INVESTIGATIONS AND MANAGEMENT OF NEW JERSEY'S FRESHWATER FISHERIES RESOURCES 2016

State of New Jersey
Division of Fish and Wildlife
Bureau of Freshwater Fisheries

NEW JERSEY DIVISION OF
Fish and Wildlife

INVESTIGATIONS AND MANAGEMENT OF NEW JERSEY'S FRESHWATER FISHERIES RESOURCES 2016

Including
Sport Fish Restoration Grant F-48-R

Job Performance Reports Segment 27
(November 1, 2015 – October 31, 2016)

and

Final Reports

March 2017

New Jersey Department of Environmental Protection
Division of Fish and Wildlife
Bureau of Freshwater Fisheries

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

State of New Jersey

Chris Christie
Governor

Kim Guadagno
Lt. Governor

New Jersey
Department of Environmental Protection

Bob Martin
Commissioner

Rich Boornazian
Assistant Commissioner
Natural and Historic Resources

Division of Fish and Wildlife

Larry Herrighty
Director

Dave Golden
Acting Assistant Director, Operations

BUREAU OF FRESHWATER FISHERIES
Research and Management Unit

Lisa Barno
Chief

Shawn Crouse
Principal Fisheries Biologist

Pat Hamilton
Principal Fisheries Biologist

Christopher Smith
Principal Fisheries Biologist

Mark Boriek
Principal Fisheries Biologist

Ross Shramko
Senior Fisheries Biologist

Scott Collenburg
Assistant Fisheries Biologist

Eric Boehm
Assistant Fisheries Biologist

Charles Sedor
Technician II

With the assistance of:
Scott Catton, Kyle Civalier, Luke Diglio, Chris Grohgans, Christine Szpond, and Scott Ward

New Jersey's Freshwater Research and Management activities are funded entirely by New Jersey's licensed anglers. These activities benefit the state's 8 million residents by protecting and assessing New Jersey's vital freshwater resources.

Clean water for fish means clean water for us and generations to come

TABLE OF CONTENTS

INTRODUCTION

Highlights for 2016

The Bureau of Freshwater Fisheries conducted total of 237 fisheries surveys at 138 waterbodies in 2016 to address a variety of recreational and resource management needs, including response to emerging fisheries issues. Fifty-six of the 138 waterbodies were streams and rivers, while 82 were ponds and lakes. Fisheries biologists captured, identified, and counted over 65,000 fish, represented by 76 species. Surveys were conducted to satisfy a wide variety of projects, such as the final year of a coolwater fisheries assessment at 12 lakes, focusing on Muskellunge, Northern Pike, Walleye, and Hybrid Striped Bass stocking programs. Warmwater fish populations were electrofished at 32 waterbodies so that staff can better manage their recreational fisheries, often with an emphasis on Largemouth Bass. Reproductive checks were also conducted at 49 ponds and lakes. Round Valley Reservoir was the focus of an intensive fisheries inventory and subsequent fisheries management plan. On the coldwater side, there was a continued effort to investigate current *Wild Trout Stream* regulations, leading to regulation changes in the management of these valuable resources. Other fisheries surveys were used to monitor populations, assess stocking programs, map the distribution of rare native fishes, document or control populations of invasive fishes/aquatic plants, among a variety of other functions. This report documents the ongoing fisheries management activities across New Jersey performed by the Division of Fish and Wildlife (NJDFW) and the status of its fisheries resources in 2016. This work is made possible by funding from the Sport Fish Restoration Federal Grant F-48-R and New Jersey's Hunter and Angler Fund.

2016 was especially difficult for the state's fisheries resources as below average precipitation levels resulted in record setting low stream flows that plagued the state's freshwater resources throughout the year. Impacts of extended dry weather patterns were further intensified by consecutive days of extreme temperatures during the summer. The Bureau continued to measure temperature through its ambient stream temperature monitoring network with 39 thermographs (instruments that continuously monitor temperature), deployed on 17 recreationally important trout streams and 14 small streams having reproducing trout populations. On July 25, 2016, an official Drought Watch was issued for most of northern New Jersey. Persistent dry weather patterns resulted in a Drought Warning being declared on October 21, 2016 for 14 counties within the Northeast, Northwest, Central, and Coastal North Water Supply Regions (Administrative Order 2016-10). A Drought Warning results in established minimum passing flow requirements to be reviewed and often reduced within affected areas. Drought conditions during the summer months are typically far more detrimental, than cooler seasons, due to reduced water temperatures, adequate oxygen, etc., in fact some flows were well beyond any flows that have been experienced in over 60 years. As a result, these extreme conditions have likely impacted aquatic biota in ways that we may or may not be able to measure.

This year marked the final year of the Coolwater Fisheries Assessment, which was initiated in 2013. This multi-year project will evaluate trophy coolwater fisheries for Muskellunge, Northern Pike, Walleye, and Hybrid Striped Bass. These fisheries are primarily maintained by annual stockings of fish reared at NJDFW's Hackettstown State Fish Hatchery. In 2016 surveys were conducted at 12 waterbodies including, Budd Lake, Canistear Reservoir, Carnegie Lake, Cranberry Lake, Deal Lake, Echo Lake, Greenwood Lake, Little Swartswood Lake, Manasquan Reservoir, Monksville Reservoir, Mountain Lake, and Pompton Lake using a variety of sampling

techniques to best capture the species of interest on each waterbody. The Bureau also conducted an online angler survey to obtain anglers opinions and experiences concerning their warmwater and coolwater fishing experiences in New Jersey.

The Bureau also conducted its three-year evaluation of streams regulated as the *Wild Trout Streams*. These 36 streams are not stocked with hatchery trout, but rather rely upon the wild, naturally reproducing trout populations inhabiting these streams to provide a recreational fishery. Electrofishing surveys were conducted on 46 sections of all 36 designated *Wild Trout Streams* in 2014, yielding 3,137 trout, with a mean of 68 trout per survey. Data collection efforts continued in 2015 with 47 additional surveys conducted on 38 streams and in 2016 with 5 additional surveys conducted at 3 streams. From January through June a team of Bureau biologists invested considerable time compiling, analyzing population data, and reviewing pertinent information including data analysis of nearly 100 stream surveys, literature review, public input (online survey and a two public meetings), and review of stocking histories. The Bureau will present recommendations to the Fish and Game Council in 2017 regarding this unique resource, which may lead to formal regulation changes into the state Fish Code.

