non-native sunfish species). When this site was last surveyed (in 1970) two Brown Trout (combined weight 0.5 lbs) were recorded in addition to Blacknose Dace, Tessellated Darter, American Eel, White Sucker, and Pumpkinseed.

Recommendation: Continue to monitor this stream reach in accordance with the established schedule. (Hamilton)

Buckhorn Creek

Date: 08/23/2016
County: Warren
Township: Harmony Twp.
Drainage: Delaware River (1)
Project: Wild Trout Stream Assessment
Location: Roxburg Station Road

Water Chemistry / Habitat

Water Temperature (°C):	16.3
Dissolved Oxygen (mg/L):	10.22
Specific Conductance (uS/cm):	237.9
pH:	7.29
Alkalinity (mg/L):	68
Sample Length (m):	150
Habitat Assessment Score:	162 Optimal

Fish Species	Number	Length (mm)
Chub, Creek	56	0 - 0
Dace, Blacknose	133	0 - 0
Dace, Longnose	7	0 - 0
Darter, Tessellated	13	0 - 0
Eel, American	16	0 - 0
Fallfish	1	0 - 0
Lamprey, Sea	3	0 - 0
Madtom, Margined	2	0 - 0
Shiner, Common	7	0 - 0
Sucker, Northern Hog	1	0 - 0
Sucker, White	3	0 - 0
Sunfish, Green	5	106 - 113
Sunfish, Pumpkinseed	1	93 - 93
Trout, Brown (YOY)	1	78 - 78

Summary: This *Trout Production* stream flows directly into the Delaware River and the main stem is stocked with trout. In past surveys Wild Brook Trout have been documented in tributaries, and small numbers of wild Brown Trout have been documented the main stem. Four surveys were conducted in this creek's watershed in 2016 (two on the main stem and two tributaries) to assess the wild trout fishery for regulation development or to assess the status and distribution of wild Brook Trout. Brook Trout is a species that will soon be designated as state Special Concern.

The data summarized in the tables above is from the survey conducted on 8/23/16 near the Roxburg Station Road (downstream of the survey conducted near the Rt. 519 bridge) that was not previously surveyed. In this reach the stream widens, the gradient is lower, and the land use is predominately agricultural. At this location 14 fish species were collected. Only one wild Brown Trout (a young-of-the-year) was present (no wild Brook Trout found) and no stocked trout were present (the road bridge is the furthest upstream trout stocking location). Other species present were Creek Chub, Blacknose Dace, Longnose Dace, Tessellated Darter, American Eel, Fallfish, Sea Lamprey Margined Madtom, Common Shiner, White Sucker, Northern Hog Sucker, Pumpkinseed, and Green Sunfish (an invasive non-native sunfish species). Northern Hog Sucker, a native sucker species, is soon to be designated state Special Concern due to its limited distribution statewide.

Recommendation: Continue to monitor this stream reach in accordance with the established schedule. (Hamilton)

Buckhorn Creek (trib.) (Roxburg)

Date: 08/26/2016
County: Warren
Township: Harmony Twp.
Drainage: Delaware River (1)
Project: Brook Trout Assessment
Location: Grist Mill Road

Fish Species	Number	Length (mm)
Chub, Creek	31	0 - 0
Dace, Blacknose	37	0 - 0
Trout, Brown (YOY)	5	80 - 97
Trout, Brown	19	149 - 265

Water Chemistry / Habitat

Water Temperature (°C): 12.7
Dissolved Oxygen (mg/L): 10.98
Specific Conductance (uS/cm): 309.6
pH: 7.98
Alkalinity (mg/L): 131
Sample Length (m): 150
Habitat Assessment Score: 162 Optimal

Summary: Buckhorn Creek is a *Trout Production* stream that is stocked with trout and flows directly into the Delaware River. Wild Trout (Brook and Brown Trout) have been documented at various locations in this watershed, including a tributary known as Lommason's Glen Brook. Brook Trout is a species that will soon be designated as state Special Concern. A total of four surveys were conducted in the Buckhorn Creek watershed in 2016 (two on the main stem and two tributaries) to assess the wild trout fishery for regulation development and to assess the status and distribution of wild Brook Trout.

The Roxburg tributary, a previously unsampled (*Trout Production* by default) tributary near Lommason's Glen Brook, was surveyed on 8/26/16 to further assess the status and distribution of wild Brook Trout in the Buckhorn Creek watershed. Unfortunately, the only trout species found was Brown Trout, despite an extremely cold water temperature (12.7°C) that often tends to favor Brook Trout. A total of 5 young-of-the-year (YOY) Brown Trout and 19 older than YOY) were found in the Roxburg tributary, and the largest fish measured 265 mm (10.4 in). It is possible that Brook Trout have been relegated to the headwaters of this tributary, where less flow may give them a competitive advantage over Brown Trout. Additional sampling might uncover the presence of Brook Trout in this small catchment. Other species documented during this survey were Blacknose Dace and Creek Chub.

Recommendation: This tributary could be specifically listed as *Trout Production* in the Surface Water Quality Standards. Additional sampling in the upper reaches of this tributary is recommended to determine if Brook Trout might be present. Continue to monitor this stream reach in accordance with the established schedule. (Hamilton)

Buckhorn Creek (trib.) (Summerfield)

Date: 08/16/2016
County: Warren
Township: White Twp.
Drainage: Delaware River (1)
Project: Wild Trout Stream Assessment
Location: Buckhorn Drive, below reservoir on Buckhorn Creek WMA

Fish Species	Number	Length (mm)
Dace, Blacknose	1	0 - 0
Eel, American	3	0 - 0
Trout, Brook (YOY)	14	40 - 80
Trout, Brook	40	98 - 209

Water Chemistry / Habitat

Water Temperature (°C): 19.7
Dissolved Oxygen (mg/L): 9.11
Specific Conductance (uS/cm): 185
pH: 7.11
Alkalinity (mg/L): 30
Sample Length (m): 150
Habitat Assessment Score: 164 Optimal

Summary: This *Trout Production* stream flows directly into the Delaware River and the main stem is stocked with trout. In past surveys Wild Brook Trout have been documented in tributaries, and small numbers of wild Brown Trout have been documented the main stem. Four surveys were conducted in this creek's watershed in 2016 (two on the main stem and two tributaries) to assess the wild trout fishery for regulation development or to assess the status and distribution of wild Brook Trout. Brook Trout is a species that will soon be designated as state Special Concern.

The data summarized in the tables above is from the survey conducted in the Buckhorn Creek WMA on 8/16/16. Only three fish species were collected (Brook Trout, Blacknose Dace, and American Eel). There were 54 Brook Trout (14 young-of-the-year (YOY) and 40 older that YOY). When last surveyed at this location in 2006, Brook Trout were more abundant (74 YOY and 60 older than YOY). No stocked trout were encountered in the 2006 or 2016 survey.

Recommendation: Continue to monitor this stream reach in accordance with the established schedule. (Hamilton)

Hakihokake Creek

Date: 08/11/2016
County: Hunterdon
Township: Milford Boro
Drainage: Delaware River (11)
Project: Wild Trout Stream Assessment
Location: Downstream of Bridge Street, (upstream of new channel)

Water Chemistry / Habitat

Water Temperature (°C):	23.7
Dissolved Oxygen (mg/L):	10.4
Specific Conductance (uS/cm):	301.5
pH:	8.53
Alkalinity (mg/L):	110
Sample Length (m):	150
Habitat Assessment Score:	120 Sub-Optimal

Fish Species	Number	Length (mm)
Bass, Rock	1	0 - 0
Bullhead, Yellow	1	72 - 72
Chub, Creek	4	0 - 0
Dace, Blacknose	558	0 - 0
Dace, Longnose	7	0 - 0
Darter, Tessellated	36	0 - 0
Eel, American	55	0 - 0
Fallfish	1	0 - 0
Lamprey, Sea	1	0 - 0
Madtom, Margined	2	0 - 0
Minnow, Cutlip	1	0 - 0
Sucker, White	104	0 - 0
Trout, Brown (YOY)	4	81 - 110
Trout, Brown	2	206 - 222

Summary: This Hunterdon County stream flows through the small town of Milford before emptying into the Delaware River. It is trout-stocked in the spring and also classified as *Trout Production*, with wild Brown Trout well-established throughout this watershed. Little York Brook, a designated *Wild Trout Stream* (not trout-stocked) is in the creek's headwaters. Several years ago, during Hurricane Irene/Tropical Storm Lee, the raging creek carved a new channel in the town and the homeowners have expressed interest in having the channel restored back to its original location (Trout Unlimited is considering assisting them with this effort). Therefore, the new channel and the reach immediately upstream were electrofished to assess both the fishery and habitat to determine if restoration is warranted. Neither site has been previously surveyed.

The data summarized in the tables above are from the survey conducted on 8/11/16 at the site upstream from the newly formed channel. In this section the stream was wide and shallow (deep pools lacking) and diversity of in-stream habitat was lacking due to the scouring that occurs during high flows. Only six wild Brown Trout (4 young-of-the-year, and 6 older fish) were present in this stretch. Although trout are stocked not far upstream from this location, no stocked trout were encountered. Twelve other fish species were encountered during this survey, including Creek Chub, Blacknose Dace, Longnose Dace, Tessellated Darter, American Eel, Fallfish, Sea Lamprey, Margined Madtom, Cutlip Minnow, White Sucker, Rock Bass, and Yellow Bullhead. The stream banks are eroded (some areas are rip rapped to prevent further erosion). This stream section would hold more trout (wild and stocked) if instream habitat were enhanced to create more diverse habitat.

Recommendation: This degraded stream section would benefit from in-stream habitat enhancement and bank stabilization. (Hamilton)

Hakihokake Creek

Date: 08/11/2016
County: Hunterdon
Township: Milford Boro
Drainage: Delaware River (11)
Project: Wild Trout Stream Assessment
Location: Bridge Street, behind library, new channel

Water Chemistry / Habitat

Water Temperature (°C):	21.6
Dissolved Oxygen (mg/L):	11.2
Specific Conductance (uS/cm):	311.1
pH:	8.32
Alkalinity (mg/L):	111
Sample Length (m):	15
Habitat Assessment Score:	152 Sub-Optimal

Fish Species	Number	Length (mm)
Bass, Rock	1	115 - 115
Dace, Blacknose	45	0 - 0
Dace, Longnose	26	0 - 0
Darter, Tessellated	23	0 - 0
Eel, American	137	0 - 0
Madtom, Margined	6	0 - 0
Sucker, White	15	0 - 0
Trout, Brown	15	183 - 318
Trout, Brown (YOY)	5	86 - 110

Summary: This Hunterdon County stream flows through the small town of Milford before emptying into the Delaware River. It is trout-stocked in the spring and also classified as *Trout Production*, with wild Brown Trout well-established throughout this watershed. Little York Brook, a designated *Wild Trout Stream* (not trout-stocked) is in the creek's headwaters. Several years ago, during Hurricane Irene/Tropical Storm Lee, the raging creek carved a new channel in the town and the homeowners have expressed interest in having the channel restored back to its original location (Trout Unlimited is considering assisting them with this effort). Therefore, the new channel and the reach immediately upstream were electrofished to assess both the fishery and habitat to determine if restoration is warranted. Neither site has been previously surveyed.

The data summarized in the tables above are from the survey conducted on 8/11/16 at the site having the newly formed channel. Despite severe bank erosion along the new channel, 20 Brown Trout were found (all wild) along with eight other fish species (Blacknose Dace, Longnose Dace, Tessellated Darter, American Eel, Margined Madtom, White Sucker, and Rock Bass). The trout ranged in size from 86 – 318 mm (3.3 – 12.5 in). Good in-stream habitat was present, including several deep pools. Although trout are stocked not far upstream from this location, no stocked trout were encountered. The new channel has good in-stream fish habitat and supports a diversity of fish including wild Brown Trout, however, it may be unstable as evidenced by severe stream bank erosion.

Recommendation: Restoring the stream to its original channel may not necessary from a fisheries management perspective as the new channel section is generally providing good habitat for fish. However, the badly eroding stream banks should be stabilized to reduce sediment inputs. (Hamilton)

Jacobs Creek

Date: 10/21/2016
County: Mercer
Township: Hopewell Twp.-Mercer Co.
Drainage: Delaware River (11)
Project: General Fisheries Survey
Location: Pennington-Titusville Road

Fish Species	Number	Length (mm)
Bass, Largemouth	4	103 - 113
Bass, Rock	4	106 - 201
Bass, Smallmouth	2	110 - 172
Chub, Creek	19	0 - 0
Eel, American	14	0 - 0
Shiner, Common	40	0 - 0
Sunfish, Bluegill	7	78 - 116
Sunfish, Green	4	79 - 134
Sunfish, Pumpkinseed	10	90 - 124
Sunfish, Redbreast	1	82 - 82

Water Chemistry / Habitat

Water Temperature (°C): 15.3
Dissolved Oxygen (mg/L): 2.04
Specific Conductance (uS/cm): 331.9
pH: 7.13
Alkalinity (mg/L): 122
Sample Length (m): 150
Habitat Assessment Score: N/A

Summary: Jacobs Creek was last surveyed in 1972 at two locations and is classified *Non-Trout*. Electrofishing surveys were conducted at two locations on 10/21/16 to obtain current fish population data for this stream. Scheduling difficulties delayed these surveys, which would normally be conducted during the summer months. At both sites large amounts of floating and submerged leaves hampered visibility. Due to extreme low flow conditions (due to the drought) a habitat assessment was not conducted.

Ten fish species were documented at the survey location near Pennington-Titusville Road (the uppermost of the two sites surveyed in 2016) and seven of these were Centrarchid species including Largemouth Bass, Smallmouth Bass, Rock Bass, Pumpkinseed, Bluegill, Redbreast Sunfish, and Green Sunfish (an invasive fish species). Only two cyprinid species (Creek Chub and Common Shiner) were collected, as well as American Eel. Tadpole Madtom (a species not commonly found in the Upper Delaware watershed) was documented in a survey conducted in this area in 1972 but was not found in this 2016 survey. Water was not flowing between pools due to drought conditions and dissolved oxygen was unusually low (2.04 mg/L). Three fish (two Green Sunfish and one Creek Chub) had open sores and were delivered to NJDFW's fish pathologist for analysis. The cause of the infection could not be determined (stressful environmental conditions likely contributed to their poor condition) and the fish pathologist requested more specimens for analysis.

Recommendation: When time permits the creek should be electrofished to obtain additional fish for analysis by the fish pathologist. Additional sites should be surveyed in the headwaters (during the summer sampling period) to determine if Tadpole Madtom are still present. (Hamilton)

Jacobs Creek

Date: 10/21/2016
County: Mercer
Township: Hopewell Twp.-Mercer Co.
Drainage: Delaware River (11)
Project: General Fisheries Survey
Location: Bear Tavern Road (Rt. 579)

Water Chemistry / Habitat

Water Temperature (°C):	19.1
Dissolved Oxygen (mg/L):	8.04
Specific Conductance (uS/cm):	463.6
pH:	7.59
Alkalinity (mg/L):	106
Sample Length (m):	150
Habitat Assessment Score:	N/A

Fish Species	Number	Length (mm)
Bass, Rock	4	46 - 76
Bass, Smallmouth	1	114 - 114
Chub, Creek	105	0 - 0
Dace, Blacknose	130	0 - 0
Dace, Longnose	12	0 - 0
Darter, Tessellated	28	0 - 0
Eel, American	21	0 - 0
Killifish, Banded	23	0 - 0
Madtom, Margined	2	0 - 0
Shiner, Common	89	0 - 0
Shiner, Spotfin	8	0 - 0
Sucker, White	26	0 - 0
Sunfish, Redbreast	1	61 - 61

Summary: Jacobs Creek was last surveyed in 1972 at two locations and is classified *Non-Trout*. Electrofishing surveys were conducted at two locations on 10/21/16 to obtain current fish population data for this stream. Scheduling difficulties delayed these surveys, which would normally be conducted during the summer months. At both sites large amounts of floating and submerged leaves hampered visibility. Due to extreme low flow conditions (due to the drought) a habitat assessment was not conducted.

Thirteen fish species were documented at the survey location near Bear Tavern Road (the lowermost of the two sites surveyed in 2016). Only three of these were Centrarchid species (Smallmouth Bass, Rock Bass, and Redbreast Sunfish). Five cyprinid species were present including Creek Chub, Blacknose Dace, Longnose Dace, Common Shiner, and Spotfin Shiner (a less common cyprinid species). Other fish species present were Tessellated Darter, American Eel, Margined Madtom, and White Sucker. When surveyed in 1972 slightly fewer fish species were documented (11) including Satinfin (not Spotfin) Shiner. These two shiner species can be difficult to tell apart in the field (specimens from the 2016 survey were preserved and later identified in the lab as Spotfin Shiner).

Recommendation: No further action is warranted. (Hamilton)

Musconetcong R (trib.)(NW of Stephensburg)

Date: 07/22/2016
County: Warren
Township: Mansfield Twp.-Warren Co.
Drainage: Musconetcong River
Project: Classification
Location: Heiser Road

Fish Species	Number	Length (mm)
Chub, Creek	21	0 - 0
Dace, Blacknose	108	0 - 0
Eel, American	4	0 - 0
Trout, Brook (YOY)	7	59 - 82

Water Chemistry / Habitat

Water Temperature (°C): 18.2
Dissolved Oxygen (mg/L): 9.14
Specific Conductance (uS/cm): 336.9
pH: 7.62
Alkalinity (mg/L): 52
Sample Length (m): 150
Habitat Assessment Score: 142 Sub-Optimal

Summary: This very small (less than 1 mile), previously unsampled tributary to the Musconetcong River in Warren County, is classified *Trout Maintenance* (by default). The survey conducted on 7/22/16 documented a wild Brook Trout population (seven young-of-the year fish present). Three other species were encountered, including American Eel, Creek Chub, and Blacknose Dace. Two larger, adult Brook Trout (approx. 200 mm long) were found in a deeper pool just outside the bounds of the 150 m section surveyed. This tributary flows alongside Heiser Road (Mansfield Township/Warren County) and passes through property adjacent to Rt. 57 where above ground oil tanks had leaked earlier in the year. Documenting the occurrence and distribution of wild Brook Trout in New Jersey is important as this species will soon be designated as state Special Concern.

Recommendation: This stream should be upgraded to *Trout Production* in the state's Surface Water Quality Standards and the trout population monitored in accordance with the established schedule. (Hamilton)

Musconetcong R (trib.)(S. of Asbury)

Date: 08/05/2016
County: Hunterdon
Township: Bethlehem Twp.
Drainage: Musconetcong River
Project: Classification
Location: River Road

Fish Species	Number	Length (mm)
Dace, Blacknose	33	0 - 0
Darter, Tessellated	1	0 - 0
Eel, American	5	220 - 310
Sculpin, Slimy	89	0 - 0
Sucker, White	1	0 - 0
Trout, Brook (YOY)	24	67 - 113
Trout, Brook	12	125 - 222
Trout, Brown	10	145 - 300

Water Chemistry / Habitat

Water Temperature (°C): 14.5
Dissolved Oxygen (mg/L): 9.54
Specific Conductance (uS/cm): 295.8
pH: 7.96
Alkalinity (mg/L): 106
Sample Length (m): 150
Habitat Assessment Score: 174 Optimal

Summary: This small, previously unsampled tributary, located on the Hunterdon County side of the Musconetcong River, is classified *Trout Maintenance* (by default). When surveyed on 8/5/16 the water was extremely cold (14.5°C) for a summer water temperature. Not surprising was the presence of three fish species (Brook Trout, Brown Trout, and Slimy Sculpin) that require cold, clean water. The Brook Trout (36 fish) outnumbered the Brown Trout (10 fish) and 24 of the 36 Brook Trout were young-of the-year. Some of the Brown Trout were of harvestable size (> 229 mm (9 in)). The other four fish species found in this survey (Blacknose Dace, Tessellated Darter, White Sucker, and American Eel) often co-occur with wild trout. Documenting the occurrence and distribution of wild Brook Trout in New Jersey is important as this species will soon be designated as state Special Concern.

Recommendation: This stream should be upgraded to *Trout Production* in the state's Surface Water Quality Standards and the trout population monitored in accordance with the established schedule. (Hamilton)

Musconetcong R (trib.)(W. of Asbury)

Date: 08/05/2016
County: Warren
Township: Franklin Twp.-Warren Co.
Drainage: Musconetcong River
Project: General Fisheries Survey
Location: Bloomsbury Road

Fish Species	Number	Length (mm)
Chub, Creek	51	0 - 0
Dace, Blacknose	22	0 - 0
Darter, Tessellated	4	0 - 0
Minnow, Fathead	2	0 - 0
Sucker, White	9	0 - 0

Water Chemistry / Habitat

Water Temperature (°C): 20.7
Dissolved Oxygen (mg/L): 7.84
Specific Conductance (uS/cm): 282.2
pH: 7.78
Alkalinity (mg/L): 75
Sample Length (m): 75
Habitat Assessment Score: N/A

Summary: This small, previously unsampled tributary to the Musconetcong River in Warren County is classified *Trout Maintenance* (by default). Although near the S of Asbury tributary (where wild Brook and Brown Trout were documented in 2016) the survey conducted on the W. of Asbury tributary on 8/5/16 did not yield similar results. No trout were present, however, five fish species were documented (Creek Chub, Blacknose Dace, Tessellated Darter, White Sucker, and Fathead Minnow). Only a 75 m stretch could be sampled (half the distance normally sampled) due to very little flow. The elevated water temperature (20.7°C) suggests that springs are not present that would contribute significantly to stream flow.

Recommendation: This tributary stream should be inspected further upstream to determine if flowing water is present in sufficient volume to warrant electrofishing. (Hamilton)

*******NON – STANDARDIZED SURVEY*******

Stephensburg Brook

Date: 07/21/2016
County: Morris
Township: Washington Twp.-Morris Co.
Drainage: Musconetcong River
Project: Temperature Study - TP Streams
Location: Stephensburg Road

Fish Species	Number	Length (mm)
Chub, Creek	7	0 - 0
Dace, Blacknose	57	0 - 0
Dace, Longnose	2	0 - 0
Darter, Tessellated	4	0 - 0
Eel, American	9	0 - 0
Trout, Brook (YOY)	25	66 - 95
Trout, Brook	13	110 - 165
Trout, Brown (YOY)	4	62 - 75
Trout, Brown	7	126 - 34

Water Chemistry / Habitat

Water Temperature (°C): 19.9
Dissolved Oxygen (mg/L): 9.01
Specific Conductance (uS/cm): 303
pH: 7.52
Alkalinity (mg/L): 35
Sample Length (m): 150
Habitat Assessment Score: 142 Sub-Optimal

(2015)

Summary: This tributary of the Musconetcong River was electrofished on 7/21/16 to assess the wild trout population structure relative to the stream temperature regime. Habitat here consists of a good mix of riffles, runs, and pools, cobble layering, and undercut banks. A heavy amount of erosion is visible in spots. Wild Brook Trout were first found here in a survey completed in 1970 and also in 2002, then in a survey conducted in 2014, wild Brown Trout were first documented in this stream. Species encountered during this survey included 38 wild Brook Trout ranging from 66 – 165 mm (2.6 – 6.5 in), including 25 young-of-the-year (YOY), and 11 wild Brown Trout ranging from 62 – 344 mm (2.4 – 13.5 in), including 4 YOY. A 26.5% decline in total trout captured was found between 2015 and 2016 surveys which is consistent with most streams in this study (10 out of 14 streams noted a decline in total trout captured). One of the objectives of this study is to understand these types of population fluctuations, the causative factors that are influencing them, and what implications it has on the standard operating procedures of stream electrofishing surveys. Brook Trout are soon to be designated state Special Concern.

Recommendation: This survey is part of a stream temperature study that is currently being conducted on 14 *Trout Production* streams. This stream will be monitored in this section for the next 1-2 years to study the relationship of stream temperature on wild trout life cycles in New Jersey and help guide in the management of our *Trout Production* streams. Stephensburg Brook is currently regulated as a *Wild Trout Stream* and recommended to remain as one, but development of those regulations are ongoing and will be determined and published in the 2018 Fish Code. This stream should be periodically monitored in accordance with the established schedule for *Wild Trout Streams.* (Collenburg)

Trout Brook (Hope) (trib.)(Shiloh)

Date: 08/15/2016
County: Warren
Township: Frelinghuysen Twp.
Drainage: Pequest River
Project: Brook Trout Assessment
Location: Shiloh Road

Fish Species	Number	Length (mm)
Chub, Creek	1	0 - 0
Dace, Blacknose	101	0 - 0
Eel, American	9	0 - 0

Water Chemistry / Habitat

Water Temperature (°C): 20.9
Dissolved Oxygen (mg/L): 9.15
Specific Conductance (uS/cm): 510.8
pH: 7.94
Alkalinity (mg/L): 148
Sample Length (m): 150
Habitat Assessment Score: 168 Optimal

Summary: This previously unsampled tributary was surveyed because its location and topography suggested that it could be inhabited by wild Brook Trout, a species soon to be designated state Special Concern. On the day of the survey the water temperature was 20.9°C and three species of fish were found (Blacknose Dace, Creek Chub, and American Eel). The Incidence of Occurrence was 25.6, confirming its default surface water classification of *Trout Maintenance*.