Standardized stream electrofishing surveys contribute valuable data used for multiple projects and management functions, including the classification of New Jersey's surface waters within the Department's Surface Water Quality Standards N.J.A.C. 7:9B. This system is the regulatory cornerstone that helps protect critical watersheds. These assessments use important stream health indicators such as Brook, Brown, and Rainbow Trout to identify high water quality and critical habitat areas. Twenty-eight surveys confirmed existing stream classifications. Twelve surveys produced results that warrant changes to current classifications, six of which are upgrades to *Trout Production* and two to *Trout Maintenance*.

In 2013 the Bureau established an ambient stream temperature monitoring network on streams that has expanded to 39 thermographs (instruments that continuously monitor temperature), deployed on 17 recreationally important trout streams and 14 small streams having reproducing trout populations. Both water and air temperatures are recorded in wild Brook Trout streams as part of an Eastern Brook Trout Joint Venture initiative to assess climate change. The temperature data will be used to assess current habitat conditions, evaluate long term trends, determine if ambient water quality is consistent with surface water quality standards, and aid in the management of coldwater fisheries, including evaluation of stocking practices and fishing regulations. See page 36 for a summary and Appendix E for a full report.

An intensive fisheries inventory was conducted at Round Valley Reservoir, the second largest lake in New Jersey (2,350 acres), with a maximum depth of 160 feet. This popular waterbody has produced four current state record fish, for Lake Trout, Brown Trout, Smallmouth Bass, and American Eel. The reservoir is rather unique for New Jersey supporting a two tier fishery for both coldwater and warmwater fish populations. The reservoir has been stocked regularly with Rainbow and Brown Trout and is managed as a *Trophy Trout Lake* and supports an abundant, reproducing Lake Trout population. By definition, this Oligotrophic lake has very low nutrient levels and adequate oxygen throughout almost all of its depth. The abundant predator population consists of slow growing Lake Trout, stocked trout, and reproducing bass, but relatively few forage species and densities. Both Lake Trout and Largemouth Bass populations, despite being

slow growing and unbalanced, have the potential of producing a state records. The complete fisheries management plan can be found in Appendix G.

Largemouth Bass are the most popular and widely distributed of the state's game species. New Jersey has over 400 impoundments open to the general public for fishing and thousands more in private ownership scattered throughout the state. These lentic environments offer excellent fishing opportunities for a variety of species such as bass, sunfish, crappie, and pickerel. These species naturally reproduce in these waterways and often do not require active stocking to sustain their populations. In addition to Round Valley Reservoir, the Bureau of Freshwater Fisheries conducted electrofishing surveys at 32 lakes and ponds throughout the state to assess the status of their warmwater fisheries. Crews also collected fish with a 20 ft. seine to assess the reproductive success of warmwater species at 49 lakes and ponds. These data are used to determine if supplemental stockings are necessary.

Significant progress was made for a second year in the assessment and protection of our state's native fishes. A formal review process led by the NJDFW's Endangered and Nongame Species Program was conducted in 2014 and 2015 to determine the status of our native freshwater fishes, known as the Delphi Technique. This is a systematic method for reaching consensus among experts by incorporating all available data and disseminating those data among all participants. Results were presented to and approved by the Endangered and Nongame Species Advisory Committee. Next steps include the formal listing of state Endangered and Threatened species (along with Special Concern designation), as well as identifying species that are considered to be stable and secure. Proposed Endangered Species include Bridle Shiner, Ironcolor Shiner, and Shortnose Sturgeon and the Slimy Sculpin as a Threatened Species. The designation of Species of Special Concern will be given to American Brook Lamprey, Brook Trout, Blackbanded Sunfish, Comely Shiner, Mud Sunfish, Northern Hog Sucker, and Shield Darter.

The Bureau of Freshwater Fisheries participated in the ten-year revision of the State Wildlife Action Plan (SWAP). The SWAP is a strategic and cost-effective mechanism to preserve the state's wildlife resources for the future. Recovery of species that have reached threatened or endangered status is typically more-costly than preventative actions that keep species populations from reaching such declines. Proactive management actions identified in the SWAP are intended to keep species from becoming federally (and state) threatened and endangered. NJDFW is currently updating the New Jersey's Wildlife Action Plan as required by Congress to continue to receive federal wildlife grants. More importantly, New Jersey's update will serve as a blueprint for conserving our wildlife heritage. The plan will identify priority actions addressing known threats facing our targeted species and habitats that we, as a conservation community, can implement in the next ten years.

In addition to these highlights, this report describes a host of other field work and educational activities conducted by the Bureau of Freshwater Fisheries. The efforts of full-time Bureau personnel are complemented by a dedicated and talented seasonal staff, who provide incredible insight, enthusiasm, and the labor which is vital to raising fish, conducting fisheries surveys statewide, and performing countless tasks that help maintain and enhance New Jersey's freshwater fisheries resources. The Bureau's work is made possibly by both the dedicated monies of the Hunter and Anglers Fund and the Sport Fish Restoration Program.

Bureau of Freshwater Fisheries

The mission of the Bureau of Freshwater Fisheries (BFF) is to protect and manage the state's freshwater fish resources to maximize their long-term biological, recreational, and economic value for all New Jerseyans. Our goals are:

1) To maintain New Jersey's rich variety of freshwater fish species at stable, healthy levels and enhance the many habitats on which they depend;

2) To educate New Jersey residents on the values and needs of our freshwater fish resources and to foster a positive human/wildlife co-existence;

3) To maximize the recreational and commercial use of New Jersey's freshwater fishes for both present and future generations.

In 2014 freshwater fish culture and maintenance operations (Fish Culture Unit) were removed from the Bureau of Freshwater Fisheries. This is the first time since the early days of NJDFW that fish culture operations were separated from the protection and management of the state's fisheries resources. The reorganization resulted in only research and management operations remaining within the Bureau of Freshwater Fisheries.

The Bureau of Freshwater Fisheries has personnel in two regionally placed offices: Lebanon Field Office (Hunterdon) and the Central Regional Office (Monmouth). The Bureau oversees the management and protection of the state's over 27,000 miles of streams and over 400 public lakes. The biologists also carry out a number of freshwater projects each year.

The Bureau conducts fishery surveys, classifies the state's waterways, provides technical input on a variety of watershed and habitat based issues, facilitates habitat restoration projects, serves as liaisons to a variety of sportsmen groups, and provides information to the general public in a variety of forums concerning the status of the state's fishery resources. The Bureau of Freshwater Fisheries also administers permits for fish stocking, water lowering, commercial baitfish, and scientific collecting to further provide for the effective management and protection of the state's aquatic resources.

The Bureau of Freshwater Fisheries works closely with NJDFW's fish pathologist, Dr. Jan Lovy, within the Office of Fish and Wildlife Health and Forensics. The fish pathology laboratory is located at the Pequest Trout Hatchery outside Oxford, NJ, and close to the Hackettstown State Fish Hatchery. Dr. Lovy conducts disease monitoring and research in wild and hatchery-raised fish populations throughout the state. For disease diagnostics staff works with the NJ Animal Health Diagnostic Laboratory (NJ AHDL). The AHDL is a state-of-the-art facility equipped with molecular biology suites, a virology laboratory with cell culture facilities maintaining fish cell lines, and modern bacterial diagnostic equipment. The AHDL also provides diagnostic services in fish health for private fish hatcheries.

The Bureau currently has seven fisheries biologists on staff. The primary delineation of responsibilities is based on regional watershed management areas. The state currently is divided into seven regional watershed management areas (Figure 1). In addition to regional responsibilities assigned to biologists, each has a specific area of expertise and oversees related research and management programs:

Eric Boehm – Assistant Fisheries Biologist
Fisheries Management in the Lower Atlantic Coastal Region (Sloop Creek to Dennis Creek watersheds) and Warmwater Fish Management

Mark Boriek – Principal Fisheries Biologist
Fisheries Management in the Lower Passaic & Upper Atlantic Region (Lower Passaic, Saddle, Hackensack, Pascack & Elizabeth to Toms River watersheds), Water Lowering Permit Coordinator, and Anadromous Fishes Management

Scott Collenburg – Assistant Fisheries Biologist
Fisheries Management in the Upper Passaic Region (Pompton, Pequannock, Wanaque, Ramapo, Upper Passaic, Whippany, & Rockaway River watersheds), Coolwater Fisheries Assessment, Stream Temperature Monitoring, and Wild Trout Stream Team

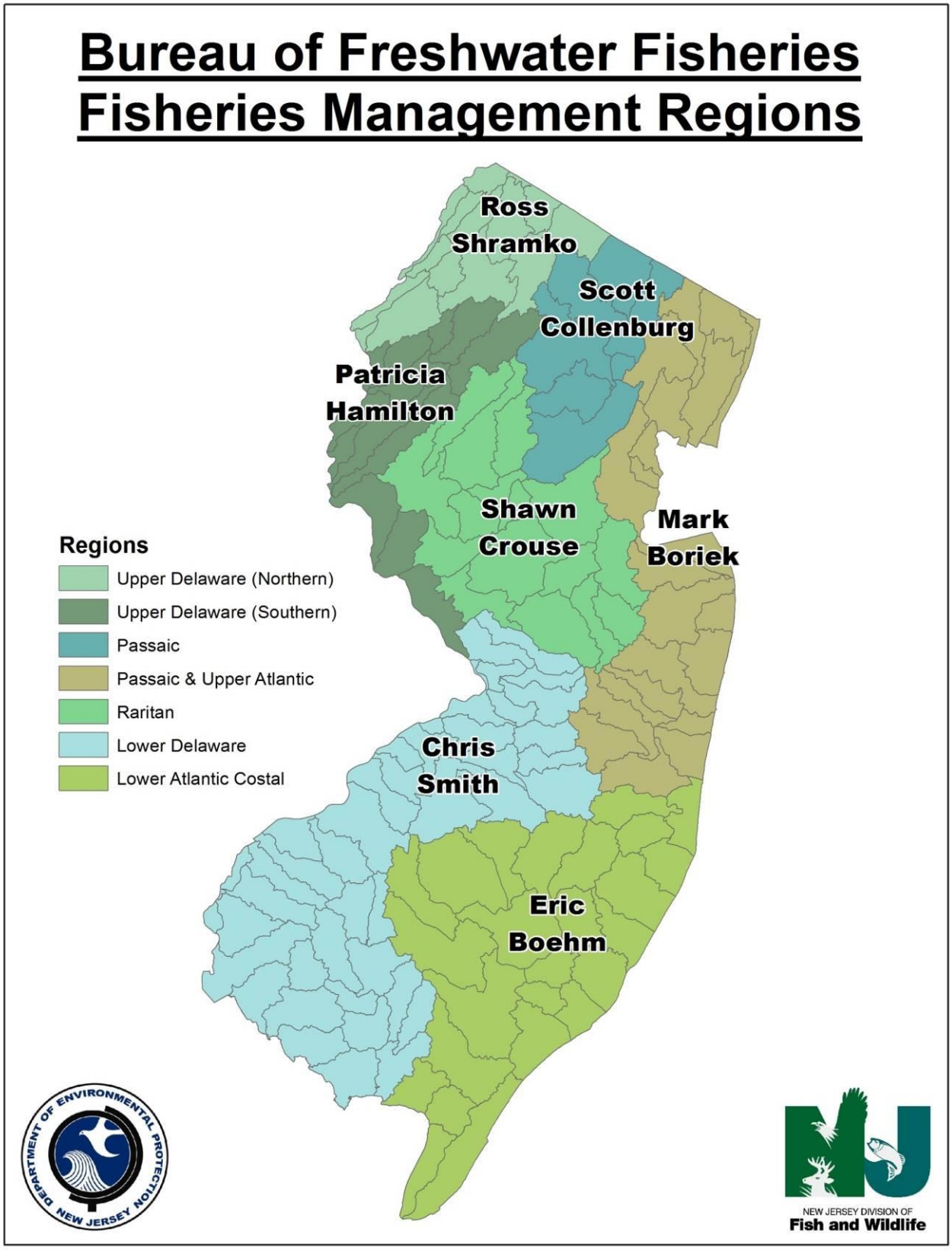
Shawn Crouse – Principal Fisheries Biologist
Fisheries Management in the Raritan Region (Raritan River Watershed), Native Fishes Management, State Wildlife Action Plan, and Annual Report Coordinator

Pat Hamilton – Principal Fisheries Biologist
Fisheries Management in the Upper Delaware (South) Region (Delawanna Creek to Lockatong Creek watersheds), Coldwater Fishes Management, Wild Trout Stream Team, and Federal Grant Coordinator

Ross Shramko – Senior Fisheries Biologist
Fisheries Management in the Upper Delaware (North) & Wallkill Region (Shimmers Brook to Paulins Kill and Wallkill River watersheds), Trout Stocking Coordinator, GIS, Database Management, and Wild Trout Stream Team

Chris Smith – Principal Fisheries Biologist
Fisheries Management in the Lower Delaware Region (Assunpink Creek to Maurice River watersheds), Warmwater Fisheries Management and Invasive Species Management

Figure 1. NJDFW, Bureau of Freshwater Fisheries – 2016 Fisheries Management Regions.