Recommendation: This tributary could be specifically listed and classified as *Trout Maintenance* in the state's SWQS. (Hamilton)

Stream Surveys in the Upper Passaic Region

(Pompton, Pequannock, Wanaque, Ramapo, Upper Passaic, Whippany, & Rockaway)

Whippany River (trib.) (Brookside)

Date: 09/02/2016
County: Morris
Township: Mendham Twp.
Drainage: Whippany River
Project: Wild Trout Stream Assessment
Location: Stoney Hill Road

Water Chemistry / Habitat

Water Temperature (°C):	18.4
Dissolved Oxygen (mg/L):	8.83
Specific Conductance (uS/cm):	497.4
pH:	7.65
Alkalinity (mg/L):	55
Sample Length (m):	150
Habitat Assessment Score:	182 Optimal

Fish Species	Number	Length (mm)
Bass, Largemouth	7	50 - 80
Sunfish, Bluegill	3	84 - 110
Sunfish, Green	2	103 - 106
Sunfish, Pumpkinseed	16	51 - 109
Trout, Brown (YOY)	11	67 - 87
Trout, Brown	2	135 - 147
Trout, Rainbow (YOY)	37	51 - 79
Trout, Rainbow	34	107 - 188

Summary: This tributary to the Whippany River was electrofished on 9/2/2016 to assess the wild trout population status. The first survey conducted on this stream in 1969 found a reproducing population of Rainbow Trout near the confluence with Whippany River. Additional surveys were completed in 2001 and 2010 where wild Brown Trout were discovered in addition to Rainbow Trout. The current survey was conducted to investigate further upstream into the heart of the Dismal Harmony Natural Area to assess the fish population and access for potential anglers. The freshwater fisheries crew hiked about a ½ mile into the natural area (from Stoney Hill Rd parking area) and started the survey approximately 4,000 feet upstream from where previous surveys were conducted. The well designated and cared for Patriot Path hiking trail provides great access into the natural area and multiple parking areas to access different stretches of the stream. Species encountered in this survey included 13 wild Brown Trout ranging from 67 – 147 mm (2.6 – 5.8 in), including 11 young-of-the-year (YOY), and 71 Rainbow Trout ranging from 51 – 188 mm (2.0 – 7.4 in), including 38 YOY. The largest trout encountered reached only 7 inches, but the population was well balanced and abundant. This stream is a great candidate for the *Wild Trout Stream* regulations. It has great access, with ample parking, and hiking trails that provide access to remote areas, and the wild trout populations of Brown Trout and Rainbow Trout continue to do well here.

Recommendation: This stream is being considered as a candidate to add to the *Wild Trout Stream* regulations, but development of those regulations are ongoing and will be determined and in effect when published in the next NJ Code cycle. (Collenburg)

Whippany River (trib.) (W. of Watnong Brook)

Date: 09/02/2016
County: Morris
Township: Mendham Twp.
Drainage: Whippany River
Project: Classification
Location: Patriot's Path off Inamere Road

Fish Species	Number	Length (mm)
Bass, Largemouth	1	57 - 57
Chub, Creek	21	0 - 0
Chubsucker, Creek	1	0 - 0
Darter, Tessellated	38	0 - 0
Mudminnow, Eastern	66	0 - 0
Pickerel, Redfin	54	97 - 147
Sucker, White	19	0 - 0
Sunfish, Pumpkinseed	1	106 - 106

Water Chemistry / Habitat

Water Temperature (°C): 19.5
Dissolved Oxygen (mg/L): 7.65
Specific Conductance (uS/cm): 493.9
pH: 7.93
Alkalinity (mg/L): 108
Sample Length (m): 150
Habitat Assessment Score: 73 Marginal

Summary: This tributary to the Whippany River was electrofished on 9/2/2016 to investigate the fish population. No survey was ever conducted on this stream and it was of interest to collect data on a stream that no information has previously been collected. Encountered during this survey was an abundant population of Redfin Pickerel and Eastern Mudminnows. The stream was channelized and low gradient with a large amount of fine sediments composing the substrate.

Recommendation: It is a tributary to the *Non-Trout* section of the Whippany River and is therefore classified as *Non-Trout* by default. Data collected during this survey confirms the *Non-Trout* classification. (Collenburg)

Bear Brook (Park Ridge)

Date: 08/17/2016
County: Bergen
Township: Park Ridge Boro
Drainage: Hackensack River
Project: Classification
Location: Brae Road

Fish Species	Number	Length (mm)
Carp, Common	2	0 - 0
Chub, Creek	200	0 - 0
Killifish, Banded	13	0 - 0
Mosquitofish, Eastern	3	0 - 0
Sunfish, Pumpkinseed	4	35 - 98

Water Chemistry / Habitat

Water Temperature (°C): 24.3
Dissolved Oxygen (mg/L): 5.21
Specific Conductance (uS/cm): 555
pH: 7.30
Alkalinity (mg/L): 62
Sample Length (m): 150
Habitat Assessment Score: N/A

Backpack electrofishing (Brae Rd.) of this *Non-Trout* tributary to Woodcliff Lake on 8/17/16 revealed Creek Chub (200), Common Carp (2), Banded Killifish (13), Mosquitofish sp. (3), and Pumpkinseed Sunfish (4). This site was the most upstream site sampled. The water temperature of 24.3°C was the highest of the of the three sites sampled. Due, no doubt, to an on-stream pond at an office building just upstream.

Recommendation: No further monitoring is required. (Boriek)

Bear Brook (Park Ridge)

Date: 08/24/2016
County: Bergen
Township: Park Ridge Boro
Drainage: Hackensack River
Project: Classification
Location: Laurel Hill Road/Arrowhead Road

Fish Species	Number	Length (mm)
Carp, Common	1	0 - 0
Chub, Creek	83	0 - 0
Dace, Blacknose	52	0 - 0
Dace, Longnose	21	0 - 0
Sucker, White	7	0 - 0
Sunfish, Pumpkinseed	2	78 - 92

Water Chemistry / Habitat

Water Temperature (°C): 18.5
Dissolved Oxygen (mg/L): 9.01
Specific Conductance (uS/cm): 772
pH: 7.51
Alkalinity (mg/L): 106
Sample Length (m): 150
Habitat Assessment Score: N/A

Summary: Backpack electrofishing in Atkins Glen Park (Laurel Hill Rd. / Arrowhead Rd.) of this *Non-Trout* tributary to Woodcliff Lake on 8/17/16 revealed Creek Chub (83), Common Carp (1), Blacknose Dace (52), Longnose Dace (21), White Sucker (7), and Pumpkinseed Sunfish (2). The water temperature was 18.5°C. This site was upstream of the site where a Brown Trout was sampled on 8/5/16.

Recommendation: Monitor this section in the future to determine if trout are present and to delineate the extent of this new *Trout Maintenance* water for reclassification. (Boriek)

Bear Brook (Park Ridge)

Date: 08/05/2016
County: Bergen
Township: Park Ridge Boro
Drainage: Hackensack River
Project: Classification
Location: Glendale Rd at Arkins Glen Park.

Fish Species	Number	Length (mm)
Chub, Creek	47	0 - 0
Dace, Blacknose	78	0 - 0
Dace, Longnose	29	0 - 0
Trout, Brown	1	368 - 368

Water Chemistry / Habitat

Water Temperature (°C): 18.5
Dissolved Oxygen (mg/L): 9.57
Specific Conductance (uS/cm): 883
pH: 7.84
Alkalinity (mg/L): 107
Sample Length (m): 150
Habitat Assessment Score: N/A

Summary: An angler called to report that, in the 1960's, he had caught trout in this tributary to the *Non-Trout* classified Woodcliff Lake. It had never been previously sampled by NJDFW. Backpack electrofishing in Atkins Glen Park (Glendale Rd.) on 8/5/16 revealed Creek Chubs (47), Blacknose Dace (78), Longnose Dace (29), and 1 adult Brown Trout 368 mm (14.5 in) of hatchery origin. This Trout may have been illegally stocked by an angler. The water temperature was 18.5°C.

Recommendation: Monitor this section in the future to determine if more trout are present. (Boriek)

Cresskill Brook

Date: 07/18/2016
County: Bergen
Township: Alpine Boro
Drainage: Hackensack River
Project: Habitat Restoration
Location: Duck Pond Rd. bridge, upstream

Fish Species	Number	Length (mm)
Dace, Blacknose	315	0 - 0

Water Chemistry / Habitat

Water Temperature (°C): 21.3
Dissolved Oxygen (mg/L): 8.63
Specific Conductance (uS/cm): 600
pH: 7.70
Alkalinity (mg/L):
Sample Length (m): 150
Habitat Assessment Score: 140 Sub-Optimal

Summary: This sole *Trout Production* stream in the Hackensack River drainage is a tributary to Tenakill Brook. This is the regular monitoring site for this stream. Last sampled in 2009, backpack electrofishing revealed Brook Trout (20) and no young-of-the-year (YOY). Blacknose Dace (189) were also collected at that time. The water temperature was 18.9°C. On 7/18/16 back pack electrofishing revealed no Brook Trout and Blacknose Dace (315). The water temperature was 21.3°C. The fact that no YOY Brook Trout were collected in 2009, indicates that the population was already on the decline at that time. It is conjectured, that perhaps, extremely high flows due to Hurricane Sandy in 2012, and the increase in the water temperature, were the final blows to this marginal wild Brook Trout population.

Recommendation: This *Trout Production* stream will be monitored in this section for the next 2-3 years. Additional surveys will be conducted, up and down stream of this site, to determine if the trout population has, indeed, been extirpated. (Boriek)

Cresskill Brook

Date: 07/18/2016
County: Bergen
Township: Demarest Boro
Drainage: Hackensack River
Project: Habitat Restoration
Location: Deer Hill Road (Wruble Property), House #9, removed concrete pool site

Fish Species	Number	Length (mm)
Dace, Blacknose	93	0 - 0
Shiner, Golden	1	0 - 0

Water Chemistry / Habitat

Water Temperature (°C): 21.9
Dissolved Oxygen (mg/L): 9.02
Specific Conductance (uS/cm): 580
pH: 7.80
Alkalinity (mg/L):
Sample Length (m): 150
Habitat Assessment Score: 155 Sub-Optimal

Summary: This sole *Trout Production* stream in the Hackensack River drainage is a tributary to Tenakill Brook. An on-stream cement swimming pool at his site was removed in 2011 and the stream was restored. In 2010, prior to the restoration, backpack electrofishing revealed Brook Trout (5), including one young-of-the-year. Pumpkinseed Sunfish (2), Brown Bullheads (2), and Blacknose Dace (275) were also collected at that time. On 7/18/16 the restored section was back pack electrofished for the first time. One trout, estimated to be 178 – 229mm (7 – 9 in) was observed, but evaded capture. Golden Shiner (1) and Blacknose Dace (93) were also collected. Water temperatures for 2010 and 2016, were 21.4°C and 21.9°C, respectively. It is conjectured, that perhaps, extremely high flows due to Hurricane Sandy in 2012 was the final blow to this marginal wild Brook Trout population.

Recommendation: This *Trout Production* stream will be monitored in this restored section for the next 2-3 years. Additional surveys will be conducted, up and down stream of this site, to determine if the trout population has, indeed, been extirpated. (Boriek)

Stream Surveys in the Raritan Region

(Mainstem Raritan River and all tributaries)

Black Brook (Hunterdon)

Date: 07/01/2016
County: Hunterdon
Township: Union Twp.-Hunterdon Co.
Drainage: Raritan River - South Branch
Project: Temperature Study - TP Streams
Location: Van Syckles Road

Fish Species	Number	Length (mm)
Chub, Creek	18	0 - 0
Dace, Blacknose	76	0 - 0
Dace, Longnose	10	0 - 0
Trout, Brown	11	162 - 213

Water Chemistry / Habitat

Water Temperature (°C): 17.4
Dissolved Oxygen (mg/L): 4.54
Specific Conductance (uS/cm): 133.3
pH: 7.48
Alkalinity (mg/L): 17.5
Sample Length (m): 150
Habitat Assessment Score: 167 Optimal (2014)

Summary: Black Brook is a small stream that flows into the Spruce Run Reservoir in Hunterdon County and is currently classified as a *Trout Production* stream and is currently regulated as a *Wild Trout Stream*. A backpack electrofishing survey was conducted here on 7/1/16 to collect more data for the purpose of assessing the wild trout population structure relative to the stream temperature regime. Since construction of the Spruce Run Reservoir (in 1964) and the management practices implemented since it's construction (trout stocking in the reservoir), wild trout populations have been in flux. Brook Trout and Rainbow Trout were originally found here in surveys conducted in 1969 and 1976. Brown Trout were first documented in 2003, but it was also the last survey that Rainbow Trout and Brook Trout were documented. Surveys conducted in 2014 and 2015 found a small population of wild Brown Trout (captured 11 and 13 wild Brown Trout in each respective survey) still inhabit this small tributary. No more than 32 trout (in 1969) have been captured in any survey. A total of 11 wild Brown Trout ranging from 162 - 213 mm (6.4 - 8.4 in) were encountered during the survey. The wild Brown Trout population continues to persist here, but the small population size and extirpation of Brook Trout are indicators of a stressed salmonid environment.

Recommendation: This survey is part of a stream temperature study that is currently being conducted on 14 *Trout Production* streams. This stream will be monitored in this section for the next 1-2 years to study the relationship of stream temperature on wild trout life cycles in New Jersey and help guide in the management of our *Trout Production* streams. In addition, data from surveys conducted in 2014 and 2015 were used to help determine new *Wild Trout Stream* regulations, and due to low population abundance, Black Brook is no longer being considered for inclusion under the new set of regulations. (Collenburg)

Hickory Run

Date: 07/11/2016
County: Hunterdon
Township: Lebanon Twp.
Drainage: Raritan River - South Branch
Project: Temperature Study - TP Streams
Location: Hickory Run Road

Fish Species	Number	Length (mm)
Chub, Creek	1	0 - 0
Dace, Blacknose	6	0 - 0
Trout, Brook (YOY)	36	50 - 87
Trout, Brook	56	101 - 175

Water Chemistry / Habitat

Water Temperature (°C): 16.5
Dissolved Oxygen (mg/L): 8.8
Specific Conductance (uS/cm): 129.7
pH: 7.44
Alkalinity (mg/L): 30
Sample Length (m): 150
Habitat Assessment Score: 183 Optimal (2015)

Summary: This tributary to the South Branch of the Raritan River was electrofished on 7/11/16 to (1) assess the wild trout population structure relative to the stream temperature regime and (2) compare the population structure upstream and downstream of a small on-stream impoundment that is acting as a barrier to Brown Trout movement upstream into an area only Brook Trout (soon to be designated state Special Concern) currently inhabit. A survey conducted in 1969, upstream of Hickory Farm Dairy, found a wild Rainbow Trout population, but the last survey to document wild Rainbow Trout in this location was in 2002. Furthermore, wild Brook Trout were not documented here until 2002, but were likely farther up in the watershed. Rainbow Trout were historically stocked in the farm pond located on the stream but this has been discontinued. It could be the stocking of Rainbow Trout was supplementing the naturally reproducing population, but then declined and has been replaced by Brook Trout that were able to more successfully occupy this stream. This survey was conducted upstream of the Hickory Farm dam. Species encountered in this survey included 92 wild Brook Trout ranging from 50 – 175 mm (2.0 – 6.9 in), including 36 young-of-the-year (YOY). The number of Brook Trout here has declined each of the last two years from 254 (221 YOY) to 198 (125 YOY) to 92 (36 YOY). All streams within the stream temperature study group have either shown to be stable (3 with no change, 1 with a 5.2% increase), but most have declined (10 out of 14), however, this stream has shown the most drastic decline in total number of trout (115.2% decrease from 2015 to 2016). Another interesting aspect of this study is to help understand the causative factors of these changes in fluctuating trout populations and if this is a healthy or normal dynamic. An additional survey was conducted on Hickory Run below an impoundment that a known mixed population of Brook and Brown Trout exist due to the existence of the connection to the South Branch of the Raritan River.

Recommendation: This survey is part of a stream temperature study that is currently being conducted on 14 *Trout Production* streams. This stream will be monitored in this section for the next 1-2 years to study the relationship of stream temperature on wild trout life cycles in New Jersey and help guide in the management of our *Trout Production* streams. Hickory is currently regulated as a *Wild Trout Stream* and recommended to remain as one, but development of those regulations are ongoing and will be determined and published in the 2018 Fish Code. This stream should be periodically monitored in accordance with the established schedule. (Collenburg)

Hickory Run

Date: 07/11/2016
County: Hunterdon
Township: Lebanon Twp.
Drainage: Raritan River - South Branch
Project: Brook Trout Assessment
Location: High Bridge-Califon Road, below dam

Fish Species	Number	Length (mm)
Dace, Blacknose	89	0 - 0
Dace, Longnose	6	0 - 0
Minnow, Fathead	2	0 - 0
Sculpin, Slimy	24	0 - 0
Sucker, White	2	0 - 0
Trout, Brook (YOY)	53	54 - 87
Trout, Brook (unknown age)	12	88 - 100
Trout, Brook	51	101 - 218
Trout, Brown (YOY)	10	65 - 90
Trout, Brown	3	113 - 140

Water Chemistry / Habitat

Water Temperature (°C): 17.5
Dissolved Oxygen (mg/L): 9.19
Specific Conductance (uS/cm): 173
pH: 7.26
Alkalinity (mg/L): 30
Sample Length (m): 150
Habitat Assessment Score: 159 Sub-Optimal

Summary: An electrofishing survey was conducted in Hickory Run to assess the structure of the fish assemblage downstream of a dam that measures approximately 1.8 m (6 ft) in height. The dam fragments the stream, resulting in a well-documented population of exclusively Brook Trout (soon to be listed state Special Concern) above the dam. The lower reaches of the stream below the dam, also contain Brook Trout and is connected to the South Branch of the Raritan River, allowing Brown Trout to colonize. Thirteen wild Brown Trout were found in this survey, consisting of 10 young-of-the-year (YOY) from 65 – 90 mm (2.6 - 3.5 in) and 3 older than YOY from 113 – 140 mm (4.4 - 5.5 in), in addition to 116 Brook Trout. The precise number of YOY Brook Trout was difficult to determine, as the data did not reveal the typical break in the length frequency curve. This may be due to the stream's immediate connection with the South Branch of the Raritan River, thus allowing YOY Brook Trout (presumably larger) into the lower end of Hickory Run. The number of YOY was estimated to be 53 based on the length-frequency of individuals up to 87 mm that were collected upstream of the dam on the same day. The 12 trout from 88 - 100 mm were not assigned an age class, and the 51 greater than 100 mm were considered older than YOY.

The relatively similar number of Brook Trout above (n=91) and below the dam (n=116) do not indicate an obvious impact to population size, however the dam may play a role in the long-term sustainability to the fishery. The dam may negatively impact the population above it, by reducing gene flow into the headwaters, possibly resulting in problems typically associated with small populations size and low genetic diversity. On the other hand, the dam may benefit the upper section by not allowing the infiltration of wild Brown or Rainbow Trout, in addition to all three species of stocked trout. Another stream survey was conducted upstream of this location this year, in conjunction with a continuous stream temperature logger to assess the relationship between temperature and fish assemblage data. Brook Trout were the only trout species found above the dam. Removal of this dam in not recommended at this time, in part because it is assumed that the wild Brown Trout found below would likely disperse upstream, posing an additional threat to one of the State's most productive Brook Trout tributaries. In order to improve fish passage, a local Trout Unlimited chapter proposed the removal of a rock delta that formed at confluence of Hickory Run and the South Brach of the Raritan River, however this project was not supported by NJDFW due to the likelihood of an influx of other trout species, both stocked and wild, that would add additional competition on the plentiful wild Brook Trout in this section of Hickory Run.

Recommendation: Continue to monitor the fish assemblage, dam, and delta in this section of Hickory Run, making particular note of the Brook Trout to Brown Trout ratio. Consider relocating Slimy Sculpin (soon to be listed state Threatened) above the dam as none were found in the upstream survey this year. (Crouse)

Millstone River

Date: 09/28/2016
County: Somerset
Township: Montgomery Twp.
Drainage: Millstone River
Project: General Fisheries Survey
Location: Griggstown Causeway, downstream of bridge

Water Chemistry / Habitat

Water Temperature (°C):	19.3
Dissolved Oxygen (mg/L):	5.24
Specific Conductance (uS/cm):	522
pH:	7.28
Alkalinity (mg/L):	59
Sample Length (m):	150
Habitat Assessment Score:	N/A

Fish Species	Number	Length (mm)
Bass, Largemouth	2	156 - 162
Bullhead, Yellow	8	85 - 231
Dace, Blacknose	2	0 - 0
Dace, Longnose	6	0 - 0
Darter, Shield	7	0 - 0
Darter, Tessellated	46	0 - 0
Eel, American	257	0 - 0
Fallfish	2	0 - 0
Killifish, Banded	22	0 - 0
Madtom, Tadpole	2	0 - 0
Pickerel, Chain	2	173 - 175
Shiner, Comely	1	0 - 0
Shiner, Common	1	0 - 0
Shiner, Satinfin	46	0 - 0
Shiner, Spottail	21	0 - 0
Shiner, Swallowtail	4	0 - 0
Sucker, White	1	0 - 0
Sunfish, Bluegill	42	28 - 129
Sunfish, Green	4	45 - 111
Sunfish, Pumpkinseed	1	124 - 124
Sunfish, Redbreast	48	26 - 161
Unknown Gambusia spp.	1	0 - 0

Summary: In anticipation of the removal of the Weston Causeway Dam on the Millstone River, a fish assemblage study was initiated. An electrofishing survey was conducted approximately 9 miles upstream at the Griggstown Causeway with a Smith Root electrofishing barge. The fish assemblage was diverse at this location, with 22 species documented, 18 of which are native to NJ. The most abundant fish at this location was the American Eel, composing 257 of the 526 fishes found, most of which were collected in the rip-rap under the bridge. No anadromous species were encountered. Two species soon to be listed as state *Special Concern* were found, including Comely Shiner and Shield Darter. Tadpole Madtoms were found at this location, which is one of the few locations in NJ it is found north of the geologic fall line. The only invasive fish regulated as a potentially dangerous species was Green Sunfish (n=4).

Recommendation: Additional electrofishing surveys will be conducted at this location during each spring and fall season from now until the spring of 2020. (Crouse)

Millstone River

Date: 09/28/2016
County: Somerset
Township: Franklin Twp.-Somerset Co.
Drainage: Millstone River
Project: General Fisheries Survey
Location: Blackwells Mills Road Bridge, downstream of bridge)

Water Chemistry / Habitat

Water Temperature (°C):	18
Dissolved Oxygen (mg/L):	6.11
Specific Conductance (uS/cm):	689
pH:	7.18
Alkalinity (mg/L):	61
Sample Length (m):	150
Habitat Assessment Score:	N/A

Fish Species	Number	Length (mm)
Bass, Largemouth	1	179 - 179
Bass, Rock	1	172 - 172
Bass, Smallmouth	4	166 - 420
Bass, Striped	2	264 - 306
Bullhead, Yellow	13	56 - 210
Catfish, White	2	239 - 349
Chubsucker, Creek	1	0 - 0
Crappie, Black	1	170 - 170
Dace, Longnose	1	0 - 0
Darter, Shield	3	0 - 0
Darter, Tessellated	130	0 - 0
Eel, American	274	0 - 0
Fallfish	6	0 - 0
Killifish, Banded	1	0 - 0
Lamprey, Sea	1	0 - 0
Madtom, Margined	2	0 - 0
Madtom, Tadpole	2	0 - 0
Perch, Yellow	3	193 - 234
Pickerel, Chain	5	128 - 206
Pickerel, Redfin	1	92 - 92
Shiner, Comely	2	0 - 0
Shiner, Common	8	0 - 0
Shiner, Satinfin	7	0 - 0
Shiner, Spottail	76	0 - 0
Sucker, White	9	0 - 0
Sunfish, Bluegill	43	26 - 145
Sunfish, Green	6	61 - 147
Sunfish, Pumpkinseed	9	70 - 135
Sunfish, Redbreast	113	27 - 180
Unknown Gambusia spp.	2	0 - 0
Weatherfish, Oriental	2	0 - 0

Summary: In anticipation of the removal of the Weston Causeway Dam on the Millstone River, a fish assemblage study was initiated. An electrofishing survey was conducted approximately 5 miles upstream at the base of the Blackwells Mills Dam with a Smith Root electrofishing barge. The fish assemblage was very diverse at this location, with 31 species documented. Two Striped Bass were found, indicating that they have the ability to traverse the Weston Causeway Dam. This site was also accessible to an abundance of American Eels, totaling 274 (125 < 200 mm and 149 ≥ 200 mm) and one Sea Lamprey. Two species soon to be listed as state Special Concern include Comely Shiner and Shield Darter. It should be noted that both of our state's madtom species were found here as well, this is significant because there are very few sites in NJ in which Margined Madtoms are found this far south and Tadpole Madtoms found this far north. Of the 731 individual fish that were encountered, very few are non-native piscivores (6 combined Largemouth Bass, Smallmouth Bass, and Rock Bass) and 42 Bluegills. The only invasive fish regulated as a potentially dangerous species was encountered upstream of the dam include Oriental Weatherfish (n=2) and Green Sunfish (n=6). This was the first time the Oriental Weatherfish was found in the Millstone Watershed.