Funding

NJDFW's Bureau of Freshwater Fisheries is funded entirely by New Jersey sportsmen, through the sale of fishing licenses and through a Federal excise tax on the manufacturing of hunting and fishing related equipment. This "user-pays" system has made great strides in financing the management of New Jersey's fish and wildlife resources, not only to the benefit of licensed hunters and anglers but to every one of the state's over 8 million residents. Wildlife associated recreation also generates $2.2 billion dollars into the state's economy each year, with an estimated 300,000 freshwater anglers generating $138 million dollars alone. The two funding sources are described below and after each activity described later in this report the funding source is indicated as either Hunter and Angler Fund or Federal Grant F-48-R (with Project Number I, II, or III specified).

Hunter and Angler Fund - Licenses, Stamps, and Permits

The sale of freshwater fishing licenses and trout stamps generates over $3.5 million dollars to NJDFW each year. Of this, 1 million is allocated to the Bureau of Freshwater Fisheries to support the state's freshwater research and management efforts. The remaining funds are used to fund other activities within NJDFW such as Fish Culture operations, Information and Education, Lands Management, and Law Enforcement, as well as Administrative staff.

Sport Fish Restoration Program

Federal excise tax money is distributed through the Sport Fish Restoration Fund administered by the United States Fish and Wildlife Service (USFWS). The Sport Fish Restoration Program, established by an amendment to the Dingell-Johnson Act of 1950, provides funding for the management, conservation and restoration of fishery resources. The Sport Fish Restoration Program (SFRP) is funded by revenues collected by the manufacturers of fishing rods, reels, creels, and lures, who pay an excise tax on these items to the U.S. Treasury. The program is a cost-reimbursement program, where the state covers the full amount of the approved project then applies for reimbursement for up to 75% of project expenses.

The SFRP provides funding to the Bureau of Freshwater Fisheries annually for fisheries research and management activities through Grant F-48-R, *Investigations and Management of New Jersey's Freshwater Fisheries Resources*. For the one-year grant cycle, November 1, 2015 – October 31, 2016, the USFWS approved a total award of $256,668, 75% of which ($192,501) is federal funds and matched 25% with Hunter and Angler funds ($64,167).

Grant F-48-R is comprised of three projects that focus on (1) assessing and managing fisheries, (2) restoring fisheries and their aquatic habitats, and (3) managing the recreational use of fisheries. The grant's three projects, project objectives, and activities conducted under each project during 2016 are listed below.

Federal Grant F-48-R

Project I: Assessment of the Biological Integrity of Inland Fisheries

Objective: To assess the biological integrity New Jersey's aquatic resources through the collection of physical, chemical, and biological data and use this information to develop, implement, and evaluate management and stocking strategies to improve and enhance sport fishing.

Activities:
1. Anadromous Fisheries Assessment
2. Coolwater Fisheries Assessment
3. Database Management – *FishTrack*
4. Inventory of *Trout Production* Streams
5. Lake Inventory – Round Valley Fisheries Management Plan
6. Lake Trout Population Assessment
7. Special Regulation Trout Area Assessment
8. Stream and Lake Assessments for Surface Water Classification
9. Temperature Monitoring – Streams
10. Wild Brook Trout Assessment
11. Wild Trout Stream Regulations – Assessment and Development

Project II: Protection and Restoration of Inland Fisheries and Aquatic Habitats

Objective: To protect, maintain, and restore healthy fisheries and their aquatic habitats in New Jersey's inland waters.

Activities:
1. Aquatic Invasive Fishes and Plants Management
2. Conservation and Restoration of Fish Habitat
3. Wild Fish Population Health Assessment

Project III: Management of Recreational Fisheries Users

Objective: To obtain and use pertinent information on freshwater angler attitudes, preferences, participation, and resource utilization to protect, manage, and enhance sport fisheries.

Activities:
1. Opening Day Trout Angler Survey
2. Trout Angler Logbook Program
3. Wild Trout Angler Survey

The Bureau of Freshwater Fisheries conducted 285 surveys throughout the state in 2016. The map below demonstrates the survey quantity, geographic distribution, and type (Figure 2). 237 surveys were conducted at 138 waterbodies in which fish were collected, most of which include the determination of basic water quality parameters such as dissolved oxygen, temperature, pH, etc. An additional 19 locations were water quality surveys only. A complete list of field locations surveyed in 2016 is found in Table 1, following the map. Surveys were conducted under two funding sources, either Hunter and Angler Fund or Federal Grant F-48-R.

Figure 2. Field sites sampled in 2016 by NJDFW, Bureau of Freshwater Fisheries.

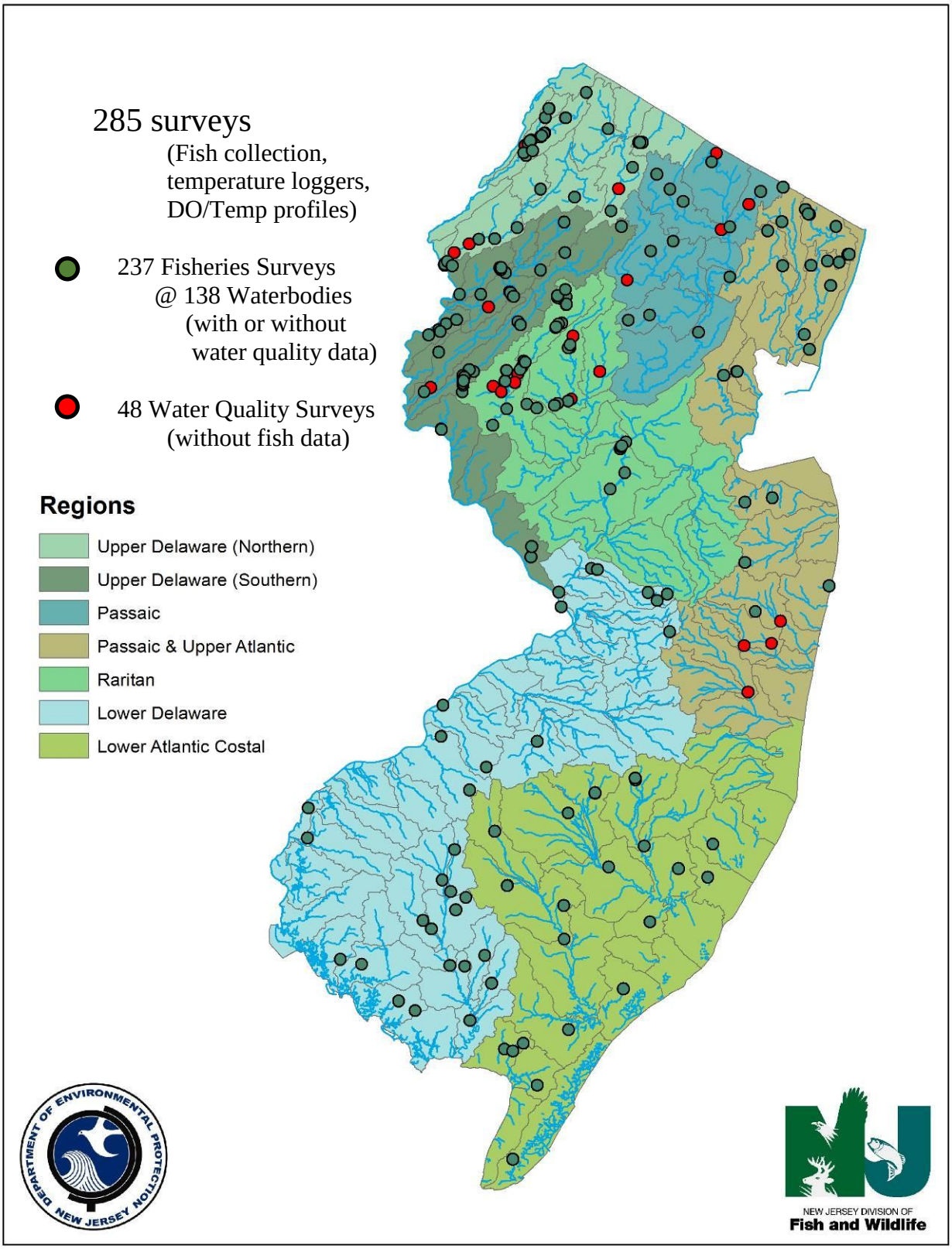


TABLE 1. 2016 field sampling locations

NEW JERSEY DIVISION OF Fish and Wildlife

Bureau of Freshwater Fisheries
2016 Field Sampling Activities

- ● Funding source or reason of data collection
- ▲ Data are applicable to additional projects
- ■ Continuous Temperature Monitoring

	Federal Grant F-48-R (Project I or II)										**Hunter & Angler Fund**						
	Classification (I)	Wild Trout Stream Reg. (I)	Brook Trout Assess. (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Coolwater Assess. (I)	Invasive Species (II)	Fish Health (II)	Anadromous (I)	Miscellaneous	Warmwater Assessment	Black Bass Assessment	Reproduction Checks	Native Fishes	Miscellaneous	RBA Stream Sampling Protocol Applied*	Results Page #
Upper Delaware (North) & Wallkill Region (Shramko) (Shimmers Brook to Paulins Kill and Wallkill River watersheds)																	
Beerskill Creek	▲	▲	▲	■										▲		✓	36,47,51,128,A1
Big Flat Brook – old police barracks b/w Route 206 & Route 560	▲	▲	▲		●									▲		✓	23,47,51,131,143,A2
Big Flat Brook – below Route 560 – Pol. Bar. (1200m)			▲		●												23,47,143
Big Flat Brook – downstream of Route 560	▲	▲	▲		●									▲		✓	23,47,51,131,143,A3
Big Flat Brook – upstream of Blewitt Tract	▲	▲	▲	■	●									▲		✓	23,36,47,51,131,143,A4,E
Big Flat Brook (trib.) (Lake Ashroe)	▲	▲	▲							●				▲		✓	30,47,51,127,A5
Black Creek (trib.) (McAfee) – Route 517	▲	▲	▲							●				▲		✓	30,47,51,131,A6
Black Creek (trib.) (McAfee) – unnamed golf course access road	▲	▲	●											▲		✓	47,51,131,A7
Black Creek (trib.) (McAfee) – Golf Course Water Treat. Area			●											▲			47,A8
Columbia Lake	▲			●					●		▲	▲				NA	68,99,134
Flat Brook – Three Bridges	▲		▲		●									▲		✓	47,128,143,A9
Flat Brook – Roy Bridge				■												NA	36,E
Forked Brook	▲	▲	▲	■										▲		✓	36,47,51,128,A10
Frelinghuysen Forest Preserve Pond													●	▲		NA	82
Hyper Humus Ponds													▲	●		NA	83,105
Lake Neepaulin													●	▲		NA	85

TABLE 1. 2016 field sampling locations (continued)

NEW JERSEY DIVISION OF Fish and Wildlife

Bureau of Freshwater Fisheries
2016 Field Sampling Activities

- ● Funding source or reason of data collection
- ▲ Data are applicable to additional projects
- ■ Continuous Temperature Monitoring

	Federal Grant F-48-R (Project I or II)										Hunter & Angler Fund						
	Classification (I)	Wild Trout Stream Reg. (I)	Brook Trout Assess. (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Coolwater Assess. (I)	Invasive Species (II)	Fish Health (II)	Anadromous (I)	Miscellaneous	Warmwater Assessment	Black Bass Assessment	Reproduction Checks	Native Fishes	Miscellaneous	RBA Stream Sampling Protocol Applied*	Results Page #
Upper Delaware (North) & Wallkill Region (Shramko) (Shimmers Bk to Paulins Kill and Wallkill River watersheds) (cont.)																	
Little Flat Brook – Layton-Hainsville Road	▲	▲	▲							●				▲		✓	30,47,51,131,A11
Little Flat Brook – Layton-Hainsville Road														●			105
Little Flat Brook – near confluence with Big Flat Bk	▲	▲	▲							●				▲		✓	30,47,51,131,A12
Little Swartswood Lake						●							●	▲		NA	60,85,F
Mud Pond Outlet Stream			▲							●				▲			47,A13
Paulins Kill – Route 94			▲						●					▲			47,99,A14
Paulins Kill – Lambert Road			▲						●					▲			47,99,A15
Paulins Kill – Vail Road and Sipley Road				■												NA	36,99,E
Paulins Kill – Paulinskill Viaduct				■												NA	36,99,E
Paulins Kill – below Columbia Lake Dam			▲	■					●					▲		NA	36,47,99,E
Paulins Kill – Route 46			▲						●					▲			47,99,A16
Sawmill Pond														●		NA	90,105
Shawanni Creek - Strubble (Dimon) Road	▲	▲	●											▲		✓	47,51,131,A17
Shawanni Creek - Mountain Road	▲	▲	▲							●				▲		✓	30,47,51,131,A18
Sparta Glen Brook	▲	▲	▲							●				▲		✓	47,51,55,131,A19
Tillman Brook	▲	▲	▲							●				▲		✓	30,47,51,128,A20
Wallkill River				■												NA	36,E

TABLE 1. 2016 field sampling locations (continued)

NEW JERSEY DIVISION OF Fish and Wildlife

Bureau of Freshwater Fisheries
2016 Field Sampling Activities

- ● Funding source or reason of data collection
- ▲ Data are applicable to additional projects
- ■ Continuous Temperature Monitoring