Recommendation: Additional electrofishing surveys will be conducted at this location during each spring and fall season from now until the spring of 2020. (Crouse)

Raritan River S/B

Date: 07/25/2016
County: Morris
Township: Washington Twp.-Morris Co.
Drainage: Raritan River - South Branch
Project: Trout Special Regulation Area
Location: Claremont Stretch, old stocking point

Water Chemistry / Habitat

Water Temperature (°C):	23.4
Dissolved Oxygen (mg/L):	12.62
Specific Conductance (uS/cm):	433.8
pH:	
Alkalinity (mg/L):	79
Sample Length (m):	150
Habitat Assessment Score:	140 Sub-Optimal

Fish Species	Number	Length (mm)
Bass, Largemouth	2	50 - 54
Chub, Creek	41	0 - 0
Dace, Blacknose	453	0 - 0
Dace, Longnose	97	0 - 0
Darter, Tessellated	197	0 - 0
Lamprey, American Brook	18	0 - 0
Madtom, Margined	4	0 - 0
Mudminnow, Eastern	10	0 - 0
Sculpin, Slimy	39	0 - 0
Sucker, White	746	0 - 0
Sunfish, Bluegill	1	64 - 64
Sunfish, Bluespotted	1	0 - 0
Sunfish, Green	1	60 - 60
Sunfish, Pumpkinseed	11	61 - 111
Trout, Brook (YOY)	2	91 - 102
Trout, Brook	5	131 - 217
Trout, Brown (YOY)	21	70 - 112
Trout, Brown	23	153 - 335
Trout, Rainbow (YOY)	1	110 - 110

Summary: The Claremont Stretch, a 1.1-mile section of the Raritan River South Branch, was surveyed to assess the fish assemblage and the current *Year Round Trout Conservation Area* regulations. Two surveys were conducted at locations routinely monitored every few years (6 surveys since 1998), the last of which was in 2013. The once abundant Brook Trout population seems to be declining. The total number of Brook Trout (soon to be listed state Special Concern) during the two most recent surveys in 2013 (n=6) and 2016 (n=7) are substantially less than the average of the four last surveys conducted from 1998 through 2007 (n=31). The total number of Brown Trout has also declined in 2016 from its previous average of 118 down to 44. Slimy Sculpin (soon to be listed state Threatened) numbers (n=39) are within the range of the previous five surveys (14-72). White Suckers are a tolerant species and generalist feeder, and when found in extremely high abundance (n=746) are an indicator of a stressed system. Water temperature was also elevated at the time of survey at 23.4°C. River conditions since last fall have been stressful, as rainfall and flows have been very low. The decline in the fishery may also be due to a change in habitat. It is noted that the number and depth of pools seems to have decreased at various locations in the upper section of this river as sand and other fine particles seem to have increased in abundance. Recent habitat assessments indicate increasing percentages of sand and silt in the channel than those previously observed.

Recommendation: The decline of this trout fishery is of concern and is believed to be related to habitat degradation, and subsequently exacerbated by drought conditions. Populations and habitats of two species soon to be designated state Special Concern (Brook Trout and American Brook Lamprey) and Slimy Sculpin should continue to be monitored. (Crouse)

Raritan River S/B

Date: 07/25/2016
County: Morris
Township: Washington Twp.-Morris Co.
Drainage: Raritan River - South Branch
Project: Trout Special Regulation Area
Location: Claremont Stretch - fiber optic crossing

Water Chemistry / Habitat

Water Temperature (°C):	20.3
Dissolved Oxygen (mg/L):	9.88
Specific Conductance (uS/cm):	470.6
pH:	7.91
Alkalinity (mg/L):	79
Sample Length (m):	150
Habitat Assessment Score:	136 Sub-Optimal

Fish Species	Number	Length (mm)
Chub, Creek	3	0 - 0
Dace, Blacknose	259	0 - 0
Dace, Longnose	206	0 - 0
Darter, Tessellated	295	0 - 0
Eel, American	2	0 - 0
Lamprey, American Brook	15	0 - 0
Madtom, Margined	5	0 - 0
Mudminnow, Eastern	2	0 - 0
Pickerel, Redfin	2	101 - 117
Sculpin, Slimy	108	0 - 0
Sucker, White	160	0 - 0
Sunfish, Pumpkinseed	3	98 - 103
Sunfish, Redbreast	1	45 - 45
Trout, Brook (YOY)	19	70 - 101
Trout, Brown (YOY)	11	68 - 101
Trout, Brown	2	180 - 190

Summary: The Claremont Stretch, a 1.1-mile section of the Raritan River South Branch, was surveyed to assess the fish assemblage and the current *Year Round Trout Conservation Area* regulations. Two surveys were conducted at locations routinely monitored every few years (6 surveys since 1998), the last of which was in 2013. The once abundant Brook Trout (soon to be listed state Special Concern) population seems to be declining. The total number of Brook Trout during the two most recent surveys in 2013 (n=18) and 2016 (n=19) are substantially less than the average the four last surveys conducted from 1998 through 2007 (n=49). The total number of Brown Trout has also declined in 2016 from its previous average of 90 down to 13. Slimy Sculpin (soon to be listed state Threatened) numbers (n=108) are within the range of the previous five surveys (21-220). White Suckers are a tolerant species and generalist feeder, and when found in high abundance (n=160) are an indicator of a stressed system. Water temperature was also elevated at the time of survey at 20.3℃. River conditions since last fall have been stressful, as rainfall and flows have been very low. The decline in the fishery may also be due to a change in habitat. It is noted that the number and depth of pools seems to have decreased at various locations in the upper section of this river as sand and other fine particles seem to have increased in abundance. Recent habitat assessments indicate increasing percentages of sand and silt in the channel than those previously observed.

Recommendation: The decline of this trout fishery is of concern and is believed to be related to habitat degradation, and subsequently exacerbated by drought conditions. Populations and habitats of two species soon to be designated state Special Concern (Brook Trout and American Brook Lamprey) and Slimy Sculpin should continue to be monitored. (Crouse)

Raritan River S/B

Date: 07/20/2016
County: Hunterdon
Township: Lebanon Twp.
Drainage: Raritan River - South Branch
Project: Trout Special Regulation Area
Location: Ken Lockwood Gorge Road, Boulder Field

Water Chemistry / Habitat

Water Temperature (°C):	20.6
Dissolved Oxygen (mg/L):	9.36
Specific Conductance (uS/cm):	418.1
pH:	8.15
Alkalinity (mg/L):	96
Sample Length (m):	150
Habitat Assessment Score:	180 Optimal (2007)

Fish Species	Number	Length (mm)
Bass, Rock	1	78 - 78
Bass, Smallmouth	23	107 - 235
Dace, Blacknose	60	0 - 0
Dace, Longnose	133	0 - 0
Darter, Tessellated	44	0 - 0
Eel, American	12	0 - 0
Madtom, Margined	30	0 - 0
Sucker, White	118	0 - 0
Sunfish, Redbreast	8	76 - 131
Trout, Brook	1	167 - 167
Trout, Brown (YOY)	2	80 - 88
Trout, Brown	36	143 - 367
Trout, Rainbow (YOY)	4	86 - 118
Trout, Rainbow	113	250 - 300

Summary: Known for its great scenery and fish habitat, the 2.5-mile section of the Raritan River South Branch known as the Ken Lockwood Gorge (KLG) is very popular among anglers looking for *Catch and Release / artificial lures only* (*C&R*) regulations. Wild Brown Trout are plentiful in this section of river, with an increase in the amount of natural reproduction in recent years, however Brook Trout (soon to be listed state Special Concern) are rarely encountered, never with more than a few individuals. This section is stocked by the Division during the spring and fall. The first of two survey locations is referred to as the boulder field and is in the upper portion of the KLG. Over the last five sampling events since 2006, the total number of all trout species encountered during electrofishing surveys have generally increased (49, 73, 70, 168, 150). Brown Trout were the most abundant trout species during the first three surveys, consisting almost exclusively wild fish, which is the foundation of the fishery. Their numbers were trending upward (41, 44, 55) until the last two years in which 28 and 38 were caught respectively. When broken down by species, the greatest difference noted is in regards to Rainbow Trout, which have generally increased (6, 11, 13, 139, 111). This large number of stocked Rainbow Trout warrants concern, as wild trout numbers have declined. In regards to angler harvest of trout less than 15 inches, the previous *Year Round Trout Conservation Area* (*TCA*) regulations (1 trout per day greater than 15 inches) is no different than the *C&R* regulations, because in both scenarios these trout must be released. The number of trout over 9 inches (general trout minimum size, not legal on previous *TCA* and current *C&R*) has generally increased (25, 43, 40, 149, 120), which meets is a management objective of increasing the average trout size. Unfortunately, the number of trout greater than 15 inches (*TCA* size limit) has not significantly increased since the new regulation went into effect.

Recommendation: It is recommended to continue to monitor the fish assemblage within the Ken Lockwood Gorge WMA to assess not only the *C&R* regulations, but also to conduct disease surveillance as Furunculosis has been confirmed on more than one occasion. It is also recommended to decrease the number of stocked trout annually in the Ken Lockwood Gorge. This action may serve two benefits: wild trout may benefit from reduction of competition by stocked trout and alleviating the likelihood of disease outbreaks by reducing densities of stocked trout. (Crouse)

Raritan River S/B

Date: 07/20/2016
County: Hunterdon
Township: Lebanon Twp.
Drainage: Raritan River - South Branch
Project: Trout Special Regulation Area
Location: Ken Lockwood Gorge Road, Below Railroad trestle

Water Chemistry / Habitat

Water Temperature (°C):	19.6
Dissolved Oxygen (mg/L):	9.36
Specific Conductance (uS/cm):	417.3
pH:	7.80
Alkalinity (mg/L):	94
Sample Length (m):	150
Habitat Assessment Score:	177 Optimal (2007)

Fish Species	Number	Length (mm)
Bass, Rock	1	182 - 182
Bass, Smallmouth	14	111 - 265
Dace, Blacknose	85	0 - 0
Dace, Longnose	72	0 - 0
Darter, Tessellated	47	0 - 0
Eel, American	5	0 - 0
Madtom, Margined	6	0 - 0
Mudminnow, Eastern	1	0 - 0
Sucker, White	48	0 - 0
Sunfish, Redbreast	7	60 - 143
Trout, Brown (YOY)	2	71 - 78
Trout, Brown	13	178 - 386
Trout, Rainbow	68	250 - 400

Summary: Known for its great scenery and fish habitat, the 2.5-mile section of the Raritan River South Branch known as the Ken Lockwood Gorge (KLG) is very popular among anglers looking for *Catch and Release / artificial lures only* (*C&R*) regulations. Wild Brown Trout are plentiful in this section of river, with an increase in the amount of natural reproduction in recent years, however Brook Trout (soon to be listed state Special Concern) are rarely encountered, never with more than a few individuals. This section is stocked by the Division during the spring and fall. The second of two survey locations is located below the railroad trestle in the middle of the KLG. Over the last five sampling events since 2006, the total number of all trout species encountered during electrofishing surveys have fluctuated (47, 53, 143, 245, 83). Brown Trout were the most abundant species during the first three surveys, consisting almost exclusively wild fish, which is the foundation of the fishery. Their numbers were trending upward (43, 29, 97) until the last two years in which 24 and 14 were caught. When broken down by species, the greatest difference noted is in regards to Rainbow Trout, which have generally increased (3, 12, 37, 221, 68). This large number of stocked Rainbow Trout warrants concern, as wild trout numbers have declined. In regards to angler harvest of trout less than 15 inches, the previous *Year Round Trout Conservation Area* (*TCA*) regulations (1 trout per day greater than 15 inches) is no different than the *C&R* regulations, because in both scenarios these trout must be released. The number of trout over 9 inches (general trout minimum size, not legal on previous *TCA* and current *C&R*) has generally increased (29, 39, 109, 231, 74), which meets is a management objective of increasing the average trout size. The lack of a significant increase of number of trout greater than 15 inches (*TCA* size limit) is disappointing.

Recommendation: It is recommended to continue to monitor the fish assemblage within the Ken Lockwood Gorge WMA to assess not only the *C&R* regulations, but also to conduct disease surveillance as Furunculosis has been confirmed on more than one occasion. It is also recommended to decrease the number of stocked trout annually in the Ken Lockwood Gorge. This action may serve two benefits: wild trout may benefit from reduction of competition by stocked trout and alleviating the likelihood of disease outbreaks by reducing densities of stocked trout. (Crouse)

Raritan River S/B (trib.) (Drakestown)

Date: 07/05/2016
County: Morris
Township: Mount Olive Twp.
Drainage: Raritan River - South Branch
Project: Temperature Study - TP Streams
Location: Joy Drive

Water Chemistry / Habitat

Water Temperature (°C):	16.9
Dissolved Oxygen (mg/L):	8.94
Specific Conductance (uS/cm):	207.8
pH:	7.46
Alkalinity (mg/L):	31
Sample Length (m):	150
Habitat Assessment Score:	176 Optimal (2011)

Fish Species	Number	Length (mm)
Chub, Creek	24	0 - 0
Dace, Blacknose	77	0 - 0
Dace, Longnose	1	0 - 0
Darter, Tessellated	3	0 - 0
Shiner, Golden	7	0 - 0
Sucker, White	7	0 - 0
Trout, Brook (YOY)	37	62 - 94
Trout, Brook	38	105 - 240

Summary: This tributary to the South Branch of the Raritan River was electrofished on 7/5/16to assess the wild trout population structure relative to the stream temperature regime. Approximately eight electrofishing surveys have been conducted since 2009 at this location, as part of a mark and recapture study conducted by NJDFW hourly employee Luke Diglio, as part of his doctoral dissertation titled, "An Assessment of New Jersey *Trout Production* Systems: A Movement Towards Sustainability." Surveys conducted here found an abundance of wild Brook Trout (soon to be designated state Special Concern). During last year's survey, 110 Brook Trout ranging from 45 – 240 mm (1.8 – 9.4 in), including 77 young-of-the-year (YOY), were captured. Species encountered during this survey included 75 Brook Trout ranging from 62 – 240 mm (2.4 – 9.4 in), including 37 YOY. This is the fourth survey since 2011 that has been conducted in the same location and data is indicating that the total number of Brook Trout has the tendency to fluctuate. In 2011, 2012, 2015, and 2016 the total number of Brook Trout captured are 84 (64 YOY), 163 (107 YOY), 110 (38 YOY), and 75 (37 YOY), respectively. One of the objectives of this study is to understand these types of population fluctuations, the causative factors that are influencing them, and what implications it has on the standard operating procedures of stream electrofishing surveys.

Recommendation: This survey is part of a stream temperature study that is currently being conducted on 14 *Trout Production* streams. This stream will be monitored in this section for the next 1-2 years to study the relationship of stream temperature on wild trout life cycles in New Jersey and help guide in the management of our *Trout Production* streams. (Collenburg)

Raritan River S/B (trib.) (SW of Budd Lake)

Date: 07/05/2016
County: Morris
Township: Mount Olive Twp.
Drainage: Raritan River - South Branch
Project: Temperature Study - TP Streams
Location: Route 46

Fish Species	Number	Length (mm)
Chub, Creek	3	0 - 0
Dace, Blacknose	273	0 - 0
Trout, Brook (YOY)	16	66 - 99
Trout, Brook	2	162 - 166

Water Chemistry / Habitat

Water Temperature (°C): 18.8
Dissolved Oxygen (mg/L): 8.62
Specific Conductance (uS/cm): 352.8
pH: 7.49
Alkalinity (mg/L): 37
Sample Length (m): 150
Habitat Assessment Score: 147 Sub-Optimal (2009)

Summary: This tributary of the South Branch of the Raritan River was electrofished on 7/5/16 to assess the wild trout population structure relative to the stream temperature regime. Approximately eight electrofishing surveys have been conducted since 2009 at this location, as part of a mark and recapture study conducted by NJDFW hourly employee Luke Diglio, as part of his doctoral dissertation titled, "An Assessment of New Jersey *Trout Production* Systems: A Movement Towards Sustainability." Among other things, the work here discovered a healthy wild Brook Trout (soon to be designated state Special Concern) population and data showed that the population abundance here has the tendency to fluctuate. However, the variability in abundance seems to be tied to sections that provide more or less habitat. Sections with more habitat (i.e. deeper pools, undercut banks, etc.) tend to hold more Brook Trout. During a survey in 2015, 24 wild Brook Trout, including 18 young-of-the-year (YOY), were captured. The survey conducted this year captured 18 wild Brook Trout, including 16 YOY. The population abundance is low in this section.

Recommendation: This survey is part of a stream temperature study that is currently being conducted on 14 *Trout Production* streams. This stream will be monitored in this section for the next 1-2 years to study the relationship of stream temperature on wild trout life cycles in New Jersey and help guide in the management of our *Trout Production* streams. (Collenburg)

Rinehart Brook

Date: 07/26/2016
County: Morris
Township: Chester Twp.
Drainage: Raritan River - North Branch
Project: Temperature Study - TP Streams
Location: Hacklebarney State Park

Fish Species	Number	Length (mm)
Dace, Blacknose	22	0 - 0
Trout, Brown (YOY)	44	60 - 93
Trout, Brown	42	125 - 218

Water Chemistry / Habitat

Water Temperature (°C): 20.3
Dissolved Oxygen (mg/L): 8.38
Specific Conductance (uS/cm): 269.1
pH:
Alkalinity (mg/L): 41
Sample Length (m): 150
Habitat Assessment Score: 171 Optimal (2014)

Summary: Rinehart Brook is a small stream that flows through Hacklebarney State Park and ultimately into the Black River. It is currently classified a *Trout Production (TP)* stream and one of the two streams inside Hacklebarney State Park that is regulated as a *Wild Trout Stream*. In the headwaters, Rinehart Brook's surrounding land use is a mix of agricultural and residential areas before it reaches the heavily forested state park dominated by Eastern hemlocks. This tributary was electrofished on 7/26/16 as part of the ongoing stream temperature study that is being conducted on a handful of *TP* streams. Species encountered during this survey included 86 wild Brown Trout ranging from 60 – 218 mm (2.4 – 8.6 in), including 44 young-of-the-year (YOY). This has been consistent with previous surveys conducted in 2004, 2014, and 2015 where a total of 143 (100 YOY), 95 (55 YOY), and 94 (44 YOY) wild Brown Trout were captured in each survey. The last time wild Brook Trout were captured at this site was in 1996 and only was found. The stream adjacent to Rinehart Brook, Trout Brook, still has a strong and persistent population of wild Brook Trout (soon to be designated state Special Concern) and may only persist due to a natural barrier that blocks Brown Trout passage and a mixed population exists downstream of this barrier. These two streams have nearly identical thermal regimes (based on continuous temperature readings), habitat, and it is conjectured to have similar geology based on their close proximity to one another. Perhaps a similar situation could be occurring in Rinehart Brook.

Recommendation: This survey is part of a stream temperature study that is currently being conducted on 14 *Trout Production* streams. This stream will be monitored in this section for the next 1-2 years to study the relationship of stream temperature on wild trout life cycles in New Jersey and help guide in management of our *Trout Production* streams. Rinehart Brook is currently regulated as a *Wild Trout Stream* and recommended to remain as one, but development of those regulations are ongoing and will be determined and published in the 2018 Fish Code. This stream should be periodically monitored in accordance with the established schedule (every five years for a *Wild Trout Stream*).

Rinehart Brook presents an opportunity to reintroduce Brook Trout. With almost identical conditions in a neighboring stream that has an abundant and healthy population of Brook Trout, Trout Brook serves as an example of what could potentially exist in Rinehart Brook if the proper intervention takes place. Furthermore, if removal did occur, steep plunge pools near Rinehart Brook's confluence with Black River exists and should inhibit most of the migration of non-native trout and Trout Brook's population of Brook Trout can serve as a source population. (Collenburg)

Rockaway Creek

Date: 07/12/2016
County: Hunterdon
Township: Readington Twp.
Drainage: Raritan River - North Branch
Project: Native Species Inventory
Location: Lamington Road bridge, downstream

Water Chemistry / Habitat

Water Temperature (°C):	20.7
Dissolved Oxygen (mg/L):	7.02
Specific Conductance (uS/cm):	260.3
pH:	7.72
Alkalinity (mg/L):	77
Sample Length (m):	150
Habitat Assessment Score:	128 Sub-Optimal

Fish Species	Number	Length (mm)
Bass, Rock	15	84 - 157
Bass, Smallmouth	15	35 - 174
Bullhead, Yellow	1	170 - 170
Dace, Blacknose	4	0 - 0
Dace, Longnose	26	0 - 0
Darter, Shield	13	0 - 0
Darter, Tessellated	242	0 - 0
Eel, American	24	0 - 0
Killifish, Banded	1	0 - 0
Madtom, Margined	8	0 - 0
Mudminnow, Eastern	1	0 - 0
Shiner, Spotfin	17	0 - 0
Shiner, Spottail	19	0 - 0
Sucker, White	67	0 - 0
Sunfish, Green	3	96 - 131
Sunfish, Redbreast	48	49 - 159

Summary: A statewide evaluation of several candidate State Threatened and/or Endangered fish species is underway. During an electrofishing survey along Mill Road Bridge on 7/15/69, 6 Bridle Shiners were collected. An electrofishing survey was conducted this summer on the Rockaway Creek along Lamington Road to determine if Bridle Shiners (soon to be listed state Endangered) are still present. The recent survey was conducted at Lamington Road, which is 0.8 miles downstream from the Mill Road site, because the previous site was inaccessible. No Bridle Shiners were found during the recent survey, which is consistent with the range-wide decline of this species. One American Brook Lamprey (soon to be designated state Special Concern) and an abundance of two native minnow species (Common Shiners and Fallfish) were found in the 1969 survey, but not in 2016. Shield Darters (soon to be listed state Special Concern) were encountered during the recent survey and also during a 2003 survey approximately 1 mile downstream. The invasive Green Sunfish (regulated as potentially dangerous) was also found in this stream for the first time, as it was not found during 4 previous surveys dating back to 1969. This site is also a trout stocking point and no stocked trout were encountered. It should be noted that upon the completion of the survey, stream flow drastically increased over a period of approximately 30 minutes around 11 am. USGS gauge station 01399670 South Branch of Rockaway Creek (upstream of the survey location) increased from 4 to 70 CFS during a similar time frame, reflecting a confirmed release of water by the New Jersey Water Supply Authority from Round Valley Reservoir. Extreme variations in flow can have a negative impact on fish assemblages.

Recommendation: Additional surveys in the watershed are necessary to determine the current status and distribution of Bridle Shiners. (Crouse)

Rockaway Creek, S/Br.

Date: 08/03/2016
County: Hunterdon
Township: Readington Twp.
Drainage: Raritan River - North Branch
Project: Native Species Inventory
Location: USGS Gauge Access Road off Railroad Avenue

Water Chemistry / Habitat

Water Temperature (°C):	22.4
Dissolved Oxygen (mg/L):	4.99
Specific Conductance (uS/cm):	312.4
pH:	7.74
Alkalinity (mg/L):	72
Sample Length (m):	150
Habitat Assessment Score:	106 Marginal

Fish Species	Number	Length (mm)
Bass, Largemouth	28	46 - 229
Bass, Smallmouth	2	66 - 74
Bullhead, Brown	1	110 - 110
Bullhead, Yellow	5	39 - 236
Carp, Common	1	560 - 560
Chub, Creek	1	0 - 0
Crappie, Black	7	76 - 192
Darter, Shield	3	0 - 0
Darter, Tessellated	12	0 - 0
Eel, American	11	0 - 0
Fallfish	3	0 - 0
Hybrid, Sunfish	1	136 - 136
Killifish, Banded	46	0 - 0
Shiner, Common	10	0 - 0
Shiner, Golden	4	0 - 0
Shiner, Spotfin	51	0 - 0
Shiner, Spottail	515	0 - 0
Sucker, White	76	0 - 0
Sunfish, Bluegill	101	44 - 165
Sunfish, Green	18	32 - 148
Sunfish, Pumpkinseed	6	50 - 116
Sunfish, Redbreast	85	30 - 152

Summary: Bridle Shiner (soon to be listed state Endangered), was last documented in the South Branch of Rockaway Creek in 1977. A survey utilizing 3 electrofishing backpacks was conducted to determine if they are still present upstream of the location in which it was last found. The location selected was downstream of Lake Cushetunk and upstream of the Round Valley Reservoir release location into the South Branch of Rockaway Creek. The fish assemblage is likely influenced thermally and biologically by Lake Cushetunk resulting in an abundance of lentic species including 101 Bluegills, 18 Green Sunfish (regulated potentially dangerous), 6 Pumpkinseeds, and 28 Largemouth Bass. Stream fish assemblage data in recent statewide surveys suggests that Bridle Shiners tend to be found in streams when non-native Centrarchids are absent or not abundant. As anticipated, no Bridle Shiners were found at this impacted site. Another environmental stressor on the stream biota may be the rapid stream fluctuations in flow and turbidity resulting from drastically the release of water by the New Jersey Water Supply Authority from Round Valley Reservoir. Bridle Shiners are sight feeders, therefore frequent turbidity events limit their ability to forage, which is thought to contribute to their range-wide loss. Another indication the system is stressed was the significant number of the sunfish and White Suckers with dermal lesions, totaling 73 individual fish. One uncommon fish species was found, the Shield Darter (soon to be designated state Special Concern).