	Federal Grant F-48-R (Project I or II)										Hunter & Angler Fund						
	Classification (I)	Wild Trout Stream Reg. (I)	Brook Trout Assess. (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Coolwater Assess. (I)	Invasive Species (II)	Fish Health (II)	Anadromous (I)	Miscellaneous	Warmwater Assessment	Black Bass Assessment	Reproduction Checks	Native Fishes	Miscellaneous	RBA Stream Sampling Protocol Applied*	Results Page #
Upper Delaware (South) Region (Hamilton) (Delawanna Creek to Lockatong Creek watersheds)																	
Allamuchy Pond	▲			●									●	▲		NA	79,134
Barkers Mill Brook – Barkers Mill Road	▲	▲	●											▲		✓	47,51,128,A21
Barkers Mill Brook – Townsburg Road	▲	▲	●											▲		✓	47,51,128,A22
Barkers Mill Brook – Cemetery Road	▲	▲	●											▲		✓	47,51,128,A23
Barkers Mill Brook – Cemetery Road, near Pequest confluence	▲	▲	●											▲		✓	47,51,128,A24
Beaver Brook (trib.) (E. of Manunka Chunk)	▲		●											▲		✓	47,127,A25
Buckhorn Creek – Route 519	▲	●	▲											▲		✓	47,51,128,A26
Buckhorn Creek – Roxbury Station Road	▲	●	▲											▲		✓	47,51,128,A27
Buckhorn Creek (trib.) (Hutchinson)			●														49
Buckhorn Creek (trib.) (Roxburg)	▲	▲	●											▲		✓	47,51,126,A28
Buckhorn Creek (trib.) (Summerfield)	▲	●	▲											▲		✓	47,51,126,A29
Cranberry Lake						●										NA	58,F
Delaware Lake	▲			●							▲	●	●	▲			69,82,134
Hakihokake Creek – Bridge Street, downstream of bridge	▲	▲	▲							●				▲		✓	47,51,55,128,A30
Hakihokake Creek – Bridge Street, behind library	▲	▲	▲							●				▲		✓	47,51,55,128,A31
Jacobs Creek – Pennington-Titusville Road			▲							●				▲		✓	47,119,A32
Jacobs Creek – Bear Tavern Road (Route 579)			▲							●				▲		✓	47,119,A33

TABLE 1. 2016 field sampling locations (continued)

NEW JERSEY DIVISION OF Fish and Wildlife

Bureau of Freshwater Fisheries
2016 Field Sampling Activities

- ● Funding source or reason of data collection
- ▲ Data are applicable to additional projects
- ■ Continuous Temperature Monitoring

	Federal Grant F-48-R (Project I or II)										Hunter & Angler Fund						
	Classification (I)	Wild Trout Stream Reg. (I)	Brook Trout Assess. (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Coolwater Assess. (I)	Invasive Species (II)	Fish Health (II)	Anadromous (I)	Miscellaneous	Warmwater Assessment	Black Bass Assessment	Reproduction Checks	Native Fishes	Miscellaneous	RBA Stream Sampling Protocol Applied*	Results Page #
Upper Delaware (South) Region (Hamilton) (Delawanna Creek to Lockatong Creek watersheds) (continued)																	
Merrill Creek Reservoir															●		34,145
Mountain Lake	▲			●		●					●	▲	●	▲			62,74,87,134,135,F
Musconetcong River (trib.) (NW of Stephensburg)	●	▲	▲											▲		✓	47,51,126,A34
Musconetcong River (trib.) (S of Asbury)	●	▲	▲											▲		✓	47,51,126,A35
Musconetcong River (trib.) (W of Asbury)			▲							●				▲			47,A36
Pequest River				■													36,143,E
Pequest River (trib.) (SE of Shiloh)			●														47
Pohatcong Creek – Ravine Road				■												NA	36,E
Pohatcong Creek – Municipal Drive			▲											▲	●		47
Saffin Pond	▲			●									●	▲			89,134
Stephensburg Brook	▲	▲	▲	■										▲		✓	36, 47,51,128,A37
Trout Brook (Hope) (trib.) (Shiloh)	▲		●											▲		✓	47,A38
Twin Lakes	▲			●									●	▲			91,134
West Portal Creek			▲					●		●				▲			47,56,121

TABLE 1. 2016 field sampling locations (continued)

NEW JERSEY DIVISION OF Fish and Wildlife

Bureau of Freshwater Fisheries
2016 Field Sampling Activities

- ● Funding source or reason of data collection
- ▲ Data are applicable to additional projects
- ■ Continuous Temperature Monitoring

	Federal Grant F-48-R (Project I or II)										Hunter & Angler Fund						
	Classification (I)	Wild Trout Stream Reg. (I)	Brook Trout Assess. (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Coolwater Assess. (I)	Invasive Species (II)	Fish Health (II)	Anadromous (I)	Miscellaneous	Warmwater Assessment	Black Bass Assessment	Reproduction Checks	Native Fishes	Miscellaneous	RBA Stream Sampling Protocol Applied*	Results Page #
Upper Passaic Region (Collenburg) (Pompton, Pequannock, Wanaque, Ramapo, Upper Passaic, Whippany, & Rockaway River watersheds)																	
Ames Lake													●	▲		NA	79
Canistear Reservoir						●					▲	▲				NA	57,67,F
Echo Lake Reservoir						●										NA	59,F
Green Turtle Pond											●	▲	●	▲		NA	71,83,135
Greenwood Lake						●					▲	▲				NA	60,71,120,F
Monksville Reservoir						●					▲					NA	61,F
Pequannock River				■												NA	36,143,E
Pompton Lake						●										NA	62,F
Ramapo River				■												NA	36,E
Rockaway River				■												NA	36,E
Scarlet Oak Pond													●	▲		NA	90
Split Rock Reservoir											●	▲				NA	77
Wanaque River				■												NA	36,E
Whippany River (trib.) (Brookside)	▲	●	▲											▲		✓	47,51,129,A39
Whippany River (trib.) (W. of Watnong Brook)	●		▲											▲		✓	47,126,A40

TABLE 1. 2016 field sampling locations (continued)

NEW JERSEY DIVISION OF Fish and Wildlife

Bureau of Freshwater Fisheries
2016 Field Sampling Activities

- ● Funding source or reason of data collection
- ▲ Data are applicable to additional projects
- ■ Continuous Temperature Monitoring

	Federal Grant F-48-R (Project I or II)										Hunter & Angler Fund						
	Classification (I)	Wild Trout Stream Reg. (I)	Brook Trout Assess. (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Coolwater Assess. (I)	Invasive Species (II)	Fish Health (II)	Anadromous (I)	Miscellaneous	Warmwater Assessment	Black Bass Assessment	Reproduction Checks	Native Fishes	Miscellaneous	RBA Stream Sampling Protocol Applied*	Results Page #
Lower Passaic & Upper Atlantic Region (Boriek) (Lower Passaic, Saddle, Hackensack, Pascack & Elizabeth to Toms River watersheds)																	
Bear Brook (Park Ridge) – Brae Road	●		▲											▲		✓	47,126,A41
Bear Brook (Park Ridge) – Laurel Hill Rd. & Arrowhead Rd.	●		▲											▲		✓	47,126,A42
Bear Brook (Park Ridge) – Glendale Road	●		▲											▲		✓	47,126,A43
Coopers Park Pond													●	▲		NA	81
Cresskill Brook – Duck Pond Road	▲	▲	▲							●				▲		✓	47,51,54,132,A44
Cresskill Brook – Deerhill Road	▲	▲	▲							●				▲		✓	47,51,54,129,A45
Deal Lake						●										NA	59,F
Durant Park Pond													●	▲		NA	82
Elizabeth River, W/Br			▲											▲	●		47,148
Haworth Park Pond													●	▲		NA	83
Jersey City Reservoir #3											●	▲				NA	72
Lefferts Lake													●	▲		NA	85
Manasquan Reservoir						●						●				NA	61,73,F
Manasquan River				■												NA	36,E

TABLE 1. 2016 field sampling locations

NEW JERSEY DIVISION OF Fish and Wildlife

Bureau of Freshwater Fisheries
2016 Field Sampling Activities

- ● Funding source or reason of data collection
- ▲ Data are applicable to additional projects
- ■ Continuous Temperature Monitoring

	Federal Grant F-48-R (Project I or II)										Hunter & Angler Fund						
	Classification (I)	Wild Trout Stream Reg. (I)	Brook Trout Assess. (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Coolwater Assess. (I)	Invasive Species (II)	Fish Health (II)	Anadromous (I)	Miscellaneous	Warmwater Assessment	Black Bass Assessment	Reproduction Checks	Native Fishes	Miscellaneous	RBA Stream Sampling Protocol Applied*	Results Page #
Lower Passaic & Upper Atlantic Region (Boriek) (Lower Passaic, Saddle, Hackensack, Pascack & Elizabeth to Toms River watersheds) (continued)																	
Metedeconk River, N/Br				■												NA	36,E
Metedeconk River, S/Br				■												NA	36,E
NJ American Water Pond														▲	●	NA	148
Passaic River – Florham Park			▲			●										NA	47,63,F
Passaic River – Fairfield			▲			●										NA	47,63,F
Passaic River – Elmwood Park			▲			●										NA	47,63,112,F
Pondside Park Lake													●	▲		NA	88
Roosevelt Commons Park Pond													●	▲		NA	88
Shallcross Pond (aka Black Brook Park Pond)														▲	●	NA	148
Silver Creek Pond													●	▲		NA	90
Thielke Arboretum Park Pond													●	▲		NA	91
Toms River				■												NA	36,143,E
Van Saun Park Pond													●	▲		NA	91
Veterans Park Pond													●	▲		NA	92
Whites Pond													●	▲		NA	92,109
Zabriske Pond													●	▲		NA	92

TABLE 1. 2016 field sampling locations

NEW JERSEY DIVISION OF Fish and Wildlife

Bureau of Freshwater Fisheries
2016 Field Sampling Activities

- ● Funding source or reason of data collection
- ▲ Data are applicable to additional projects
- ■ Continuous Temperature Monitoring

	Federal Grant F-48-R (Project I or II)										Hunter & Angler Fund						
	Classification (I)	Wild Trout Stream Reg. (I)	Brook Trout Assess. (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Coolwater Assess. (I)	Invasive Species (II)	Fish Health (II)	Anadromous (I)	Miscellaneous	Warmwater Assessment	Black Bass Assessment	Reproduction Checks	Native Fishes	Miscellaneous	RBA Stream Sampling Protocol Applied*	Results Page #
Raritan Region (Crouse) (Raritan River watershed)																	
Black Brook	▲	▲	▲	■										▲		✓	36,47,51,132,A46
Black River – Below Kay's Pond				■												NA	36,E
Black River – Hacklebarney State Park				■												NA	36,E
Black River – River Rd below Fiddlers Elbow				■												NA	36,E
Budd Lake						●										NA	57,117,F
Carnegie Lake						●										NA	58,113,118,F
Hickory Run – Hickory Run Road	▲	▲	▲	■										▲		✓	36, 47,51,129,A47
Hickory Run – High Bridge – Califon Road	▲	▲	●											▲	●	✓	47,51,129,A48
Millstone River – Griggstown Causeway			▲											▲	●	✓	47,94,A49
Millstone River – Blackwells Mills Dam			▲											▲	●	✓	47,94,109,A50
Millstone River – above Weston Causeway Dam											▲	▲			●	NA	94
Millstone River – below Weston Causeway Dam											▲	▲		▲	●	NA	94
Millstone River – near Raritan confluence											▲	▲			●	NA	94
Raritan River, N/Br – off Peapack Road				■												NA	36,E
Raritan River, S/Br – Claremont - old stocking pt.	▲	▲	▲		●									▲		✓	29,47, 51,129,143,A51
Raritan River, S/Br – Claremont - fiber optic cross.	▲	▲	▲	■	●									▲		✓	29,36,47,51,129,143,A52,E
Raritan River, S/Br – KLG - boulder field	▲	▲	▲		●									▲		✓	27,47,51,121,126,143,A53
Raritan River, S/Br – KLG - below trestle	▲	▲	▲	■	●									▲		✓	27,36,47, 51,126,143,A54,E

TABLE 1. 2016 field sampling locations

NEW JERSEY DIVISION OF
Fish and Wildlife

Bureau of Freshwater Fisheries
2016 Field Sampling Activities

- ● Funding source or reason of data collection
- ▲ Data are applicable to additional projects
- ■ Continuous Temperature Monitoring