Recommendation: Additional surveys in the watershed are necessary to determine the current status and distribution of Bridle Shiners. Specimens should be collected from this site in 2017 and investigated by our fish pathologist. (Crouse)

Rockaway Creek, S/Br.

Date: 08/03/2016
County: Hunterdon
Township: Readington Twp.
Drainage: Raritan River - North Branch
Project: Native Species Inventory
Location: Route 22 bridge, downstream

Water Chemistry / Habitat

Water Temperature (°C):	23.3
Dissolved Oxygen (mg/L):	6.05
Specific Conductance (uS/cm):	333.7
pH:	7.57
Alkalinity (mg/L):	76
Sample Length (m):	150
Habitat Assessment Score:	114 Sub-Optimal

Fish Species	Number	Length (mm)
Bass, Largemouth	3	51 - 189
Bass, Rock	2	86 - 127
Bass, Smallmouth	5	43 - 229
Bullhead, Yellow	1	59 - 59
Chub, Creek	2	0 - 0
Crappie, Black	1	152 - 152
Dace, Longnose	15	0 - 0
Darter, Shield	8	0 - 0
Darter, Tessellated	115	0 - 0
Eel, American	10	0 - 0
Fallfish	1	0 - 0
Madtom, Margined	1	0 - 0
Shiner, Common	9	0 - 0
Shiner, Spotfin	165	0 - 0
Shiner, Spottail	34	0 - 0
Shiner, Swallowtail	1	0 - 0
Sucker, White	26	0 - 0
Sunfish, Bluegill	4	24 - 114
Sunfish, Green	3	34 - 51
Sunfish, Redbreast	36	30 - 156

Summary: Bridle Shiner (soon to be listed state Endangered), was last documented in the South Branch of Rockaway Creek in 1977. A survey utilizing 3 electrofishing backpacks was conducted to determine if they are still present at this location. The fish assemblage remains relatively intact when compared to the 1977 survey, with the exception of the apparent loss of Bridle Shiners. Five non-native predators of Bridle Shiners were found at this location including Green Sunfish (regulated as potentially dangerous), Bluegill, Rock Bass, Largemouth Bass, and Smallmouth Bass. Stream fish assemblage data in recent statewide surveys suggests that Bridle Shiners tend to be found in streams when non-native Centrarchids are absent or not abundant. Another environmental stressor on the stream biota may be the rapid stream fluctuations in flow and turbidity resulting from drastically the release of water by the New Jersey Water Supply Authority from Round Valley Reservoir. Bridle Shiners are sight feeders, therefore frequent turbidity events limit their ability to forage, which is thought to contribute to their range-wide loss. Eight Shield Darters (soon to be designated state Special Concern) were found at this location.

Recommendation: Additional surveys in the watershed are necessary to determine the current status and distribution of Bridle Shiners. (Crouse)

Rocky Run

Date: 07/26/2016
County: Hunterdon
Township: Lebanon Twp.
Drainage: Raritan River - South Branch
Project: Temperature Study – TP stream
Location: Rocky Run Road

Fish Species	Number	Length (mm)
Dace, Blacknose	74	0 - 0
Trout, Brook (YOY)	23	60 - 83
Trout, Brook	28	110 - 197

Water Chemistry / Habitat

Water Temperature (°C): 22.2
Dissolved Oxygen (mg/L): 7.55
Specific Conductance (uS/cm): 183
pH: 7.66
Alkalinity (mg/L): 36
Sample Length (m): 150
Habitat Assessment Score: 159 Sub-Optimal (2014)

Summary: This tributary to the South Branch of the Raritan River was electrofished on 7/26/16 to assess the wild trout population structure relative to the stream temperature regime. The survey was conducted just upstream of an on stream impoundment that blocks migration up into this section. Brown Trout and Brook Trout (soon to be designated state Special Concern) are known to exist below this impoundment. Species encountered during this survey included 51 wild Brook Trout ranging from 60 – 197 mm (2.4 – 7.8 in), including 23 young-of-the-year (YOY). Surveys were conducted here in 2009, 2014, 2015, and 2016 and captured a total of 22 (9 YOY), 69 (61 YOY), 81 (32 YOY), and 51 (23 YOY), respectively, indicating that the population of trout here fluctuates. Low flows were noted, effecting the amount of available habitat and few Brook Trout were captured in the first 75 m where most of the braids occur. Overall, streams that were part of this study showed a decline in total trout captured (10 out of 14). Rocky Run showed a 58.8% decrease in total number of trout captured between 2015 and 2016.

Recommendation: This survey is part of a stream temperature study that is currently being conducted on 14 *Trout Production* streams. This stream will be monitored in this section for the next 1-2 years to study the relationship of stream temperature on wild trout life cycles in New Jersey and help guide in the management of our *Trout Production* streams.

Rocky Run is currently regulated as a *Wild Trout Stream* and recommended to remain as one, but development of those regulations are ongoing and will be determined and published in the 2018 Fish Code. This stream should be periodically monitored in accordance with the established schedule. (Collenburg)

Stony Brook (Morris – Washington)

Date: 08/02/2016
County: Morris
Township: Washington Twp.-Morris Co.
Drainage: Raritan River - South Branch
Project: Temperature Study - TP Streams
Location: Columbia Trail Walking Bridge

Water Chemistry / Habitat

Water Temperature (°C):	19.6
Dissolved Oxygen (mg/L):	8.29
Specific Conductance (uS/cm):	211.8
pH:	7.82
Alkalinity (mg/L):	39.5
Sample Length (m):	150
Habitat Assessment Score:	168 Optimal (2015)

Fish Species	Number	Length (mm)
Chub, Creek	15	0 - 0
Dace, Blacknose	38	0 - 0
Dace, Longnose	15	0 - 0
Darter, Tessellated	15	0 - 0
Eel, American	7	0 - 0
Lamprey, American Brook	3	0 - 0
Sculpin, Slimy	70	0 - 0
Sucker, White	35	0 - 0
Trout, Brook	8	137 - 256
Trout, Brown (YOY)	43	53 - 90
Trout, Brown	41	112 - 310

Summary: This tributary of the South Branch of the Raritan River was electrofished on 8/2/16 to assess the wild trout populations structure relative to the stream temperature regime. The first survey conducted here in 1969 discovered a wild Brown Trout and Brook Trout population, with Slimy Sculpin present. Many years have passed since the next survey was conducted on this stream but the species composition has not changed much except for the dominant trout species (now Brown Trout). The current survey encountered a total of 10 species with Slimy Sculpin and Brown Trout being the most prevalent. The Slimy Sculpin, considered an excellent indicator of water quality, is soon to be listed state Threatened and the American Brook Lamprey, soon to be designated Special Concern, were captured as well. A total of 84 wild Brown Trout were captured, including 43 young-of-the-year, and 8 wild Brook Trout (soon to be designated state Special Concern). One wild Brown Trout not captured during this survey but almost netted looked to have exceeded 15 inches in size. Another interesting note is that 184 wild Brown Trout were captured in 2015 and 84 were captured in 2016. This stream section has a lot of silt and sand deposited throughout and can potentially be limiting better habitat. Otherwise, undercut banks and large pools (some at depths of 3.5-4 feet deep) are abundant here which provide ample cover in times of low flows like we experienced during this survey. In contrast, upstream sections of this same stream has much less fine sediments and embedded substrate, which provides habitat through cobble layering creating interstitial spaces beneficial to the Slimy Sculpin's habitat preference (263 Slimy Sculpin captured from 2015 survey upstream of Naughtright Road). The 2016 site is further downstream from multiple ponds and impoundments. The Brook Trout population is struggling throughout the stream reach.

Recommendation: This survey is part of a stream temperature study that is currently being conducted on 14 *Trout Production* streams. This stream will be monitored in this section for the next 1-2 years to study the relationship of stream temperature on wild trout life cycles in New Jersey and help guide in the management of our *Trout Production* streams.

Stony Brook is currently regulated as a *Wild Trout Stream* and recommended to remain as one, but development of those regulations are ongoing and will be determined and published in the 2018 Fish Code. This stream should be periodically monitored in accordance with the established schedule for *Wild Trout Streams*. (Collenburg)

Sun Valley Brook

Date: 07/15/2016
County: Morris
Township: Mount Olive Twp.
Drainage: Raritan River - South Branch
Project: Brook Trout Assessment
Location: Stedwick Road

Fish Species	Number	Length (mm)
Chub, Creek	163	0 - 0
Dace, Blacknose	216	0 - 0
Sucker, White	1	0 - 0
Trout, Brook	9	106 - 154

Water Chemistry / Habitat

Water Temperature (°C): 18.9
Dissolved Oxygen (mg/L): 7.87
Specific Conductance (uS/cm): 382
pH: 7.56
Alkalinity (mg/L): 43
Sample Length (m): 150
Habitat Assessment Score: 168 Optimal

Summary: This tributary of the South Branch of the Raritan River has been part of the Stream Temperature Monitoring Study and because of this, stream temperature of notable concern has been documented here. Continuous stream temperature data that was collected over the past year was analyzed and extreme spikes in temperature were seen to coincide with rainfall events. Spikes in stream temperature were extreme enough to cause acute thermal stress and a high possibility of death would inherently occur in any coldwater trout inhabiting downstream of the source of thermal pollution. Bureau of Freshwater Fisheries crews were out to investigate the source and found the main source of thermal pollution to be the drainage coming from Wolfe Road and directly channeled into the stream via culverts. In addition, multiple ephemeral channels that were coming from a development directly upstream of Wolfe Road were believed to be contributing to the. Two fish surveys conducted since 2011 have not found Brook Trout below Wolfe Road bridge. This year, two additional surveys were conducted to determine the status of Brook Trout (soon to be designated state Special Concern) above the thermally impacted area (Wolfe Road) and one survey was conducted downstream. This survey was conducted on 7/15/16 and was the furthest upstream survey conducted. A total of nine adult wild Brook Trout were encountered during this survey. This is added evidence that the thermal impact may be forcing Brook Trout to stay or be relegated to upstream sections of Sun Valley Brook.

Recommendation: The signs of degradation and existence of sensitive species upstream of the point source of pollution is evidence that mitigation of these problems has the potential to restore Sun Valley Brook's Brook Trout population downstream. (Collenburg)

Sun Valley Brook

Date: 07/14/2016
County: Morris
Township: Mount Olive Twp.
Drainage: Raritan River - South Branch
Project: Brook Trout Assessment
Location: Wolfe Road Bridge

Fish Species	Number	Length (mm)
Chub, Creek	110	0 - 0
Dace, Blacknose	238	0 - 0
Sucker, White	3	0 - 0
Trout, Brook	11	111 - 165

Water Chemistry / Habitat

Water Temperature (°C): 17.5
Dissolved Oxygen (mg/L): 7.86
Specific Conductance (uS/cm): 281.2
pH: 7.21
Alkalinity (mg/L): 32
Sample Length (m): 150
Habitat Assessment Score: 142 Sub-Optimal

Summary: This tributary of the South Branch of the Raritan River has been part of the Stream Temperature Monitoring Study and because of this, stream temperature of notable concern has been documented here. Continuous stream temperature data that was collected over the past year was analyzed and extreme spikes in temperature were seen to coincide with rainfall events. Spikes in stream temperature were extreme enough to cause acute thermal stress and a high possibility of death would inherently occur in any coldwater trout inhabiting downstream of the source of thermal pollution. Bureau of Freshwater Fisheries crews were out to investigate the source and found the main source of thermal pollution to be the drainage coming from Wolfe Road and directly channeled into the stream via culverts. In addition, multiple ephemeral channels that were coming from a development directly upstream of Wolfe Road were believed to be contributing to the warming. Two fish surveys conducted since 2011 have not found Brook Trout (soon to be designated state Special Concern) below Wolfe Road bridge. This year, two additional surveys were conducted to determine the status of Brook Trout above the thermally impacted area (Wolfe Road) and one survey was conducted downstream. This survey was conducted on 7/14/16 and was located 42 meters upstream from Wolfe Road.

This location is above what is believed to be the major thermal impact and 11 adult wild Brook Trout were encountered here. This is added evidence that the thermal impact may be forcing Brook Trout to stay or be relegated to upstream sections of Sun Valley Brook.

Recommendation: The signs of degradation and existence of sensitive species upstream of the point source of pollution is evidence that mitigation of these problems has the potential to restore Sun Valley Brook's Brook Trout population. (Collenburg)

Sun Valley Brook

Date: 07/14/2016
County: Morris
Township: Mount Olive Twp.
Drainage: Raritan River - South Branch
Project: Brook Trout Assessment
Location: Upstream of confluence with Raritan River, S/Br

Fish Species	Number	Length (mm)
Chub, Creek	55	0 - 0
Dace, Blacknose	41	0 - 0
Dace, Longnose	4	0 - 0
Darter, Tessellated	1	0 - 0
Sucker, White	3	0 - 0

Water Chemistry / Habitat

Water Temperature (°C): 18.7
Dissolved Oxygen (mg/L): 8.92
Specific Conductance (uS/cm): 359.8
pH: 7.34
Alkalinity (mg/L): 39
Sample Length (m): 150
Habitat Assessment Score: 173 Optimal (2010)

Summary: This tributary of the South Branch of the Raritan River has been part of the Stream Temperature Monitoring Study and because of this, stream temperature of notable concern has been documented here. Continuous stream temperature data that was collected over the past year was analyzed and extreme spikes in temperature were seen to coincide with rainfall events. Spikes in stream temperature were extreme enough to cause acute thermal stress and a high possibility of death would inherently occur in any coldwater trout inhabiting downstream of the source of thermal pollution. Bureau of Freshwater Fisheries crews were out to investigate the source and found the main source of thermal pollution to be the drainage coming from Wolfe Road and directly channeled into the stream via culverts. In addition, multiple ephemeral channels that were coming from a development directly upstream of Wolfe Road were believed to be contributing to the warming. Two fish surveys conducted since 2011 have not found Brook Trout below Wolfe Road bridge. This year, two additional surveys were conducted to determine the status of Brook Trout (soon to be designated state Special Concern) above the thermally impacted area (Wolfe Road) and one survey was conducted downstream. This survey was conducted on 7/14/16 and was located below Wolfe Road, 50 meters upstream of the confluence with the South Branch of the Raritan River. No Brook Trout were captured during this survey.

This site was located downstream of the thermal impact. It is suspected to be contributing to the Brook Trout's continued absence in the downstream section where plenty of habitat exists. In addition, this stream will be monitored in this section for another year to study the relationship of stream temperature on wild trout life cycles in New Jersey and help guide management of our *Trout Production* streams.

Recommendation: This survey is part of a stream temperature study that is currently being conducted on 14 *Trout Production* streams. This stream will be monitored in this section for the next 1-2 years to study the relationship of stream temperature on wild trout life cycles in New Jersey and help guide in better management of our *Trout Production* streams. (Collenburg)

Trout Brook (Hacklebarney)

Date: 07/14/2016
County: Morris
Township: Chester Twp.
Drainage: Raritan River - North Branch
Project: Temperature Study - TP Streams
Location: Hacklebarney State Park

Fish Species	Number	Length (mm)
Dace, Blacknose	108	0 - 0
Dace, Longnose	8	0 - 0
Trout, Brook (YOY)	90	48 - 86
Trout, Brook	115	99 - 217

Water Chemistry / Habitat

Water Temperature (°C): 17.5
Dissolved Oxygen (mg/L): 11.04
Specific Conductance (uS/cm): 295
pH: 7.72
Alkalinity (mg/L): 57
Sample Length (m): 150
Habitat Assessment Score: 179 Optimal (2014)

Summary: Trout Brook is a small stream that flows through Hacklebarney State Park and ultimately into the Black River. It is currently classified a *Trout Production (TP)* stream and one of the two streams inside Hacklebarney State Park that is regulated as a *Wild Trout Stream*. This tributary of the South Branch of the Raritan River was electrofished on 7/14/16 to assess the wild trout populations structure relative to the stream temperature regime. Past surveys have found an abundant and persistent population of wild Brook Trout (soon to be designated state Special Concern) here, and a natural barrier ~100 m downstream of the survey's start point has kept Brown Trout only present in the downstream section of this brook. Species encountered during this survey included 205 wild Brook Trout, including 90 young-of-the-year. Blacknose Dace and Longnose Dace were also present. A total of 194 Brook Trout were captured in 2015, consistent with the numbers captured this year, indicating an abundant and stable population.

Recommendation: This survey is part of a stream temperature study that is currently being conducted on 14 *Trout Production* streams. This stream will be monitored in this section for the next 1-2 years to study the relationship of stream temperature on wild trout life cycles in New Jersey and help guide in better management of our *Trout Production* streams.

Trout Brook is currently regulated as a *Wild Trout Stream* and recommended to remain as one, but development of those regulations are ongoing and will be determined and published in the 2018 Fish Code. This stream should be periodically monitored in accordance with the established schedule for *Wild Trout Streams*. (Collenburg)

Turkey Brook

Date: 07/21/2016
County: Morris
Township: Mount Olive Twp.
Drainage: Raritan River - South Branch
Project: Temperature Study - TP Streams
Location: Stephens Mill Road

Water Chemistry / Habitat

Water Temperature (°C):	16.7
Dissolved Oxygen (mg/L):	10.15
Specific Conductance (uS/cm):	464.8
pH:	7.44
Alkalinity (mg/L):	23
Sample Length (m):	150
Habitat Assessment Score:	165 Optimal (2010)

Fish Species	Number	Length (mm)
Bullhead, Yellow	1	82 - 82
Chub, Creek	1	0 - 0
Dace, Blacknose	26	0 - 0
Dace, Longnose	12	0 - 0
Mudminnow, Eastern	3	0 - 0
Sculpin, Slimy	69	0 - 0
Sucker, White	3	0 - 0
Sunfish, Bluegill	1	139 - 139
Sunfish, Pumpkinseed	1	82 - 82
Trout, Brook (YOY)	13	62 - 84
Trout, Brook	3	131 - 170
Trout, Brown (YOY)	66	51 - 80
Trout, Brown	1	216 - 216

Summary: This tributary of the South Branch of the Raritan River was electrofished on 7/21/16 to assess the wild trout populations structure relative to the stream temperature regime. A survey conducted in 1969 discovered a wild Brook Trout (soon to be designated state Special Concern) population here. Since then, Brown Trout have been either directly or indirectly introduced into the system. Approximately eight electrofishing surveys have been conducted since 2009 at this location, as part of a mark and recapture study conducted by NJDFW hourly employee Luke Diglio, as part of his doctoral dissertation titled, "An Assessment of New Jersey *Trout Production* Systems: A Movement Towards Sustainability." Multiple surveys have shown Brown Trout populations dominate the species composition closer to the confluence of the South Branch of the Raritan River. Headwater sections are still dominated by Brook Trout, helped by a few on stream impoundments. Species encountered in this survey included 16 wild Brook Trout, including 13 young-of-the-year (YOY), and 67 wild Brown Trout, including 66 YOY. The abundance of Brook Trout changed dramatically from the survey conducted last year when a total of 49 wild Brook Trout and 50 wild Brown Trout were captured. A nearly one to one ratio of Brook Trout to Brown Trout is now one to four. Another survey will be conducted here next year to continue the project and the monitoring of the Brook Trout population here. A total of 11 species were encountered during the survey. Of special note, 69 Slimy Sculpin were captured during the survey and continue to do well in Turkey Brook (soon to be listed state Threatened).

Recommendation: This survey is part of a stream temperature study that is currently being conducted on 14 *Trout Production* streams. This stream will be monitored in this section for the next 1-2 years to study the relationship of stream temperature on wild trout life cycles in New Jersey and help guide in the management of our *Trout Production* streams.

Turkey Brook is currently regulated as a *Wild Trout Stream* and recommended to remain as one, but development of those regulations are ongoing and will be determined and published in the 2018 Fish Code. This stream should be periodically monitored in accordance with the established schedule for *Wild Trout Streams.* (Collenburg)

Willhoughby Brook

Date: 07/01/2016
County: Hunterdon
Township: Lebanon Twp.
Drainage: Raritan River - South Branch
Project: Temperature Study - TP Streams
Location: Route 31

Water Chemistry / Habitat

Water Temperature (°C):	19.3
Dissolved Oxygen (mg/L):	8.74
Specific Conductance (uS/cm):	155.2
pH:	7.61
Alkalinity (mg/L):	86
Sample Length (m):	150
Habitat Assessment Score:	149 Sub-Optimal (2015)

Fish Species	Number	Length (mm)
Bass, Largemouth	10	0 - 0
Bass, Smallmouth	2	0 - 0
Bullhead, Yellow	7	82 - 121
Dace, Blacknose	13	0 - 0
Dace, Longnose	7	0 - 0
Darter, Tessellated	36	0 - 0
Pike, Northern	1	193 - 193
Sucker, White	10	0 - 0
Sunfish, Green	3	69 - 136
Trout, Brook (YOY)	5	71 - 89
Trout, Brook	2	189 - 211
Trout, Brown (YOY)	1	86 - 86
Trout, Brown	30	137 - 284

Summary: This tributary to the Spruce Run Reservoir was electrofished on 7/1/16 to assess the wild trout population structure relative to the stream temperature regime. It is currently classified as a *Trout Production* stream and regulated as a *Wild Trout Stream*. A survey conducted over a mile upstream from this location in 2014 indicated abundant populations of wild Brook Trout (soon to be designated state Special Concern) and wild Brown Trout. The survey conducted in this location in 2015 found that this section was dominated by larger trout of both species. There was a concern last year that the population of Brook Trout is low and may be struggling compared to the Brown Trout. Again, this year, Brown Trout outnumbered the Brook Trout by a great deal. Encountered during this survey was a total of 7 wild Brook Trout ranging from 71 – 211 mm (2.8 – 8.3 in), including 5 young-of-the-year (YOY), and 31 Brown Trout ranging from 86 – 284 mm (3.4 – 11.2 in), including 1 YOY. A potential factor limiting Brook Trout success in Willoughby Brook may be the stream's sensitivity to climatic factors and their innate intolerance to thermal degradation (in preliminary analysis of stream temperature data, it was the most sensitive to air temperature changes in a subset of 5 of the 14 streams currently in the study).

Recommendation: This survey is part of a stream temperature study that is currently being conducted on 14 *Trout Production* streams. This stream will be monitored in this section for the next 1-2 years to study the relationship of stream temperature on wild trout life cycles in New Jersey and help guide in the management of our *Trout Production* streams.

Willhoughby Brook is currently regulated as a *Wild Trout Stream* and recommended to remain as one, but development of those regulations are ongoing and will be determined and published in the 2018 Fish Code. This stream should be periodically monitored in accordance with the established schedule for *Wild Trout Streams*. (Collenburg)

Stream Surveys in the Lower Delaware Region

(Assunpink Creek to Maurice River)

Assunpink Creek

Date: 06/20/2016
County: Mercer
Township: Hamilton Twp.-Mercer Co.
Drainage: Assunpink Creek
Project: Native Species Inventory
Location: Quaker Bridge Road

Water Chemistry / Habitat

Water Temperature (°C): 26.2
Dissolved Oxygen (mg/L): 4.58
Specific Conductance (uS/cm): 157.4
pH: 6.90
Alkalinity (mg/L):
Sample Length (m): 150
Habitat Assessment Score: N/A

Fish Species	Number	Length (mm)
Bass, Largemouth	1	116 - 116
Bullhead, Brown	9	96 - 225
Bullhead, Yellow	10	89 - 248
Darter, Tessellated	1	66 - 66
Eel, American	22	0 - 0
Shiner, Golden	1	122 - 122
Sucker, White	13	180 - 246
Sunfish, Bluegill	4	98 - 140
Sunfish, Pumpkinseed	12	105 - 139
Sunfish, Redbreast	49	55 - 200

Summary: A stream electrofishing survey was completed at Assunpink Creek, Quaker Bridge Rd, on 6/20/16 to evaluate the native fish population. The location historically supported a population of Ironcolor Shiners, a species soon to be listed as state Endangered Species. The Ironcolor Shiner was documented by Fowler in 1917. A total of 10 species of fish including Redbreast Sunfish, Pumpkinseed, Bluegill, Largemouth Bass, White Sucker, Yellow Bullhead, Golden Shiner, Tessellated Darter, Brown Bullhead, and American Eel were collected in the 150-m stretch. The streambed had a good mix of soft mud and hard sand and gravel. Woody debris and aquatic vegetation appeared to be good habitat for the Redbreast Sunfish population. There were no rare native species collected.

Recommendation: Assunpink Creek does not appear to support any rare native species due to land use activities and the creation of impoundments during the 1960's. (Smith)

Burnt Mill Branch

Date: 08/16/2016
County: Gloucester
Township: Newfield Boro
Drainage: Maurice River
Project: Native Species Inventory
Location: Rt. 40 Newfield

Fish Species	Number	Length (mm)
Mudminnow, Eastern	50	0 - 0
Perch, Pirate	2	0 - 0
Pickerel, Chain	6	0 - 0
Sunfish, Mud	5	0 - 0

Water Chemistry / Habitat

Water Temperature (°C): 17.5
Dissolved Oxygen (mg/L): 10.44
Specific Conductance (uS/cm): 153.1
pH: 5.42
Alkalinity (mg/L):
Sample Length (m): 200
Habitat Assessment Score: N/A

Summary: Burnt Mill Branch is a tributary of the Maurice River. A backpack electrofishing survey was conducted on 8/16/16 looking for the presence of Ironcolor Shiner, a species soon to be listed as state Endangered Species. Ironcolor Shiners were documented at the location by Hastings in 1973. A 200-meter stretch was sampled downstream of the Route 40 bridge. A total of 4 species were collected which included Eastern Mudminnow (50), Pirate Perch (2), Chain Pickerel (6), and Mud Sunfish (5) (soon to be designated state Special Concern). No Ironcolor Shiners were collected during the survey. Run time was 0.52 hours. Water chemistry was recorded; pH measured 6.63, temperature 17.5°C (63.3°F) and dissolved oxygen 10.44 mg/L.

Recommendation: This survey is part of an ongoing native fish inventory that is being conducted throughout the state. Additional sampling should be conducted in this watershed over the next several years to determine whether or not the Ironcolor Shiner is present or has been extirpated. (Smith)

*******NON – STANDARDIZED SURVEY*******

Masons Run (trib.)(Pine Hill)

Date: 08/26/2016
County: Camden
Township: Pine Hill Boro
Drainage: Big Timber Creek
Project: Brook Trout Assessment
Location: Downstream of golf course access road

Fish Species	Number	Length (mm)
Chubsucker, Creek	1	0 - 0
Darter, Tessellated	8	0 - 0
Eel, American	5	0 - 0
Mudminnow, Eastern	1	0 - 0
Pickerel, Chain	1	0 - 0
Sunfish, Green	1	0 - 0
Sunfish, Pumpkinseed	1	0 - 0

Water Chemistry / Habitat

Water Temperature (°C): 23
Dissolved Oxygen (mg/L): 9.28
Specific Conductance (uS/cm): 126.6
pH: 6.65
Alkalinity (mg/L):
Sample Length (m): 150
Habitat Assessment Score: 144 Sub-optimal Low Gradient

Summary: A backpack electrofishing survey was completed on 8/26/16 at Masons Run Tributary to assess the fish population. The location, which is an unnamed tributary to Mason's Run, was previously unsampled. A total of 7 species of fish including Creek Chubsucker (1), Tessellated Darter (8), American Eel (5), Eastern Mudminnow (1), Chain Pickerel (1), Green Sunfish (1) and Pumpkinseed (1) were collected. The stream had a habitat score of 144 (sub-optimal).

Recommendation: This survey was completed to assess the trout supporting potential of the tributary. Habitat and water temperature are rather different from the *Trout Production* stretch of this Masons Run tributary and may not be conducive to supporting trout during the summer. (Smith)

Rancocas Creek, SW/Br

Date: 08/31/2016
County: Burlington
Township: Medford Twp.
Drainage: Rancocas Creek
Project: Native Species Inventory
Location: Main St. bridge

Fish Species	Number	Length (mm)
Catfish, Channel	1	0 - 0
Eel, American	10	0 - 0
Madtom, Tadpole	3	0 - 0
Perch, Pirate	2	0 - 0
Sunfish, Redbreast	6	0 - 0

Water Chemistry / Habitat

Water Temperature (°C): 26
Dissolved Oxygen (mg/L): 7.17
Specific Conductance (uS/cm): 218
pH: 7.08
Alkalinity (mg/L):
Sample Length (m): 150
Habitat Assessment Score: 117 Sub-Optimal (Low Gradient)

Summary: A backpack electrofishing survey was conducted on 8/31/16 looking for the presence of Ironcolor Shiner (soon to be listed as state Endangered*)*. A 150-meter stretch was sampled downstream of the Main Street bridge crossing in the town of Medford. A total of five species were collected which included American Eel, Redbreast Sunfish, Tadpole Madtom, Pirate Perch, and Channel Catfish. No Ironcolor Shiners were collected. Run time was 1524 seconds (25 minutes). This location is a NJDFW trout stocked water.

Recommendation: This survey is part of an ongoing native fish inventory that is being conducted throughout the state. Additional sampling should be conducted on the upper Rancocas Creek watershed in the future to determine whether Ironcolor Shiners are present or have been extirpated. (Boehm)

Scotland Run

Date: 08/24/2016
County: Gloucester
Township: Franklin Twp.-Gloucester Co.
Drainage: Maurice River
Project: Native Species Inventory
Location: Downstream of Malaga Lake, below Route 40 bridge/dam.

Water Chemistry / Habitat

Water Temperature (°C):	26.3
Dissolved Oxygen (mg/L):	9.28
Specific Conductance (uS/cm):	88.9
pH:	6.63
Alkalinity (mg/L):	
Sample Length (m):	150
Habitat Assessment Score:	143 Sub-optimal Low Gradient

Fish Species	Number	Length (mm)
Bullhead, Brown	29	0 - 0
Bullhead, Yellow	9	0 - 0
Eel, American	2	0 - 0
Madtom, Tadpole	3	0 - 0
Perch, Pirate	1	0 - 0
Shiner, Ironcolor	3	0 - 0
Sunfish, Banded	1	0 - 0
Sunfish, Bluegill	1	0 - 0
Sunfish, Mud	1	0 - 0
Sunfish, Redbreast	3	0 - 0

Summary: Scotland Run is a tributary of the Maurice River. A backpack electrofishing survey was conducted on 8/24/16 looking for the presence of Ironcolor Shiner, a species soon to be listed as state Endangered Species. A 150-meter stretch was sampled downstream of Malaga Lake. A total of 10 species were collected which included Ironcolor Shiner (3), American Eel (2), Yellow Bullhead (9), Brown Bullhead (29), Tadpole Madtom (3), Pirate Perch (1), Mud Sunfish (1) (soon to be designated state Special Concern), Bluegill (1), Bluespotted Sunfish (1), and Redbreast Sunfish (3). A representative sample of all *Enneacanthus* and *Notropis* species collected was preserved for identification. Total sampling time 0.63 hours. Water chemistry was recorded and pH measured 6.63. Scotland Run was previously sampled in 2000, 2002, 2004 and 2006 for the Integrated Biological Aquatic Assessment project. Only one Ironcolor Shiner was collected, with more observed, during the 2002 survey.

Recommendation: This survey is part of an ongoing native fish study that is being conducted throughout the state. Continued sampling is recommended to monitor the Ironcolor Shiner population and determine its extent of distribution within the Scotland Run watershed. Data gathered will be used to guide future management decisions and help protect the vulnerable Ironcolor Shiner. (Smith)

Stream Surveys in the Lower Atlantic Region

(Sloop Creek to Dennis Creek)

Marsh Lake Branch

Date: 07/20/2016
County: Atlantic
Township: Buena Vista Twp.
Drainage: Great Egg Harbor River
Project: Native Species Inventory
Location: downstream of Cedar Lake

Fish Species	Number	Length (mm)
Bass, Largemouth	1	60 - 60
Bullhead, Yellow	7	0 - 0
Eel, American	7	0 - 0
Pickerel, Chain	2	0 - 0
Sunfish, Bluegill	2	0 - 0

Water Chemistry / Habitat

Water Temperature (°C): 24.8
Dissolved Oxygen (mg/L): 9.12
Specific Conductance (uS/cm): 57.3
pH: 6.28
Alkalinity (mg/L):
Sample Length (m): 150
Habitat Assessment Score: 108 Marginal (Low Gradient)

Summary: Marsh Lake Branch is a tributary of the Great Egg Harbor River. This location has not been previously sampled by the NJ DFW. A backpack electrofishing survey was conducted on 7/20/16 looking for the presence of Ironcolor Shiners (soon to be listed as state Endangered). A 150-meter stretch was sampled downstream of the Cedar Lake dam. A total of five species were collected which included American Eel, Yellow Bullhead, Chain Pickerel, Bluegill, and Largemouth Bass. No Ironcolor Shiners were collected. Run time was 1681 seconds (28 minutes). Water chemistry was recorded; pH measured 6.28 and conductivity was 57.1 us/cm.

Recommendation: This survey is part of an ongoing native fish inventory that is being conducted throughout the state. Additional sampling should be conducted on the Great Egg Harbor River watershed to determine whether Ironcolor Shiner are present or have been extirpated. (Boehm)

Morses Mill Stream

Date: 07/07/2016
County: Atlantic
Township: Galloway Twp.
Drainage: Mullica River
Project: Native Species Inventory
Location: W. Moss Mill Road

Fish Species	Number	Length (mm)
Bullhead, Yellow	3	109 - 205
Eel, American	7	0 - 0

Water Chemistry / Habitat

Water Temperature (°C): 27.9
Dissolved Oxygen (mg/L): 4.45
Specific Conductance (uS/cm): 103
pH: 5.58
Alkalinity (mg/L):
Sample Length (m): 150
Habitat Assessment Score: N/A

Summary: A backpack electrofishing survey looking for native pinelands fishes was conducted on 7/7/16. This location has not been previously sampled by the NJ DFW. Morse Mill Stream flows into Nacote Creek. A 150-meter stretch was sampled downstream of the West Moss Mill Road bridge. A total of two species were collected which included American Eel and Yellow Bullhead. Water chemistry was collected; pH measured 5.58 and conductivity was 103 us/cm. Instream flow was significant for a low gradient stream, which decreased electrofishing effectiveness.

Recommendation: This survey is part of an ongoing native fish inventory that is being conducted throughout the state. Based on the lack of potential to develop a recreational fishery this location should not be stocked. (Boehm)

Skit Branch

Date: 06/22/2016
County: Burlington
Township: Shamong Twp.
Drainage: Batsto River
Project: Native Species Inventory
Location: Carranza Road bridge

Fish Species	Number	Length (mm)
Eel, American	2	0 - 0
Perch, Pirate	2	0 - 0
Pickerel, Chain	1	0 - 0

Water Chemistry / Habitat

Water Temperature (°C): 22.5
Dissolved Oxygen (mg/L): 4.52
Specific Conductance (uS/cm): 21.7
pH: 4.74
Alkalinity (mg/L):
Sample Length (m): 150
Habitat Assessment Score: 140 Sub-Optimal (Low Gradient)

Summary: Skit Branch is a headwater tributary of the Batsto River. This location has not been previously sampled by the NJDFW. A backpack electrofishing survey was conducted on 6/22/16 looking for native species. A 150-meter stretch was sampled downstream of the Carranza Road bridge within Wharton State Forest. A total of three species were collected which included American Eel, Pirate Perch, and Chain Pickerel. Water chemistry was collected; pH measured 4.74 and conductivity was 20.7 us/cm. All species collected are considered native fishes. The low pH and conductivity made electrofishing difficult. Unfavorable wading conditions were also an issue. Backpack electrofishing may not be an effective sampling method for some pinelands streams were conductivity is extremely low. The New Jersey Pinelands Commission preference for seining similar locations lends further support to move away from backpack electrofishing as a sampling method in the future.

Recommendation: This survey is part of an ongoing native fish inventory that is being conducted throughout the state. Based on the present native fish community, location within pinelands, and lack of potential to develop a recreational fishery this location should not be stocked. Additional sampling on the Batsto River watershed is recommended. (Boehm)

Wading River W/Br

Date: 06/21/2016
County: Burlington
Township: Woodland Twp.
Drainage: Mullica River
Project: Native Species Inventory
Location: Below Chatsworth Lake

Water Chemistry / Habitat

Water Temperature (°C):	26.2
Dissolved Oxygen (mg/L):	6.34
Specific Conductance (uS/cm):	52.1
pH:	4.27
Alkalinity (mg/L):	
Sample Length (m):	150
Habitat Assessment Score:	N/A

Fish Species	Number	Length (mm)
Bullhead, Yellow	21	68 - 180
Mudminnow, Eastern	1	45 - 45
Pickerel, Chain	1	40 - 40
Pickerel, Chain	2	157 - 202
Sunfish, Banded	7	44 - 70
Sunfish, Blackbanded	5	38 - 63
Sunfish, Bluespotted	2	53 - 69

Summary: A backpack electrofishing survey was conducted on 6/21/16 on the West Branch of the Wading River downstream of Chatsworth Lake in Woodland Township. A 150-meter stretch was sampled 75 meters downstream of the Chatsworth Road (Rt. 532) crossing. Run time was 1398 seconds (23.3 minutes). A total of six species were collected which included Blackbanded Sunfish (soon to be designated state Special Concern), Banded Sunfish, Bluespotted Sunfish, Chain Pickerel, Eastern Mudminnow, and Yellow Bullhead. All the previously mentioned fishes are considered native pinelands species. Yellow Bullheads were the most numerous species collected; totaling 21 and ranged in length from 68mm to 180mm (2.6 - 7.1in), with an average length of 120mm (4.7in). Two intermediate and one young-of-the-year (YOY) Chain Pickerel were collected. Water chemistry was collected and pH measured 4.27 which should account for the absence of nonnative fishes and the presence of endemic pinelands species within the sample. This site was last sampled in 1977 and 1953. Records show one seine haul was conducted and a total of 5 Chain Pickerel and 10 Banded Sunfish were collected in 1977. A rotenone survey was conducted in 1953 which included 52 Yellow Bullhead, 6 Swamp Darter, 6 Pirate Perch, 8 Chain Pickerel, 28 Banded Sunfish, and 4 Blackbanded Sunfish. It is reassuring that the fish assemblage, which is comprised of native pinelands species, has remained intact.

Recommendation: This survey is part of an ongoing native fish inventory that is being conducted throughout the state. Based on the present native fish community, location within pinelands, and lack of potential to develop a recreational fishery this location should not be stocked. (Boehm)

APPENDIX B

Field Sampling Protocols
Lake Profiles and Wadeable Streams

Lakes – Dissolved Oxygen / Temperature Profiles

Most New Jersey lakes deeper than 3 m (10 ft) thermally stratify during the summer. The epilimnion (surface waters) becomes too warm to support coldwater fishes (trout), and the metalimnion and hypolimnion (middle and bottom waters), while often cold enough for trout, often have dissolved oxygen levels too low to support trout (and other fish species). Only deep lakes (generally at least 15 m (50 ft) deep), that are not overly eutrophic, maintain sufficient levels of dissolved oxygen in some portion of the strata below the epilimnion during the summer and early fall. New Jersey lakes are characteristically shallow and therefore most are too warm to support trout through the critical summer months. They are however quite suitable for a multitude of other cool and warmwater species. The criteria used to determine a lake's trout-supporting capabilities is water temperature $\leq$ 21ºC (69.8ºF) and dissolved oxygen $\geq$ 4 mg/L (Hamilton and Barno 2006).

Dissolved oxygen and temperature profiles are performed during mid–August at the deepest point of the impoundment using a YSI oxygen meter with cable marked in one-foot increments. Measurements are generally taken at 5 to 10 foot intervals, but more frequently (1-ft increments) when marked changes are observed (typically in the metalimnion). A secchi disk (also marked in one-foot increments) is used to measure water transparency.

For QA/QC purposes oxygen meters are re-verified on a monthly basis against a Winkler Titration of deionized water samples. The re-verification procedure is also repeated after any atypical field readings to verify the meter is functioning properly. Meters are field calibrated prior to each use according to the manufacturer specifications.

Wadeable Streams - Electrofishing

As with lakes the summer months are a critical time period for trout survival due to elevated temperatures, lower dissolved oxygen concentrations, and reduced flows. Streams are sampled from June through mid September of each year using electrofishing gear. Electrofishing provides for the safe, effective sampling of resident fishes with limited associated mortality. Prior to 1980, A.C. electrofishing equipment was used to sample stream fish populations. This sampling gear consisted of two or three paddle-type electrodes powered by a gas generator and operated by a four to six person crew (two or three electrode-bearers, one or two netters, and one generator operator). With technological advances in electrofishing gear, D.C. electrofishing equipment, powered by battery or generator, has been used almost exclusively since 1980. A battery-powered D.C. backpack unit, having one paddle-type electrode and used by an operator and one or two netters, has been in used since 1980 to sample small streams. On larger streams a gas generator is used in conjunction with a conversion box (to convert A.C. to D.C.), two or three electrodes, and a five to seven person field crew.

The standard sampling distance, which has been used during and since the original stream surveys, is 182.9 meters (600 feet). This length was occasionally shortened when trout reproduction was found or when conditions such as an abundance of warmwater species or physical stream conditions indicated that trout would not be found. Occasionally a prospective stream or site would not be sampled based upon a visual, water temperature, or pH check that indicated conditions unsuitable for trout. Lack of water, excessive turbidity, temperatures in excess of 24°C, and extremely low pH values (4.0 or less) would result in sampling site rejection. Since 2001, in an effort to standardize data collection efforts across various research and field inventories a distance of 150 meters was established and is used on streams when young-of-the-year trout are encountered. Since the development of the Incidence of Occurrence was based on a sampling distance of 182 meters (600 feet) this distance is still used for classifying streams when young of the year trout are not encountered.

Sampling methods follow those outlined by Kurtenbach (Kurtenbach, 1994) and as defined in the EPA manual "Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers" (Barbour 1999) and are consistent, for comparative purposes, with data collection efforts for other Activities. All sites are sampled under typical stream flows during the months of June through September. Electrofishing gear is used to provide pulsed direct current to collect fishes. Settings on each of the stream units vary depending on the conductivity and flow conditions at each site, output usually ranges from 3 to 4 amperes. A typical backpack field crew consists of three persons, one to wear the backpack and netters. Stream widths exceeding the capabilities of one backpack unit are either sampled with two backpack teams traveling in tandem or with a two-paddle streamside generator. The type of unit selected is based upon stream width, depth, and contour of the stream environment. One up-stream pass is made through the sample stretch. The sample stretch length is 150 meters for streams having naturally reproducing trout populations and 182 meters (600 feet) for trout maintenance or non trout waters. Sampling time averages approximately 2.5 hours per site.

All fish encountered are collected without bias to species or size. Fishes with lengths greater than 20 mm are identified to the species level, counted, and examined for disease or anomalies. Anomalies such as visible lesions, tumors, skeletal anomalies, and fin damage may be an indication of impaired conditions. Any obvious injuries due to electrofishing are noted, but not considered anomalies. Total length measurements are taken on all trout and other game species. Retained specimens are preserved in 10% formalin solution in the field. Specimens are then transferred to a 70% ethanol solution for long-term preservation 2-3 weeks after initial collection.

In addition to fish collection, basic physical and chemical parameters of the stream environment are also measured and recorded on the Bureau's Stream Survey Data Sheet. All physical and chemical data are collected one-time-only, thus no long-term data is collected. Physical parameters included stream depth, stream width, substrate type, and shade index. YSI Model 85 and YSI Model 60 meters are used to determine chemical parameters such as dissolved oxygen, temperature, salinity, conductivity, and pH. For QA/QC purposes oxygen meters are re-verified on a monthly basis against a Winkler Titration of deionized water samples. The re-verification procedure is also repeated after any atypical field readings to verify the meter is functioning properly. Meters are field calibrated prior to each use according to the manufacturer

specifications. Alkalinity and specific conductance data have been collected since 2002. In-house laboratory staff determine alkalinity via titration. The reference temperature and temperature coefficient for specific conductance are 25°C and 1.91% respectively.

A stream habitat assessment is also conducted at each site, in accordance with criteria established by the EPA (EPA 1999). The habitat assessment is intended to evaluate various aspects of the aquatic habitat, surrounding terrestrial environment, and potential anthropogenic factors that may impact the aquatic biota of the stream. Habitat Assessments have been designed for two stream types - high gradient (riffle/run prevalent) and low gradient (glide/pool prevalent) streams. High Gradient Habitat Assessments are conducted on most streams north of the Fall line, in the Piedmont, Highlands, and Appalachian Valley and Ridge physiographic provinces. Natural high-gradient streams have substrates composed primarily of coarse sediment particles (i.e. gravel or larger) or frequent coarse particulate aggregations along stream reaches. Low gradient habitat assessments are conducted on streams in the Coastal Plain and in other moderate to low gradient landscapes. Natural low gradient streams have substrates of fine sediment or infrequent aggregations of more coarse (gravel of larger) sediment particles along stream reaches. Data are recorded on the Bureau's High Gradient Habitat Assessment Data Sheet and Low Gradient Habitat Assessment Data Sheet (Appendix B).

For the habitat assessment, ten specific physical parameters are assessed. For a low gradient stream the parameters are: epifaunal substrate, pool substrate, pool variability, sediment deposition, channel flow status, channel alteration, channel sinuosity, bank stability, vegetative protection, and riparian vegetative zone width. The assessment for a high gradient stream substitutes pool substrate, pool variability, and channel sinuosity with embeddedness, velocity/depth regime, and frequency of riffles or bends. The first five parameters of each assessment are assessed within the stretch of the stream electrofished. Assessments of the five remaining variables are based upon a larger stream reach that extends 150 meters upstream and downstream of the electrofished stretch. Each assessment variable is divided into four condition categories: optimal, sub-optimal, marginal, and poor, each with established criteria. Twenty points are allotted for each of the ten variables resulting in a maximum score of 200. The left and right banks of a stream, determined by facing downstream, are assessed separately for bank stability, vegetative protection, and riparian vegetative zone width. Biologists from the Bureau of Freshwater Fisheries have received habitat assessment training from EPA staff.

APPENDIX C

Habitat Assessment Data Sheets

NJ Division of Fish and Wildlife

Bureau of Freshwater Fisheries

Habitat Assessment - Datasheet

High Gradient Streams

Stream Name		Date
Location		
WMA	Drainage	
Assessment Completed By:	Weather	

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate **Available Cover**	Greater than 70 % of substrate favorable for epifaunal colonization and fish cover;mix of snags submerged logs, undercut banks cobble and other stable habitat and at stage to allow full colonization potentia. (Logs/snag are not new fall and not transient.)	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale)	20-40 % mix of stable habitat;habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
2. Embeddedness Assessed in riffle area	Gravel, cobble and boulder particles are 0-25 % surrounded by fine sediment. Cobble layering provides habitat diversity.	Gravel, cobble and boulder particles are 25-50 % surrounded by fine sediment	Gravel, cobble and boulder particles are 50-75% surrounded by fine sediment	Gravel, cobble and boulder particles are more than 75 % surrounded by fine sediment
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
3. Velocity/Depth Regime	All four velocity/depth regimes are present: (slow-deep, slow-shallow, fast deep, fast shallow) Slow is < 0.3 m/s, deep is > 0.5 m	Only 3 of the 4 regimes are present. If fast-shallow is missing, score lower than if missing other regimes.	Only 2 of the 4 regimes are present. If fast-shallow or slow shallow are missing score low.	Dominated by 1 velocity/depth regime. Usually slow deep
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5 % of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5 -30% of the bottom affected; slight deposition in pools	Moderate depostion of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected;sediment deposits at obstructions, constrictons and bends;moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development;more than 50% of the bottom changing frequently;pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present in standing pools
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

Above parameters are to be evaluated for the length of the sample reach only.

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present;usually in areas of bridge abutments;evidence of past channelization, ie. dredging (greater than past 20 yr) may be present but recent channelization is not	Extensive channelization and/or embankments or shoring structures present on both banks; and 40-80% of the stream reach is channelized and disrupted.	Banks shored with gabion or cement;over 80% of the stream reach channelized and disupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent;ratio of distance between riffles divided by width of stream < 7:1 (generally 5 to 7);In streams where riffles are continuous, placement of boulders or other large natural obstructions is important. Variety of habitat is key.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 and 15.	Occassional rifle or bend, bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 and 25	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio > 25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
8. Bank Stability Left and right bank determined by facing downstream	Banks stable:evidence of erosion or bank failure absent or minimal;little or potential for future problems. < 5% of the bank affected	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion;high erosion potential during floods.	Unstable;many eroded areas:"raw" areas frequent along straight sections and bends;obvious bank sloughing;60-100% of bank has erosional scars.
SCORE	**Left Bank** 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or non woody plants; vegetative disruption through grazing or mowing minimal or not evident;almost all plants allowed to grow naturally	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well represented;disruption evident but not affecting full growth potential to any great extent;more than 1/2 potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation;disruption obvious;patches of bare soil or closely cropped vegetation common;less than one-half of the potential plant stubble height remaining..	Less than 50 % of the streambank surfaces covered by vegetation;disruption of streambank is very high;vegetation has been removed to 5 cm or less tin average stubble height.
SCORE	**Left Bank** 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width	Width of riparian zone > 18 meters;human activities (i.e. parking lots, roadbeds, clear cuts, lawns or crops) have not impacted zone.	Width of riparian zone 12-18 meterts;human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters;human activities have impacted zone agreat deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.
SCORE	**Left Bank** 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Above parameters are to be evaluated 1 sampling length broader upstream and 1 sampling length broader downstream

TOTAL SCORE ☐

NJ Division of Fish and Wildlife

Bureau of Freshwater Fisheries

Habitat Assessment - Datasheet

Low Gradient Streams

Fish and Wildlife

Stream Name		Date
Location		
WMA	Drainage	
Assessment Completed By:	Weather	

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1.Epifaunal Substrate / Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags,submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e. logs/snags that are not new fall and not transient)	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale)	10-30% mix of stable habitat;habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
2. Pool Substrate	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud or clay; mud may be dominant; some root mats and submerged vegetation present	All mud or clay or sand bottom; little or no root mat;no submerged vegetation	Hard-pan clay or bedrock;no root mat or vegetation
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
3. Pool Variability	Even mix of large-shallow (> half the stream cross section and < 1 m deep), large-deep(> half the stream cross section and > 1 m deep), small shallow (< half the stream cross section and < 1 m depth), small-deep (< half the stream cross section and > 1m depth) pools present.	Majority of pools large deep; very few shallow pools present (< 1 m in depth)	Shallowpools (< 1 m depth) much more prevalent than deep pools (> 1 m depth)	Majority of pools small and shallow (< half the stream cross section and < 1m in depth) or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20 % of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected;sediment deposits at obstructions, constrictons and bends;moderate deposition of pools	Heavy deposits of fine material, increased bar development;more than 80% of the bottom changing frequently;pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or < 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present in standing pools
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

Above parameters are to be evaluated for the length of the sample reach only.

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6.Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present;usually in areas of bridge abutments;evidence of past channelization, ie. dredging (greater than past 20 yr) may be present but recent channelization is not	Extensive channelization and/or embankments or shoring structures present on both banks; and 40-80% of the stream reach is channelized and disrupted.	Banks shored with gabion or cement;over 80% of the stream reach channelized and disupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was a straight line. (Note-channel braiding is considered normal in coastal plains and other low lying areas. This parameter is not easily rated in these	The bends in the stream increase the stream length 1 to 2 times longer if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
8. Bank Stability Left and right bank determined by facing downstream	Banks stable:evidence of erosion or bank failure absent or minimal;little or potential for future problems. < 5% of the bank affected	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion;high erosion potential during floods.	Unstable;many eroded areas:"raw" areas frequent along straight sections and bends;obvious bank sloughing;60-100% of bank has erosional scars.
SCORE **Left Bank**	10 9	8 7 6	5 4 3	2 1 0
SCORE **Right Bank**	10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or non woody macrophytes;vegetative disruption through grazing or mowing minimal or not evident;almost all plants allowed to grow naturally	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well represented;disruption evident but not affecting full growth potential to any great extent;more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation;disruption obvious;patches of bare soil or closely cropped vegetation common;less than one-half of the potential plant stubble height remaining.	Less than 50 % of the streambank surfaces covered by vegetation;disruption of streambank is very high;vegetation has been removed to 5 cm or less in average stubble height.
SCORE **Left Bank**	10 9	8 7 6	5 4 3	2 1 0
Right Bank	10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width	Width of riparian zone > 18 meters;human activities (i.e. parking lots, roadbeds, clear cuts, lawns or crops) have not impacted zone.	Width of riparian zone 12-18 meterts;human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters;human activities have impacted zone agreat deal.	Width of riparian zone < 6 meters; little or no riparian vegetation due to human activities.
SCORE **Left Bank**	10 9	8 7 6	5 4 3	2 1 0
Right Bank	10 9	8 7 6	5 4 3	2 1 0

Above parameters are to be evaluated 1 sampling length broader upstream and 1 sampling length broader downstream

TOTAL SCORE ☐

APPENDIX D
List of New Jersey Freshwater Fishes

(Revised 2016)

Scientific Name	Common Name	Trophic Guild	Tolerance	Historical Presence	Status Pending
Petromyzontidae:					
Lampetra appendix	American Brook Lamprey	NF	IS	N	SC
Petromyzon marinus	Sea Lamprey	PF	MT	N	S
Acipenseridae:					
Acipenser brevirostrum	Shortnose Sturgeon	BI	IS	N	E
Acipenser oxyrhynchus	Atlantic Sturgeon	BI	IS	N	E (FED)
Lepisosteidae:					
Lepisosteus osseus	Longnose Gar	P	M	EX	NA
Amiidae:					
Amia calva	Bowfin	P	TS	NN	NA
Anguillidae:					
Anguilla rostrata	American Eel	P	TS	N	S
Monopterus albus	Asian Swamp Eel	G	TS	E	I
Clupeidae:					
Alosa aestivalis	Blueback Herring	PL	MT	N	NE
Alosa mediocris	Hickory Shad	I/P	US	N	NE
Alosa pseudoharengus	Alewife	PL	MT	N	NE
Alosa sapidissima	American Shad	PL	MT	N	NE
Drosoma cepedianum	Gizzard Shad	G	TS	N	NE
Salmonidae:					
Oncorhynchus mykiss	Rainbow Trout	I/P	IS	NN	NA
Salmo salar	Atlantic (Landlocked)	P	IS	NN	NA
Salmo trutta	Brown Trout	I/P	IS	E	NA
Salvelinus fontinalis	Brook Trout	I/P	IS	N	SC
Salvelinus namaycush	Lake Trout	P	IS	NN	NA
Osmeridae:					
Osmerus mordax	Rainbow Smelt	I	IS	N	NE
Umbridae:					
Umbra pygmaea	Eastern Mudminnow	I	TS	N	S
Channidae					
Channa Argus	Northern Snakehead	P	TS	E	I

Scientific Name	Common Name	Trophic Guild	Tolerance	Historical Presence	Status Pending
Esocidae:					
Esox americanus	Redfin Pickerel	P	MT	N	S
Esox lucius	Northern Pike	P	IS	NN	NA
Esox masquinongy	Muskellunge	P	IS	NN	NA
Esox niger	Chain Pickerel	P	MT	N	S
Cyprinidae:					
Carassius auratus	Goldfish	G	TS	E	NA
Carpiodes cyprinus	Quillback	BI	TS	N	S
Cyprinus carpio	Common Carp	G	TS	E	NA
Exoglossum maxillingua	Cutlip Minnow	BI	IS	N	S
Hybognathus regius	Eastern Silvery Minnow	H	MT	N	S
Notemigonus crysoleucas	Golden Shiner	G	TS	N	S
Notropis amoenus	Comely Shiner	I	TS	N	SC
Cyprinella analostana	Satinfin Shiner	I	TS	N	S
Cyprinella spiloptera	Spotfin Shiner	I	TS	N	S
Margariscus margarita	Pearl Dace	G	MT	NN	NA
Notropis bifrenatus	Bridle Shiner	I	IS	N	E
Notropis chalybaeus	Ironcolor Shiner	I	IS	N	E
Luxilis cornutus	Common Shiner	I	MT	N	S
Notropis husdonius	Spottail Shiner	I	MT	N	S
Notropis procne	Swallowtail Shiner	I	MT	N	S
Pimephales notatus	Bluntnose Minnow	G	TS	NN	NA
Pimephales promelas	Fathead Minnow	G	TS	NN	NA
Rhinichthys atratulus	Blacknose Dace	BI	TS	N	S
Rhinichthys cataractae	Longnose Dace	BI	MT	N	S
Semotilus atromaculatus	Creek Chub	I	TS	N	S
Semotilus corporalis	Fallfish	I	MT	N	S
Ctenopharyngodon idella	Grass Carp	H	MT	E	I
Catostomidae:					
Catostomus commersoni	White Sucker	BI	TS	N	S
Erimyzon oblongus	Creek Chubsucker	BI	MT	N	S
Hypentelium nigricans	Northern Hog Sucker	BI	IS	N	SC
Ictaluridae:					
Ameiurus catus	White Catfish	I/P	MT	N	S
Ameiurus melas	Black Bullhead	BI	MT	NN	NA
Ameiurus natalis	Yellow Bullhead	BI	MT	N	S
Ameiurus nebulosus	Brown Bullhead	BI	TS	N	S
Ictalurus punctatus	Channel Catfish	I/P	MT	NN	NA
Noturus gyrinus	Tadpole Madtom	BI	MT	N	S
Noturus insignis	Margined Madtom	BI	IS	N	S
Pylodictis olivaris	Flathead Catfish	P	TS	NN	I
Aphredoderidae:					
Aphredoderus sayanus	Pirate Perch	I	MT	N	S

Scientific Name	Common Name	Trophic Guild	Tolerance	Historical Presence	Status Pending
Cyprinodontidae:					
Fundulus diaphanus	Banded Killifish	I	TS	N	S
Fundulus heteroclitus	Mummichog	I	TS	N	S
Poeciliidae:					
Gambusia affinis	Mosquitofish	I	TS	NN	NA
Gambusia holbrooki	Eastern Mosquitofish	I	TS	N	U
Gasterosteidae:					
Apletes quadracus	Fourspine Stickleback	I	MT	N	NE
Gasterosteus aculeatus	Threespoine Stickleback	I	MT	N	NE
Pungitius pungitius	Ninespine Stickleback	I	MT	N	NE
Moronidae:					
Morone americana	White Perch	I/P	MT	N	S
Morone saxatilis	Striped Bass	P	MT	N	U
Centrarchidae:					
Acantharchus pomotis	Mud Sunfish	I	MT	N	SC
Ambloplites rupestris	Rock Bass	I/P	MT	NN	NA
Enneacanthus chaetodon	Blackbanded Sunfish	I	IS	N	SC
Enneacanthus gloriosus	Bluespotted Sunfish	I	IS	N	S
Enneacanthus obesus	Banded Sunfish	I	IS	N	S
Lepomis auritus	Redbreast Sunfish	I	MT	N	S
Lepomis cyanellus	Green Sunfish	I/P	TS	NN	I
Lepomis gibbosus	Pumpkinseed	I	MT	N	S
Lepomis gulosus	Warmouth	I/P	TS	NN	NA
Lepomis macrochirus	Bluegill	I	TS	NN	NA
Micropterus dolomieu	Smallmouth Bass	I/P	MT	NN	NA
Micropterus salmoides	Largemouth Bass	P	MT	NN	NA
Pomoxis annularis	White Crappie	I/P	TS	NN	NA
Pomoxis nigromaculatus	Black Crappie	I/P	MT	NN	NA
Percidae:					
Etheostoma fusiforme	Swamp Darter	BI	IS	N	S
Etheostoma olmstedi	Tessellated Darter	BI	MT	N	S
Perca flavescens	Yellow Perch	I/P	MT	N	S
Percina peltata	Shield Darter	BI	IS	N	SC
Sander vitreus	Walleye	P	IS	NN	NA
Cottidae:					
Cottus cognatus	Slimy Sculpin	BI	IS	N	T
Cobitidae:					
Misgurnus anguillicaudatus	Oriental Weatherfish	G	TS	E	I
Soleidae:					
Trinectes maculatus	Hogchoker	G	IS	N	NE

Key:

Abbrev.	Term	Definition
Trophic Guild		
BI	Benthic	Specialist feeder that primarily consumes insects taken from the bottom substrate.
H	Herbivore	A species that consumes plant and algae materials.
I	Insectivore	A species that consumes primarily insects.
NF	Nonparasitic	A species that feeds by filtering algae and other microorganisms found in detritus.
G	Generalist	A species that consumes a wide variety of food types from a wide variety of habitats.
P	Piscivore	A species that primarily consumes fish.
PF	Parasitic	A species that feeds by attaching to and rasping a hole in the side of a large fish.
PL	Planktivore	A species that consumes small organisms (algae and animals) that float in the water column.
Historical Presence		
E	Exotic	A non-native species introduced from a foreign country.
EX	Extirpated	A native species no longer present, either as a result of natural causes or because of eradication by humans.
N	Native	In the U.S., a species historically occurring in a geographic range previous to the arrival of the first European settlers.
NN	Non-Native	A species found outside of their historical range. The occurrence of a non-native species may be a result of intentional stocking (sportfish or biological control), unintentional stocking (escape), or a response to habitat/climatic changes.
Tolerance		
IS	Intolerant Species	A species most sensitive to environmental degradation. These species have historical distributions significantly greater than presently occurring populations.
MT	Moderately Tolerant Sp.	A species moderately sensitive to environmental degradation. These species can withstand slight environmental conditions, but can not tolerate significant impact.
TS	Tolerant Species	A species least sensitive to environmental degradation. These species can withstand stressful environmental conditions and often become a dominant member in the fish assemblage.
Status (Formal status review completed and approved by ENSAC in 2016, but not yet implemented into formal regulation.)		
E	Endangered	A species whose prospects for survival within the state are in immediate danger due to one or several factors and likely requires immediate action to avoid extinction within NJ.
T	Threatened	A species that may become Endangered if conditions surrounding it begin to or continue to deteriorate, thus is one that is already vulnerable.
SC	Special Concern	A species that warrants special attention because of inherent vulnerability to environmental deterioration or habitat modification that would result in their becoming Threatened if conditions surrounding the species begin or continue to deteriorate.
S	Secure/ Stable	A species that appear to be secure in NJ and not in any immediate foreseeable danger of becoming Endangered, Threatened, or Special Concern.
NA	Not Applicable	This species does not occur in NJ with regularity or predictability. (ie. Extirpated or Non-native).
NE	Not Evaluated	A species not evaluated as part of the recent species evaluation, due to significant life-history component in brackish/marine habitats.
I	Invasive	A non-native species that has the potential to cause ecologic or economic harm, identified as a Potentially Dangerous Fish Species in N.J.A.C. 7:25-6.2. (2010)
Miscellaneous		
U	Undetermined / Unknown	A species in which not enough information exists on which to base a judgement.

Stream Temperature Monitoring Report (2016)

Investigations and Management of New Jersey's Freshwater Fisheries Resources (APPENDIX E)

By
Scott Collenburg, Assistant Fisheries Biologist

New Jersey Department of Environmental Protection

Division of Fish and Wildlife

Bureau of Freshwater Fisheries

Sportfish Restoration Grant F-48-R

This grant was paid for by fishing license sales and matching Dingell-Johnson/Wallop-Breaux funds available through the Federal Sportfish Restoration Act.

Introduction

Studies have shown that stream temperature is the main determinant of fish species distribution and slight fluctuations in water temperature can severely influence fish species absence\occurrence. Temperature is especially important to cold-water species of fish such as trout, as elevated stream temperatures can be lethal, and chronic exposure to sub-lethal temperatures can affect their growth, reproduction, and tolerance to pollutants or disease. Continuous temperature monitoring provides Bureau of Freshwater Fisheries staff with reliable data that is used to guide management decisions related to fish stocking, fish and habitat restoration, and fishing regulations.

In 2013 the Bureau established an ambient stream temperature monitoring network on streams having trout fisheries that are recreationally important or of conservation interest. The temperature data collected will be used to assess current temperature conditions, evaluate long term trends, determine if ambient water quality is consistent with NJDEP's Surface Water Quality Standards, and aid in the management of coldwater (trout) fisheries inhabiting these streams. Integral to the establishment of this monitoring network was the development of a quality assurance plan that complied with NJDEP's regulations concerning the certification of laboratories and environmental measurements under N.J.A.C. 7:18-1 et seq. A Quality Assurance Project Plan (QAPP) for Ambient Stream Water and Air Temperature Monitoring was prepared and subsequently approved by NJDEP's Office of Quality Assurance in July 2013. This certification has been renewed annually.

In 2016 water temperature was monitored at 39 sites (Figure 1 and Table 1). Twenty-five of the sites were located on 17 recreationally important, major trout-stocked streams. Seventeen sites were located on stream sections classified as FW2-*Trout Production* (TP), nineteen were on stream sections classified as FW2-*Trout Maintenance* (TM), and three were on stream sections classified FW2-*Non-Trout* (NT). Five sites were located on small streams having populations of wild Brook Trout, as part of the Eastern Brook Trout Joint Venture initiative to assess climate change (using paired water/air thermographs). A total of 44 thermographs (Onset Hobo Pro v2) were deployed to record temperature at 30 minute intervals year round. The thermographs were calibrated and regularly checked to maintain the validity of the temperature data. The following results are only inclusive of the twenty-five stream temperature monitoring sites located on 17 recreationally important trout-stocked streams (Figure 1). The other fourteen sites will be reported on separately, as they are a part of a three-year study designed to collect three years of year-round stream temperature monitoring. This effort includes electrofishing surveys at the same locations. An analysis will be conducted to assess stream temperature influence on New Jersey's wild trout populations. Information will be used to develop metrics based on Growing Degree Days (GDD), to understand sac fry emergence times, identify critical temperatures during the spring/summer/fall/winter, and to assess aerobic scope curves, all of which can guide in the management of *Trout Production* streams. Results will be submitted to NJDEP's Bureau of Water Monitoring and Standards, Bureau of Water Monitoring and Standards, Environmental Analysis Restoration and Standards to help determine if particular stream segments qualify as part of 303(d) list.

Figure 1. Locations of the 25 continuous stream temperature logger sites maintained by NJDFW in 2016 on recreationally important trout-stocked streams.

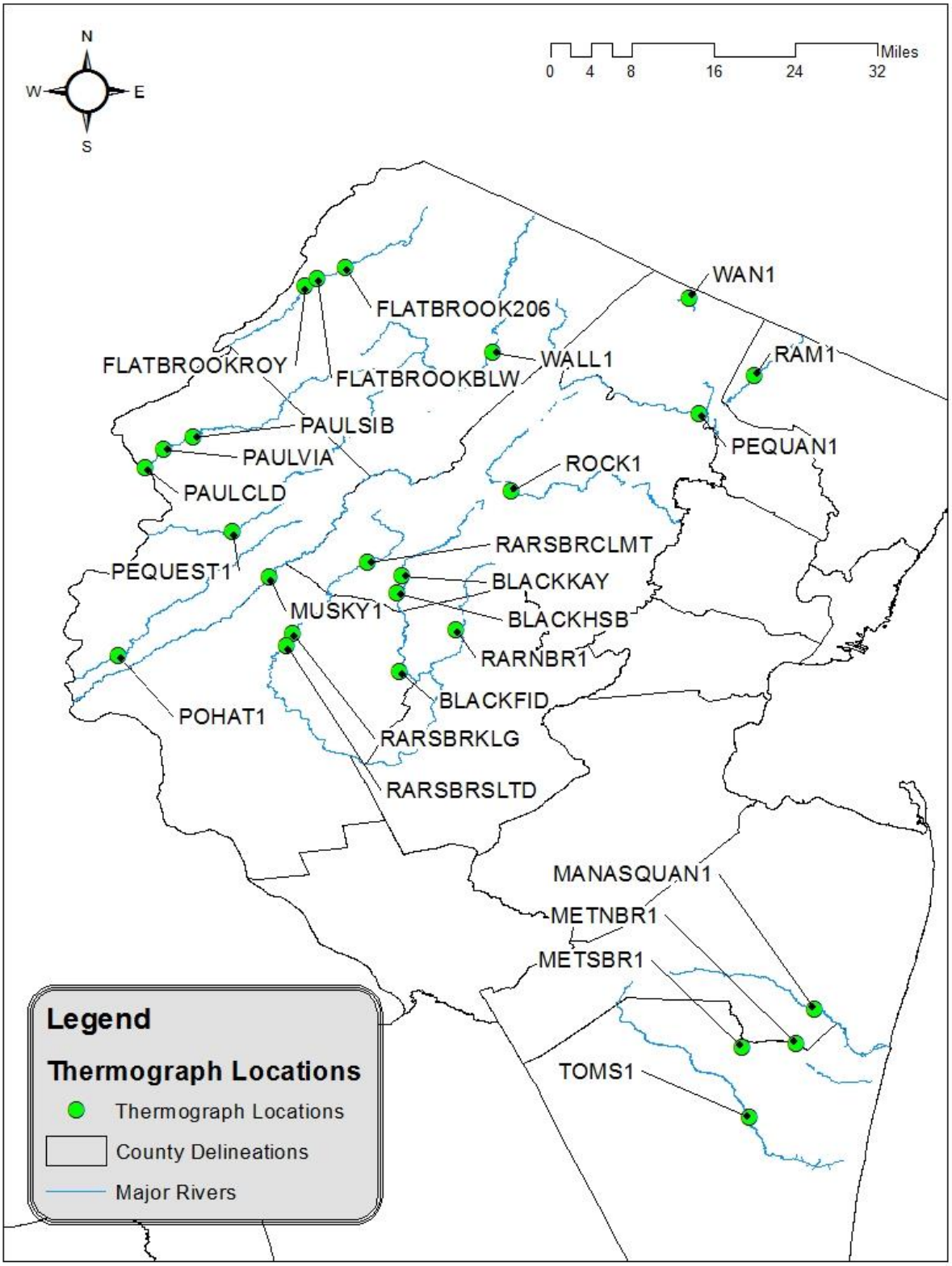


Table 1: 2016 NJDFW stream temperature monitoring network on recreationally important trout-stocked streams.

Stream	Site ID	Surface Water Classification	Monitoring Type
Black River	BLACKHSB	Trout Maintenance	water
Black River *	BLACKKAY	Trout Maintenance	water
Black River	BLACKFID	Non-Trout	water
Big Flat Brook	FLATBROOK206	Trout Production	water
Big Flat Brook	FLATBROOKBLW	Trout Production	water
Flat Brook	FLATBROOKROY	Trout Maintenance	water
Manasquan River	MANASQUAN1	Trout Maintenance	water
Metedeconk River, N/Br	METNBR1	Trout Maintenance	water
Metedeconk River, S/Br.	METSBR1	Non-Trout	water
Musconetcong River **	MUSKY1	Trout Maintenance	water
Paulinskill	PAULCLD	Trout Maintenance	water
Paulinskill	PAULVIA	Trout Maintenance	water
Paulinskill	PAULSIB	Trout Maintenance	water
Pequannock River	PEQUAN1	Trout Maintenance	water
Pequest River	PEQUEST1	Trout Maintenance	water
Pohatcong Creek	POHAT1	Trout Maintenance	water
Ramapo River	RAM1	Non-Trout	water
Raritan River, N/Br.	RARNBR1	Trout Maintenance	water
Raritan River, S/Br.	RARSBRKLG	Trout Maintenance	water
Raritan River, S/Br.	RARSBRCLMT	Trout Production	water
Raritan River, S/Br.	RARSBRSLTD	Trout Maintenance	water
Rockaway River	ROCK1	Trout Maintenance	water
Toms River	TOMS1	Trout Maintenance	water
Wallkill River	WALL1	Trout Maintenance	water
Wanaque River *	WAN1	Trout Maintenance	water

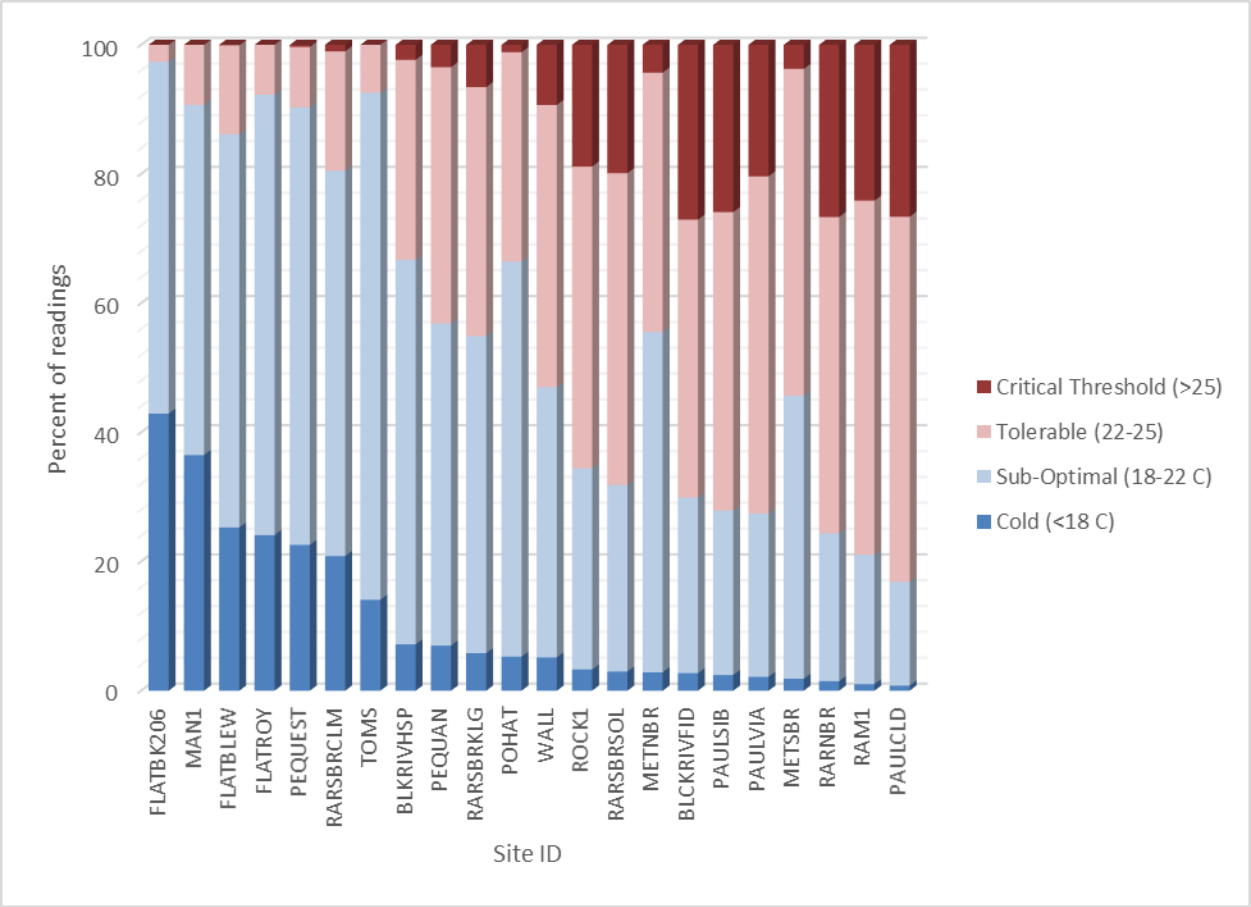
* Thermograph lost. Location will be monitored in 2017.
** No data collected in 2016.

Thermal Classification

Identifying the thermal classification of a stream is a useful tool in giving a basic understanding of the thermal regime of a stream. Figure 2 shows the proportion of all summer (June 1 to August 31) stream temperature records above 25°C (Critical Threshold), between 22-25°C (Tolerable), between 18-22°C (Sub-Optimal), and below 18°C (Cold). The categories are based on trout preferences and limitations to certain stream temperatures. The "Cold" category is based on research that shows optimum temperature for overall welfare, activity, and feeding is below 18°C (Mullen 1958; Baldwin 1951), 18-22°C is a range that is sub-optimal and temperature begins to effect feeding and growth (McAfee 1966), 22-25°C is a range that is tolerable (maybe only for short durations) (Embody 1921), and temperatures reaching over 25°C can kill trout exposed to it after only a couple hours (Brasch et. Al 1958).

Sites on the Flat Brook/Big Flat Brook, the Claremont section of the South Branch of the Raritan River, and Pequest River had the highest percentages of cold temperatures (below 18°C) throughout summer while the sites on the Black River downstream of Fiddler's Elbow Golf Course, North Branch of the Raritan River, three sites on the Paulins Kill, Ramapo River, South Branch of the Raritan River below Lake Solitude, and Rockaway River all had the highest percentage of readings exceeding 25°C (all greater than 18%).

Figure 2: Proportion of 2016 summer stream temperatures that fit into each thermal regime category: cold, cool, and sub-optimal, and critical threshold.



Trout Production Streams

New Jersey's Surface Water Quality Standards New Jersey Administrative Code (N.J.A.C.) 7:9B states that for waters classified as FW-TP "temperatures shall not exceed a daily maximum of 22 degrees Celsius or rolling seven-day average of the daily maximum of 19 degrees Celsius, unless due to natural conditions." In Figure 3, the seven-day rolling average of the daily maximum temperature for three sites classified as FW-TP (sites with paired thermographs excluded) was compared against the FW-TP criteria for each week of summer. The results indicate that weekly average maximum temperatures at the TP sites exceeded the FW-TP standard for a seven-day rolling average of stream temperature over 94% of the summer time period at each site (Table 2).

Figure 3: Weekly average of the daily average maximum temperature for each FW2-TP site during summer weeks encompassing June 1 to August 31, 2016. The black-dotted horizontal line indicates the "FW-TP" criteria that *Trout Production* streams should not exceed when observing their seven-day rolling average of daily average max temperature.

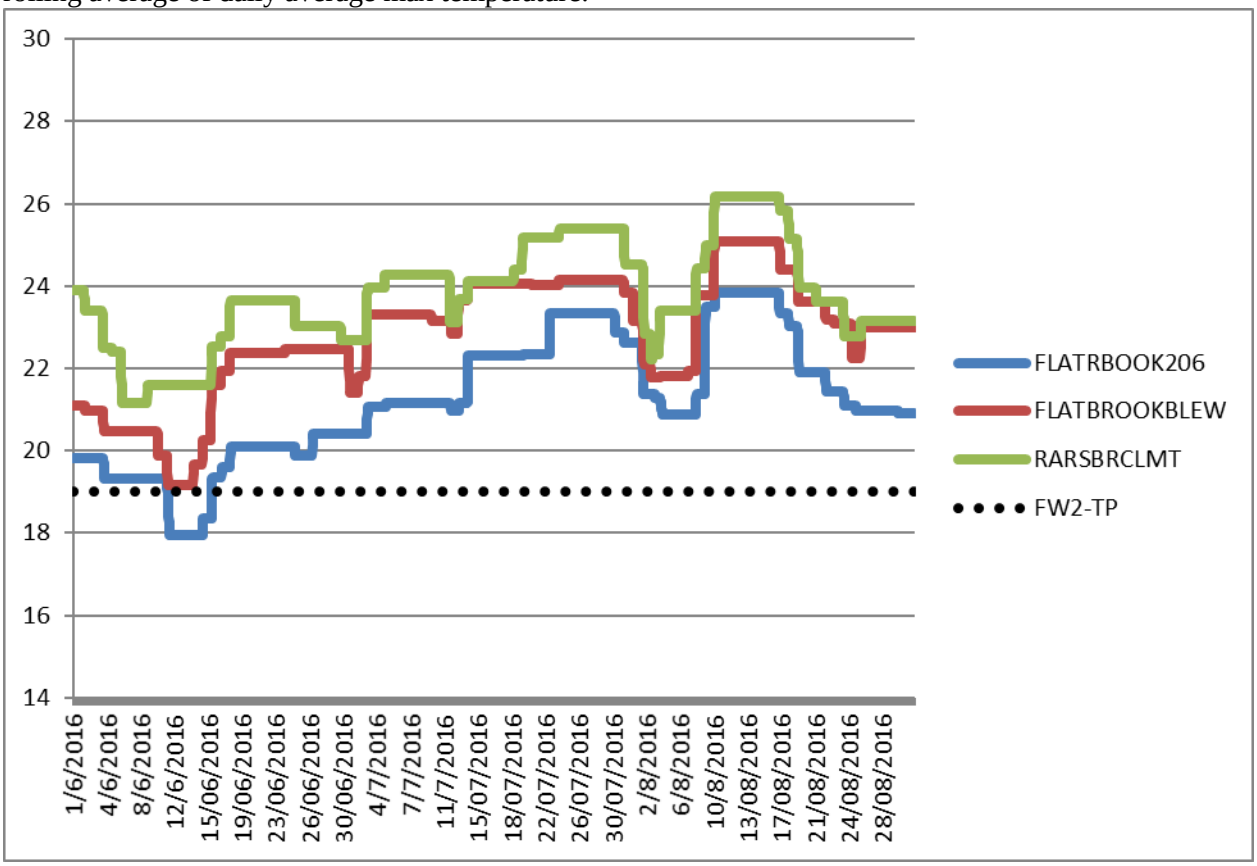


Table 2: Weekly average of the daily average maximum temperature for each FW2-TP site during summer weeks encompassing June 1 to August 31. Temperatures in red exceed the Surface Water Quality Standard criteria (FW2-TP) for a seven-day rolling average of stream temperature.

	Site Name		
	RARSBRCLMT	**FLATBROOK206**	**FLATBROOKBLEW**
Percent of 7-day rolling average over 19	94.75	100.00	100.00

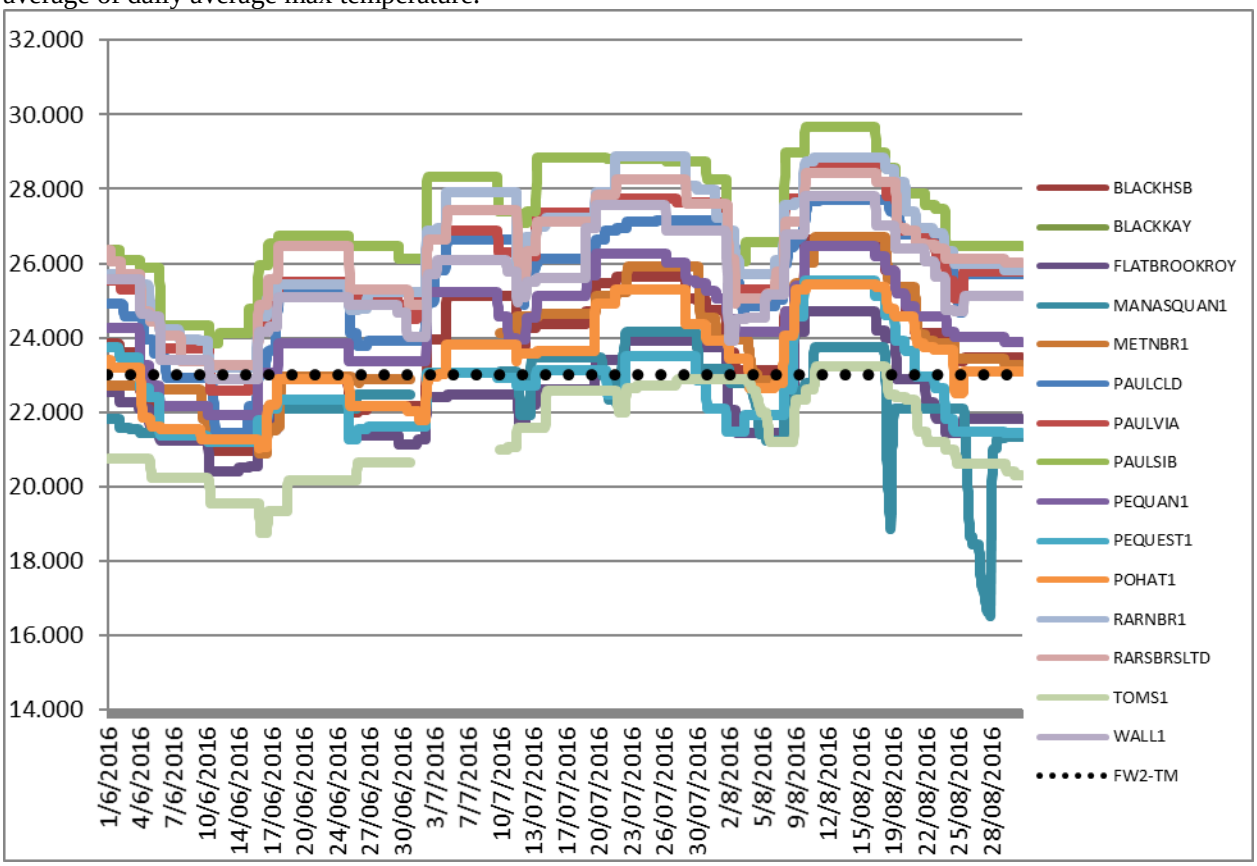
Trout Maintenance Streams

New Jersey's Surface Water Quality, Standards New Jersey Administrative Code (N.J.A.C.) 7:9B states that for waters classified as FW-TM "temperatures shall not exceed a daily maximum of 25 degrees Celsius or rolling seven-day average of the daily maximum of 23 degrees Celsius, unless due to natural conditions." In Figure 4, the seven-day rolling average of the daily maximum temperature for each site classified as FW-TM was compared against the FW-TM standard each week of summer. The results indicate that weekly average maximum temperatures at the TM sites are, more often than not, exceeding the FW-TM standard for a seven-day rolling average of stream temperature (Table 3). Some sites did not exceed the standard as often including, a site on the Flat Brook, Toms River, and Manasquan River (all less than 33% of the time), but some sites may be cause for concern especially with a current classification that are, by definition, able to support trout year round. A site on the Black River, three sites on the Paulins Kill, a site on the Pequannock River, a site on the Wallkill River, and a site on the North Branch of the Raritan River all exceeded the TM temperature standard over 88% of the summer period.

Table 3: Percent of time that the seven-day rolling average of the daily maximum temperature for each site classified as FW-TM exceeded the Surface Water Quality Standard criteria of 23°C encompassing the time period of June 1 to August 31, 2016.

	Site Name							
	BLACKHSB	**FLAT-BROOKROY**	**MANA-SQUAN1**	**METNBR1**	**PAULCLD**	**PAULVIA**	**PAULSIB**	**PEQUAN1**
Percent of readings exceeding the FW-TM threshold	68.7	25.7	32.6	60.2	89.9	94.8	100.0	88.1
	PEQUEST1	**POHAT1**	**RARNBR1**	**RARSBR-SLTD**	**ROCK1**	**TOMS1**	**WALL1**	
Percent of readings exceeding the FW-TM threshold	40.0	62.8	100.0	100.0	100.0	8.7	94.7	

Figure 4: Seven-day rolling average of the daily average maximum temperature for each FW2-TM site during summer weeks encompassing June 1 to August 31, 2016. The black-dotted horizontal line indicates the "FW-TM" criteria that *Trout Maintenance* streams should not exceed when observing their seven-day rolling average of daily average max temperature.



Non-Trout Streams

New Jersey's Surface Water Quality, Standards New Jersey Administrative Code (N.J.A.C.) 7:9B states that for waters classified as FW-NT "temperatures shall not exceed a daily maximum of 31 degrees Celsius or rolling seven-day average of the daily maximum of 28 degrees Celsius, unless due to natural conditions." In Figure 5, the seven-day rolling average of the daily maximum temperature for each site classified as FW-NT was compared against the FW-NT standard each week of summer. The results showed that temperatures at the NT site on Black River exceeded the FW-NT standard 36% of the time and the Ramapo site exceeded the same standard 27% of the time (Table 4).

Figure 5: Weekly average of the daily average maximum temperature for each FW2-NT site during summer weeks encompassing June 1 to August 31, 2016. The black-dotted horizontal line indicates the "FW-NT" criteria that *Non-Trout* streams should not exceed when observing their seven-day rolling average of daily average max temperature.

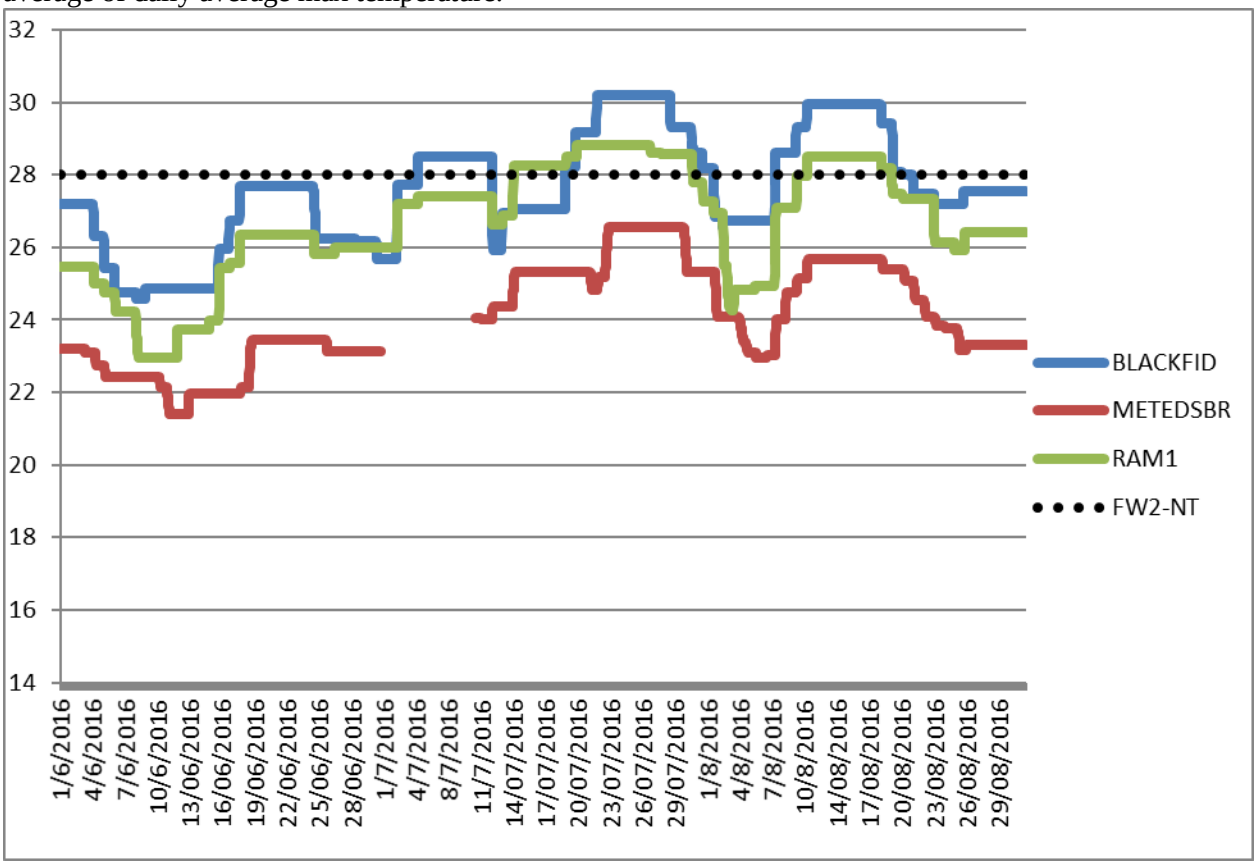


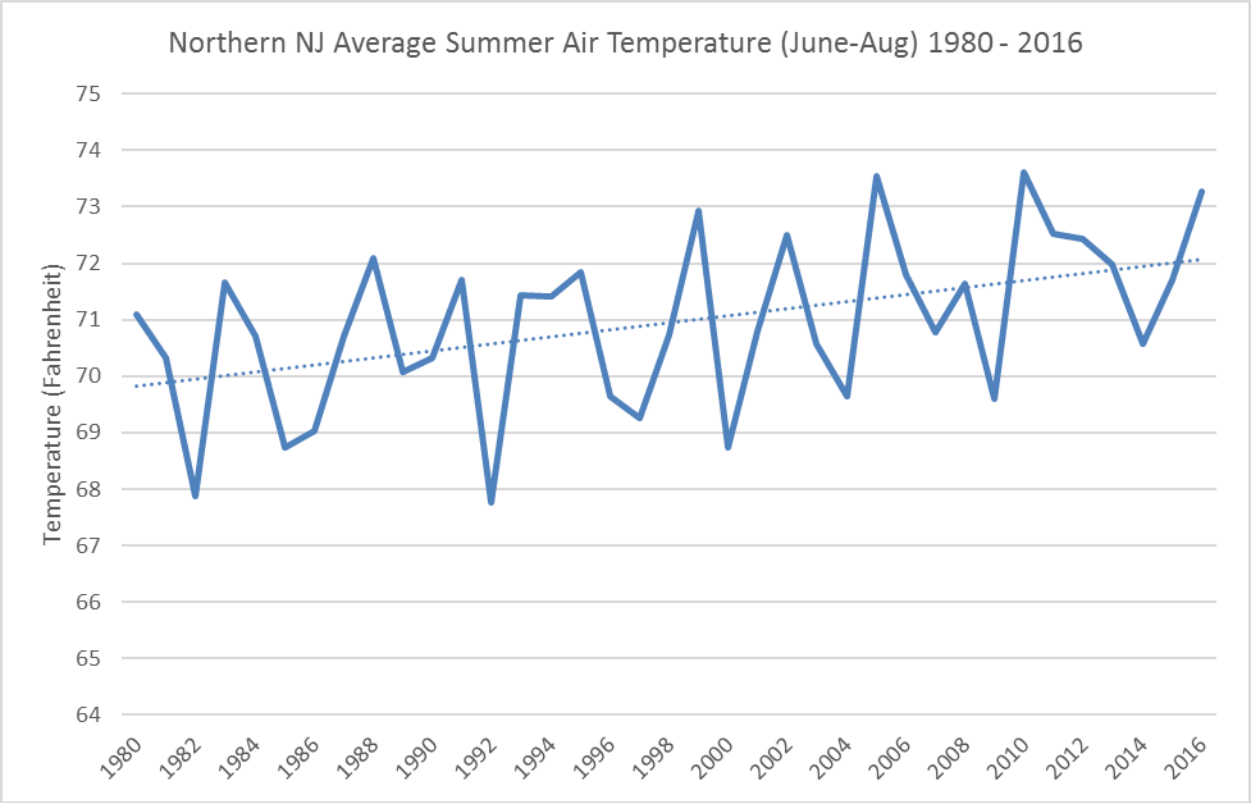
Table 4: Weekly average of the daily average maximum temperature for each FW2-NT site during summer weeks encompassing June 1 to August 31. Temperatures in red exceed the Surface Water Quality Standard criteria (FW2-NT) for a seven-day rolling average of stream temperature.

	Site Name		
	BLACKFID	METEDSBR	RAM1
Percent of 7-day rolling average over 28	36.3	0.0	27.3

Summary

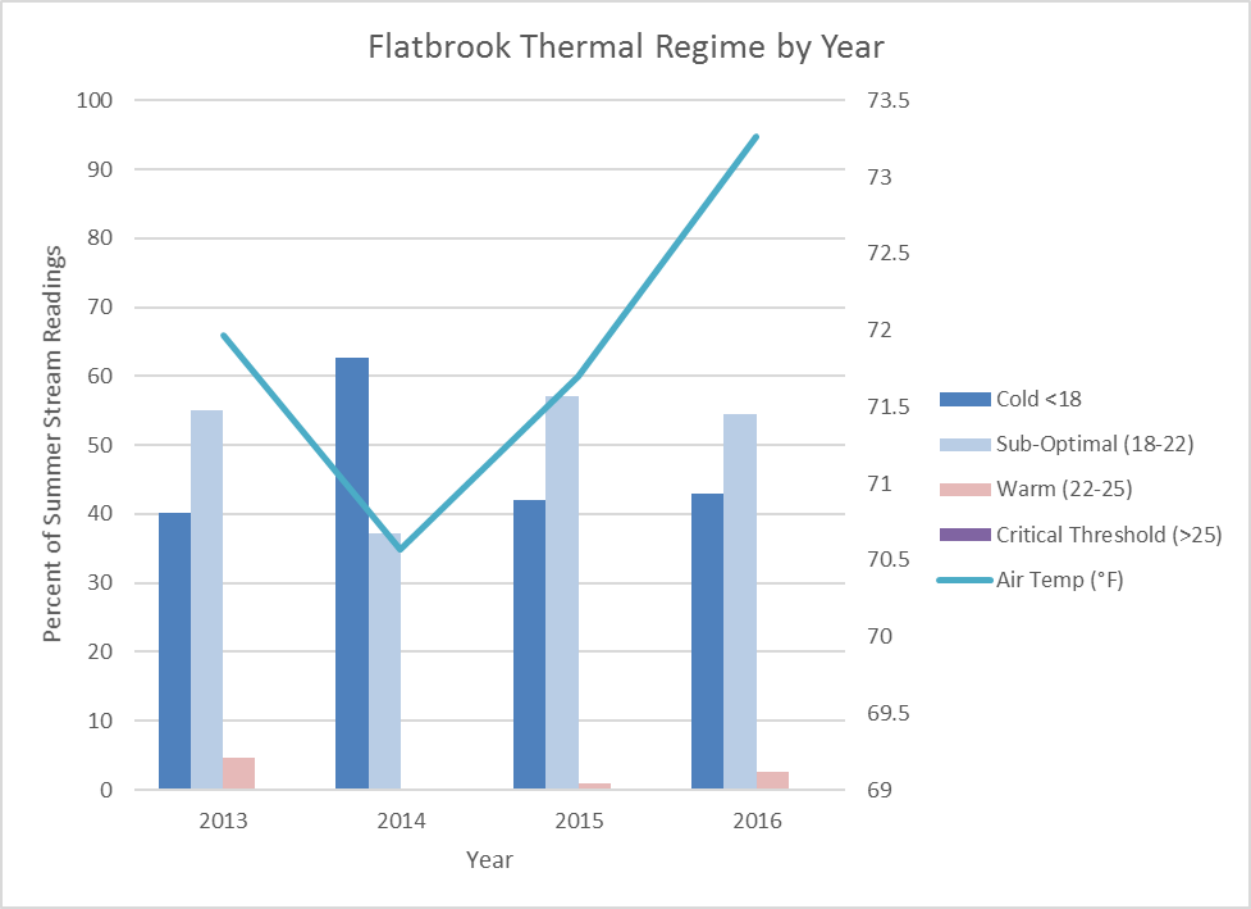
The stream temperature data collected in 2016 indicates that many of the streams stocked with trout experienced summer water temperatures that were stressful for trout. This is not surprising of recent trends that are indicating unusual summertime warmth in New Jersey statewide, which may be attributed to predicted climate change patterns. Broccoli et al. (2013) found that six of the ten warmest summers on record have occurred since 2005 (including data up to 2012). Looking specifically at Northern New Jersey (location of most of the state's trout stream sections), 2016 has been another warm summer and consistent with the long-term upward trend that is expected to continue in the decades to come as greenhouse gas concentrations continue to increase (Figure 6).

Figure 6. Average summer (June 1 - August 31) air temperature in Northern New Jersey from 1980 to 2016.



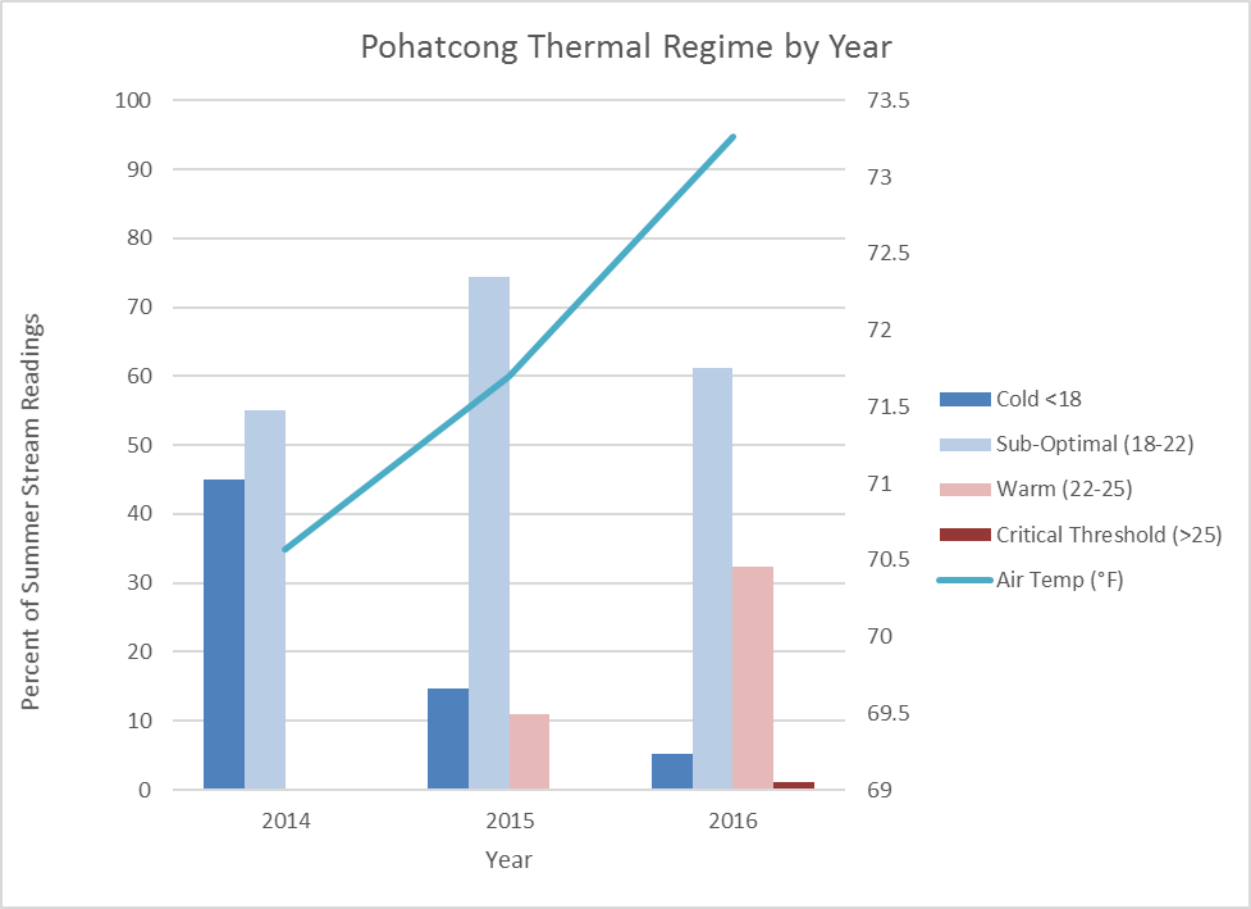
Summer temperatures are critical for trout survival and a continuing warming trend can threaten the future of the NJDFW's trout stocking program if stream sections continue to warm and continually shorten the length of time the trout can survive in any section. As 2016 has been the warmest summer since the temperature monitoring program has initiated, the sensitivity of these stream sections to climate influencing factors such as air temperature was made more apparent. The Big Flatbrook site located on Route 206 in Sussex County consistently has the coldest stream temperatures compared to other sites across the state. This year was no different and it maintained relatively cold stream temperatures despite the warm summer (Figure 7).

Figure 7. Flat Brook's thermal regime from 2013-2016 compared to average summer air temperature data for northern New Jersey.



A stream's structure helps exert internal control over stream temperature through its channel, the riparian zone, and the alluvial aquifer. The great thermal buffering capability of the Big Flat Brook is obvious when it did not exhibit extreme shifts in its thermal regime despite the warm summer of 2016 (see figure above). However, not all streams have the buffering capabilities that the Flat Brook seems to inherently hold. For example, the Pohatcong Creek, in cooler years (2014), has much more "cold" temperatures than in warmer years (2016), where it has shown how sensitive it can be when a warm summer occurs with much more readings in the "warm" and "critical threshold" categories (Figure 8).

Figure 8. Pohatcong Creek's thermal regime from 2014-2016 compared to average summer air temperature data for northern New Jersey.



This is a large concern as already marginal habitat becomes even less hospitable for the game fish that are stocked here for recreational anglers to enjoy. One of the concerns of rising stream temperatures for the Division's trout stocking program is that the trout will simply not reside close to their stocking points. This is not so much of an issue around the opening day of trout season, which occurs during the first or second Saturday in April, but when temperatures start to warm up as the summer begins or even later into the trout stocking season, sections of streams that typically had the ability to hold trout, will no longer be hospitable. Currently, anglers report catching stocked trout on the Pequannock River, South Branch of the Raritan River, and the Pohatcong Creek late into the summer and holdover trout are common. As temperatures continue to climb, there will be fewer habitats to occupy, competition for limited space may increase, and stocked trout may find refuge elsewhere.

The development of the stream temperature monitoring program in New Jersey was intended to document stream temperatures in marginal trout habitat and use it as a tool to study the short and long term fluctuations in these popular waterbodies. The monitoring network has continued to expand every year. After 2-3 years of monitoring at a stream site, most of the useful information on that site and understanding the thermal patterns has already been done. It is useful to have permanent sites for long term monitoring (as these are rare), but efforts may shift in the near future to develop predictive temperature models, enabling the Division of Fish and Wildlife to be better prepared to manage our state's lotic waters into the future.

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Opening Day Trout Angler Survey Data (2016)

Investigations and Management of New Jersey's Freshwater Fisheries Resources (APPENDIX F)

By
Ross Shramko, Senior Fisheries Biologist

April, 2016

New Jersey Department of Environmental Protection

Division of Fish and Wildlife

Bureau of Freshwater Fisheries

Sportfish Restoration Grant F-48-R

This grant was paid for by fishing license sales and matching Dingell-Johnson/Wallop-Breaux funds available through the Federal Sportfish Restoration Act.

County	Waterbody	Lake/ River Conditions	# of Cormorants Present	Time	# of Shoreline anglers		# of Boat anglers		Total # of anglers	Brook Trout caught				Brown Trout caught				Rainbow Trout caught				Total trout caught	Angler comments / Interviewer observations
										<14 in		>14 in		<14 in		>14 in		<14 in		>14 in			
					adult	child	adult	child		kept	rel	kept	rel	kept	rel	kept	rel	kept	rel	kept	rel		
Atlantic	Heritage Park Pond		8	8:00	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	No cormorants prior to stocking. 6 Catfish caught. 3 inches of snow in afternoon. -- Mitch Smith, Volunteer
				9:00	0	0	0	0	0														
				10:00	7	0	0	0	7														
				11:00	0	0	0	0	0														
				12:00	0	0	0	0	0														
Burlington	Crystal Lake	Choppy/ Clear	0	8:00	X	X	X	X	X	0	0	0	0	0	0	0	0	5	0	0	0	5	
				9:00	69	17	18	2	106														
				10:00	X	X	X	X	X														
				11:00	X	X	X	X	X														
				12:00	X	X	X	X	X														
Cape May	Tuckahoe Lake	Calm, clear	0	8:00	12	3	6	3	24	0	0	0	0	0	0	0	0	0	0	0	0	0	
				9:00	7	4	6	2	19														
				10:00	0	0	0	0	0														
				11:00	0	0	0	0	0														
				12:00	0	0	0	0	0														
Cumberland	South Vineland Park Pond	Cloudy/Muddy	0	8:00	7	1	8	0	16	0	0	0	0	0	0	0	0	6	1	6	0	13	For such a cloudy day, I thought the turnout was good. Everyone I spoke to including the conservation officer seemed in good spirits and excited about today. Most stayed clear of me at first until word spread that I was just here to help and collect data. By the end of shift I actually had anglers tracking me down to take photos of their
				9:00	10	0	8	0	18														
				10:00	8	0	10	0	18														
				11:00	6	0	2	0	8														
				12:00	2	0	0	0	2														
Gloucester	Grenloch Lake	Clear/ Choppy	0	8:00	X	X	X	X	X	0	0	0	0	0	0	0	0	5	2	0	0	7	Fishing was slow. Anglers relied on spinners and lures. Despite their best efforts to catch fish, it seems that the local fishermen were not satisfied. Some fishermen caught none, while others caught only a few. -- Ronald S Mares, WCC Volunteer
				9:00	X	X	X	X	X														
				10:00	X	X	X	X	X														
				11:00	1	1	9	0	11														
				12:00	10	2	9	0	21														
Hunterdon	Amwell Lake	Calm, clear	5	8:00	16	1	0	0	15	0	0	0	0	0	0	0	0	3	0	1	0	4	Fish arent biting, lake usually busy w/people on boats, slow cause of weather. Anglers usually report lake is successful. Fish biting intermittently. --Andrea Zasoski
				9:00	17	2	0	0	19														
				10:00	16	2	0	0	18														
				11:00	X	X	X	X	X														
				12:00	X	X	X	X	X														
Hunterdon	Manny's Pond		0	8:00	X	X	X	X	X	0	0	0	0	0	0	0	0	41	26	1	0	68	
				9:00	X	X	X	X	X														
				10:00	31	8	0	0	39														
				11:00	X	X	X	X	X														
				12:00	X	X	X	X	X														

Opening Day Trout Angler Survey Report Data

County	Waterbody	Lake/ River Conditions	# of Cormorants Present	Time	# of Shoreline anglers		# of Boat anglers		Total # of anglers	Brook Trout caught				Brown Trout caught				Rainbow Trout caught				Total trout caught	Angler comments / Interviewer observations
										<14 in		>14 in		<14 in		>14 in		<14 in		>14 in			
					adult	child	adult	child		kept	rel	kept	rel	kept	rel	kept	rel	kept	rel	kept	rel		
Mercer	Colonial Lake	Clear, Choppy	0	8:00	38	12	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	Saw no fish of any species caught. Anglers all said they're not biting. 3 Blue herrons eating fingerlings.
				9:00	35	3	0	0	38														
				10:00	24	2	0	0	26														
				11:00	17	0	0	0	17														
				12:00	21	0	0	0	21														
Monmouth	Englishtown Mill Pond	Muddy	4	8:00	8	1	1	0	10	0	0	0	0	0	0	0	0	7	3	1	1	12	4 Cormorants in tree. One angler wasn't happy, thinks birds get more fish than them. Feels the birds are cleaning fish out of the lake, leaving less for the anglers. This angler wants the state to stock the lake with more trout. -- Patricia Walker, WCC Volunteer
				9:00	9	1	1	0	11														
				10:00	10	1	1	0	12														
				11:00	14	4	0	0	18														
				12:00	4	2	0	0	6														
Monmouth	Mac's Pond	Clear	0	8:00	55	18	0	0	73	0	0	0	0	0	0	0	0	35	47	32	16	130	Anglers annoyed that it was so packed, lines crossed and tangled very often. Anglers had a lot of fun and brought kids out. Once the rain started, everyone started leaving. A lot of species in the pond surprised anglers. Some anglers annoyed that lake Tacanasse is still not being stocked. Many said it was their first time fishing this
				9:00	48	12	0	0	60														
				10:00	45	10	0	0	55														
				11:00	35	8	0	0	43														
				12:00	20	7	0	0	27														
Morris	Mount Hope Pond		5	8:00	40	7	0	0	47	0	0	0	0	0	0	0	0	0	0	0	0	0	Cormorants feeding on fish, no bites.
				9:00	44	14	0	0	58														
				10:00	20	9	0	0	29														
				11:00	21	11	0	0	32														
				12:00	20	7	0	0	27														
Ocean	Lake Pohatcong	Clear	22	8:00	21	6	0	0	27	0	0	0	0	0	0	0	0	0	0	0	0	0	Cormorants were feeding early in the morning. Extremely windy, hard to stand. Comments from most anglers foucsed on the wnd. They blamed the lack of biting fish on the wind. Anglers changed position because of wind but still no success. (Joanna Peluso, WCC)
				9:00	11	6	0	0	17														
				10:00	4	0	0	0	4														
				11:00	5	0	0	0	5														
				12:00	0	0	0	0	0														
Passaic	Clinton Reservoir	Clear	0	8:00	X	X	X	X	X	0	0	0	0	0	0	0	0	0	0	0	0	0	9-10: No angler to talk with, all on boats out on reservoir, can't tell what they're targeting. 10:30: two anglers came back to boat launch, targeted trout but caught none. Caught 2lmb. Really slow, but further investigation on actual holdover trout here is the primary interest. -- Scott Collenburg, Fisheries Biologist.
				9:00	0	0	6	0	6														
				10:00	0	0	4	0	4														
				11:00	0	0	3	0	3														
				12:00	0	0	3	0	3														
Passaic	Green Turtle Pond	Clear, Low water	0	8:00	1	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	Drove around Green Turtle Pond and observed two anglers. There was no safe place to park, so do not know if any fish were caught. Also, they had crossed approximately 12 feet of water to get to the berm they were fishing on. At least that was the only visual place I could see how they got to where they were. --Karen Young, WCC Volunteer
				9:00	1	0	2	0	3														
				10:00	3	0	2	0	5														
				11:00	3	0	2	0	5														
				12:00	X	X	X	X	X														

County	Waterbody	Lake/ River Conditions	# of Cormorants Present	Time	# of Shoreline anglers		# of Boat anglers		Total # of anglers	Brook Trout caught				Brown Trout caught				Rainbow Trout caught				Total trout caught	Angler comments / Interviewer observations
										<14 in		>14 in		<14 in		>14 in		<14 in		>14 in			
					adult	child	adult	child		kept	rel	kept	rel	kept	rel	kept	rel	kept	rel	kept	rel		
Sussex	Lake Ocquittunk	Clear, Low water	0	8:00	66	10	4	1	81	0	0	0	0	0	0	0	0	44	5	2	1	52	Most of the people fishing were either young or new to trout fishing, so the amount of fish caught was less than the Big Flatbrook for that reason as well as the fact the fish had a whole lake to swim in compared to a condensed stream.
				9:00	65	8	5	1	79														
				10:00	40	9	1	0	50														
				11:00	45	8	3	1	57														
				12:00	36	4	2	0	42														
Union	Echo Lake Pond		0	8:00	30	12	0	0	42	0	0	0	0	0	0	0	0	27	6	2	0	35	Tough conditions. Being a county park pond in Union County, the majority of anglers were not "hard-core" fishermen, and didn't hang out too long in the cold and raw conditions. Majority of fish caught in first hour, then slowed up. --Tom Karakowski
				9:00	35	15	0	0	50														
				10:00	26	9	0	0	35														
				11:00	15	11	0	0	26														
				12:00	10	7	0	0	17														
Union	Nomahegan Pond	Muddy	0	8:00	60	13	0	0	73	0	0	0	0	0	0	0	0	36	20	0	1	57	12 Largemouth bass caught. 4 Crappie caught. Numerous sunfish caught. Only one broodstock was landed, two were lost. Most anglers fishing were there because of the brood stock fish! -- Gene Herre, WCC Volunteer
				9:00	57	8	0	0	65														
				10:00	55	4	0	0	59														
				11:00	53	3	0	0	56														
				12:00	49	3	0	0	52														

Streams

County	Waterbody	Lake/ River Conditions	# of Cormorants Present	Time	# of Shoreline anglers		# of Boat anglers		Total # of anglers	Brook Trout caught				Brown Trout caught				Rainbow Trout caught				Total trout caught	Angler comments / Interviewer observations
										<14 in		>14 in		<14 in		>14 in		<14 in		>14 in			
					adult	child	adult	child		kept	rel	kept	rel	kept	rel	kept	rel	kept	rel	kept	rel		
Hunterdon	Beaver Brook	Clear	0	8:00	5	0	0	0	5	0	0	0	0	0	0	0	0	1	10	0	0	11	
				9:00	4	0	0	0	4														
				10:00	0	0	0	0	0														
				11:00	0	0	0	0	0														
				12:00	0	0	0	0	0														
Hunterdon	Capoolong Creek	Clear	0	8:00	9	0	0	0	9	0	0	0	0	0	0	0	0	7	18	0	0	25	Water said to be 31F
				9:00	6	0	0	0	6														
				10:00	11	0	0	0	11														
				11:00	8	1	0	0	9														
				12:00	9	0	0	0	9														
Hunterdon	Hakihokake Creek	Clear	0	8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	10	10	5	0	25	Fly fishing, not catching. Noted they aren't biting. Fresh beer bottles by stream. Lots of fish in flat areas. Swimming but not as hungry as usual. Noticed more beer bottles, concerned about people starting a few days before opening day.
				9:00	4	3	0	0	7														
				10:00	2	1	0	0	3														
				11:00	5	1	0	0	6														
				12:00	0	0	0	0	0														

County	Waterbody	Lake/ River Conditions	# of Cormorants Present	Time	# of Shoreline anglers		# of Boat anglers		Total # of anglers	Brook Trout caught				Brown Trout caught				Rainbow Trout caught				Total trout caught	Angler comments / Interviewer observations
										<14 in		>14 in		<14 in		>14 in		<14 in		>14 in			
					adult	child	adult	child		kept	rel	kept	rel	kept	rel	kept	rel	kept	rel	kept	rel		
Hunterdon	Mullhockaway	Clear, low water	0	8:00	17	1	0	0	18	0	0	0	0	0	5	0	0	12	25	0	0	42	One angler who was one of the two fishing at the Feinstein bridge on Van Syckle's Rd was leaving location #2 at 8:25 after not catching anything. He was upset because he said that 2 men were fishing at the bridge this past Tuesday drinking beer and keeping many fish. The four anglers who fished all morning a location 2 have been fishing
				9:00	15	2	0	0	17														
				10:00	20	1	0	0	21														
				11:00	15	0	0	0	15														
				12:00	5	0	0	0	4														
Hunterdon	South Branch Rockaway Creek	Clear	0	8:00	4	2	0	0	6	0	0	0	0	0	2	0	0	2	3	0	0	7	
				9:00		X	X	X	X														
				10:00	X	X	X	X	X														
				11:00	X	X	X	X	X														
				12:00	5	1	0	0	6														
Hunterdon	Spruce Run Creek	Low Water	9	8:00	16	4	0	0	20	0	0	0	0	0	0	0	0	27	15	0	0	42	
				9:00	X	X	X	X	X														
				10:00	12	2	0	0	14														
				11:00	X	X	X	X	X														
				12:00	7	1	0	0	8														
Morris	India Brook		0	8:00	12	4	0	0	16	0	0	0	0	0	0	0	0	1	5	0	0	6	
				9:00	10	5	0	0	15														
				10:00	5	0	0	0	5														
				11:00	0	0	0	0	0														
				12:00	2	0	0	0	2														
Morris	Upper South Branch Raritan River	Clear	0	8:00	21	6	6	0	27	0	1	0	0	1	0	0	0	151	4	3	0	160	There was not a lot of angler turnover, most anglers from the morning stuck around, with the exception of a few groups that left after catching their limit. A few more people trickled in throughout the day and as the weather got a little worse around 11 (rain/snow started), some groups began to leave. Many of the anglers noted that,
				9:00	27	0	10	0	37														
				10:00	25	0	5	0	30														
				11:00	22	0	4	0	26														
				12:00	18	0	2	0	20														
Morris	Whippany River	Clear, low water, heavy sedimentation	0	8:00	8	1	0	0	9	0	0	0	0	1	0	0	1	6	0	0	0	8	
				9:00	8	1	0	0	9														
				10:00	5	1	0	0	6														
				11:00	4	1	0	0	5														
				12:00	1	1	0	0	2														
Passaic	Pequannock River TCA	Clear - 6C	0	8:00	7	4	0	0	11	0	0	0	0	0	0	0	0	2	0	0	0	2	Saw trout surfacing at 8am. Angler commented water was probably too cold. Angler planned to be at Flatbrook at 8am, but weather report scared them off. They left for Flatbrook.
				9:00	4	1	0	0	5														
				10:00	11	4	0	0	15														
				11:00	3	1	0	0	4														
				12:00	2	0	0	0	2														

Opening Day Trout Angler Survey Report Data

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										<14 in		>14 in		<14 in		>14 in		<14 in		>14 in			
					adult	child	adult	child		kept	rel	kept	rel	kept	rel	kept	rel	kept	rel	kept	rel		
Sussex	Franklin Pond Creek	Clear, low water	0	8:00	30	1	0	0	31	0	0	0	0	0	0	0	0	51	18	7	0	76	Not all of the anglers were willing to answer my questions, either ignored me or said "I came to fish not answer questions" -- Lisa Kisch, WCC Volunteer
				9:00	30	1	0	0	31														
				10:00	23	2	0	0	25														
				11:00	18	1	0	0	19														
				12:00	18	1	0	0	19														
Sussex	Big Flat Brook	Clear, low water	0	8:00	31	0	0	0	31	0	0	0	0	0	0	0	0	45	13	9	0	67	Most complaints were of the crowded are under the stone bridge. At 10:00 it started snowing causing a sharp drop in people fishing.
				9:00	26	3	0	0	29														
				10:00	18	2	0	0	20														
				11:00	12	2	0	0	14														
				12:00	X	X	X	X	X														
Sussex	Trout Brook		0	8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				9:00	3	0	0	0	0														
				10:00	0	0	0	0	0														
				11:00	X	X	X	X	X														
				12:00	X	X	X	X	X														
Warren	Lopatcong Creek	Clear, low water	0	8:00	14	4	0	0	18	0	0	0	0	1	1	0	0	30	11	0	0	43	Total number of anglers observed, from 8am to noon. The two brown trout were wild (saw one, didn't see the other released). All anglers I spoke to were spin fishing and all were using bait except one inexperienced angler at the end of the day. Some anglers moved around to different locations. All anglers interviewed were fishing
				9:00	X	X	X	X	X														
				10:00	X	X	X	X	X														
				11:00	X	X	X	X	X														
				12:00	X	X	X	X	X														
Warren	Furnace Brook	Water low, clear, 43F		8:00	2	0	0	0	2	0	0	0	0	0	0	0	0	5	0	0	0	5	Left at 9:30 when no other anglers showed up. Siltation bad in this section --Jeff Kurt, WCC volunteer
				9:00	2	0	0	0	2														
				10:00	X	X	X	X	X														
				11:00	X	X	X	X	X														
				12:00	X	X	X	X	X														

Spot Checks

County	Waterbody	Lake/ River Conditions	# of Cormorants Present	Time	# of Shoreline anglers		# of Boat anglers		Total # of anglers	Brook Trout caught				Brown Trout caught				Rainbow Trout caught				Total trout caught	Angler comments / Interviewer observations
										<14 in		>14 in		<14 in		>14 in		<14 in		>14 in			
					adult	child	adult	child		kept	rel	kept	rel	kept	rel	kept	rel	kept	rel	kept	rel		
Warren	Pequest River	Clear	0	8:00						0	0	0	0	0	0	0	0	4	2	0	1	7	Near intersection of Rts 31and 46, approx. 1.5 mile stretch
				9:00																			
				10:00																			
				11:00																			
				12:00																			

County	Waterbody	Lake/ River Conditions	# of Cormorants Present	Time	# of Shoreline anglers		# of Boat anglers		Total # of anglers	Brook Trout caught				Brown Trout caught				Rainbow Trout caught				Total trout caught	Angler comments / Interviewer observations
										<14 in		>14 in		<14 in		>14 in		<14 in		>14 in			
					adult	child	adult	child		kept	rel	kept	rel	kept	rel	kept	rel	kept	rel	kept	rel		
Sussex	Pond Brook		0	8:00	3	0	0	0	3	0	0	0	0	0	0	0	0	1	1	0	0	2	Keen's Grist Mill
				9:00	4	2																	
				10:00																			
				11:00																			
				12:00																			
Sussex	Pond Brook		0	8:00	28	0	0	0	28	0	0	0	0	0	0	0	0	7	3	0	0	0	Veterans Park
				9:00																			
				10:00																			
				11:00																			
				12:00																			
Sussex/ Warren	Paulin's Kill		0	8:00	15	3			18	0	0	0	0	0	0	0	0	0	25	0	0	0	Sadle Back Rd
				9:00	6	0																	
				10:00																			
				11:00																			
				12:00																			
Sussex/ Warren	Paulin's Kill		0	8:00						0	0	0	0	0	0	0	0	10	10	0	0	20	Veterans Park
				9:00	15	1			16														
				10:00																			
				11:00																			
				12:00																			
Sussex/ Warren	Paulin's Kill		0	8:00						0	0	0	0	0	0	0	0	7	2	0	0	9	610 Bridge
				9:00	9	0			9														
				10:00																			
				11:00																			
				12:00																			
Sussex/ Warren	Paulin's Kill		0	8:00						0	0	0	0	0	0	0	0	1	1	0	0	2	Sharp's Farm
				9:00																			
				10:00	1	0			1														
				11:00																			
				12:00																			
Sussex/ Warren	Paulin's Kill			8:00						0	0	0	0	0	0	0	0	8	15	0	0	23	Station Rd
				9:00																			
				10:00																			
				11:00																			
				12:00	20				20														
Warren	Jacksonburg Creek		0	8:00						0	0	0	0	0	0	0	0	0	0	0	0	0	
				9:00																			
				10:00																			
				11:00	3				3														
				12:00																			

Opening Day Trout Angler Survey Report Data