	Federal Grant F-48-R (Project I or II)										Hunter & Angler Fund						
	Classification (I)	Wild Trout Stream Reg. (I)	Brook Trout Assess. (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Coolwater Assess. (I)	Invasive Species (II)	Fish Health (II)	Anadromous (I)	Miscellaneous	Warmwater Assessment	Black Bass Assessment	Reproduction Checks	Native Fishes	Miscellaneous	RBA Stream Sampling Protocol Applied*	Results Page #
Raritan Region (Crouse) (Raritan River watershed) (continued)																	
Raritan River, S/Br – Below Lake Solitude				■												NA	36,E
Raritan River, S/Br – Hamden Road														▲	●	NA	NA
Raritan River, S/Br (trib) (Drakestown)	▲	▲	▲	■										▲		✓	36,47,51,127,A55
Raritan River, S/Br (trib) (SW of Budd Lake)	▲	▲	▲	■										▲		✓	36,47,51,127,A56
Rinehart Brook	▲	▲	▲	■										▲		✓	36,47,51,129,A57
Rockaway Creek	▲													●		✓	47,105,129,A58
Rockaway Creek S/Br – off Railroad Ave.	▲													●		✓	47,105,132,A59
Rockaway Creek S/Br – Route 22	▲													●		✓	47,105,132,A60
Rocky Run	▲	▲	▲	■										▲		✓	36,47,51,129,A61
Round Valley Fathead Pond														▲	●	NA	NA
Round Valley Reservoir	▲			●						●	▲	▲	▲	▲		NA	32,64,89,114,134,146,H
Stony Brook (Morris-Washington)	▲	▲	▲	■										▲		✓	36,47, 1,129,A62
Spruce Run Reservoir	▲			●												NA	134
Sun Valley Brook – Stedwick Road	▲	▲	●	■										▲		✓	36,47,51,132,A63
Sun Valley Brook – Wolfe Road	▲	▲	●	■										▲		✓	36,47,51,132,A64
Sun Valley Brook – confluence with Raritan S/Br	▲	▲	●	■										▲		✓	36,47,51,132,A65
Trout Brook (Hacklebarney)	▲	▲	▲	■										▲		✓	36,47,51,129,A66
Turkey Brook	▲	▲	▲	■										▲		✓	36,47,51,129,A67
Willhoughby Brook	▲	▲	▲	■										▲		✓	36,47,51,129,A68

TABLE 1. 2016 field sampling locations (continued)

NEW JERSEY DIVISION OF Fish and Wildlife

Bureau of Freshwater Fisheries
2016 Field Sampling Activities

- ● Funding source or reason of data collection
- ▲ Data are applicable to additional projects
- ■ Continuous Temperature Monitoring

	Federal Grant F-48-R (Project I or II)										**Hunter & Angler Fund**						
	Classification (I)	Wild Trout Stream Reg. (I)	Brook Trout Assess. (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Coolwater Assess. (I)	Invasive Species (II)	Fish Health (II)	Anadromous (I)	Miscellaneous	Warmwater Assessment	Black Bass Assessment	Reproduction Checks	Native Fishes	Miscellaneous	RBA Stream Sampling Protocol Applied*	Results Page #
Lower Delaware Region (Smith) (Assunpink Creek to Maurice River watersheds)																	
Assunpink Creek			▲											●		✓	47,105,A69
Assunpink Lake								●			▲	●				NA	66,115,117,150
Burnt Mill Pond											●	▲				NA	67
Burnt Mills Branch			▲											●			47,105,A70
Cedar Lake (Cedarville, Cumberland Co.)											●	▲	●	▲		NA	67,80
Davis Mill Pond												●				NA	68
Delaware River - Route 1 to PSE&G Mercer							●				▲					NA	70,109
Delaware River - Pennsauken Creek to Petty Island							●				▲					NA	70
DOD Lake							●					▲				NA	70,109,150
Game Creek							●					▲				NA	71,109
Iona Lake													▲	●		NA	84,105
Lake Audry												●				NA	72
Masons Run (trib.) (Pine Hill)	▲	▲	●											▲		✓	47,51,132,A71
Menatico Sand Pond											▲	●	▲	●		NA	73,86,105
Mercer Lake											▲	●				NA	73,112
Newton Lake							●					▲				NA	75,109
Parvin Lake												●				NA	75

TABLE 1. 2016 field sampling locations (continued)

NEW JERSEY DIVISION OF Fish and Wildlife

Bureau of Freshwater Fisheries
2016 Field Sampling Activities

- ● Funding source or reason of data collection
- ▲ Data are applicable to additional projects
- ■ Continuous Temperature Monitoring

	Federal Grant F-48-R (Project I or II)										**Hunter & Angler Fund**						
	Classification (I)	Wild Trout Stream Reg. (I)	Brook Trout Assess. (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Coolwater Assess. (I)	Invasive Species (II)	Fish Health (II)	Anadromous (I)	Miscellaneous	Warmwater Assessment	Black Bass Assessment	Reproduction Checks	Native Fishes	Miscellaneous	RBA Stream Sampling Protocol Applied*	Results Page #
Lower Delaware Region (Smith) (Assunpink Creek to Maurice River watersheds) (continued)																	
Prospertown Lake											●	▲			▲	NA	76
Rainbow Lake												●				NA	76
Rancocas Creek SW/Br			▲											●		✓	47,105,A72
Rising Sun Lake												●				NA	76
Scotland Run	▲		▲											●		✓	47,105,130,A73
Shaws Mill Pond											▲	●	▲	●		NA	77,90,105
Silver Lake (Camden)							●									NA	109
Stone Tavern Lake												●				NA	77
Union Lake												●				NA	77
Wheaton Glass Pond											●	▲				NA	78
Wilson Lake											●	▲	●	▲		NA	78,92,105

TABLE 1. 2016 field sampling locations (continued)

NEW JERSEY DIVISION OF Fish and Wildlife

Bureau of Freshwater Fisheries
2016 Field Sampling Activities

- ● Funding source or reason of data collection
- ▲ Data are applicable to additional projects
- ■ Continuous Temperature Monitoring

	Federal Grant F-48-R (Project I or II)										Hunter & Angler Fund						
	Classification (I)	Wild Trout Stream Reg. (I)	Brook Trout Assess. (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Coolwater Assess. (I)	Invasive Species (II)	Fish Health (II)	Anadromous (I)	Miscellaneous	Warmwater Assessment	Black Bass Assessment	Reproduction Checks	Native Fishes	Miscellaneous	RBA Stream Sampling Protocol Applied*	Results Page #
Lower Atlantic Coastal (Boehm) (Sloop Creek to Dennis Creek watersheds)																	
Atsion Lake													▲	●		NA	80,106
Cedar Lake (WMA)													▲	●		NA	80,106
Chatsworth Lake													▲	●		NA	80,106
Clint Mill Pond													▲	●		NA	81,106
Cresse Lane Pond (Cape May WMA)													●	▲		NA	68,81
Cumberland Pond													▲	●		NA	81,107
East Creek Pond													▲	●		NA	82,106
Harrisville Lake													▲	●		NA	83,106
Lake Absegami													▲	●		NA	84,106
Lake Lenape													▲	●		NA	84,106
Lake Nummy													▲	●		NA	85,106
Makepeace Lake													▲	●		NA	86,106
Marsh Lake Branch			▲											●		✓	47,106,A74
Mill Pond (Atlantic)													▲	●		NA	86,106
Morses Mill Stream			▲											●		✓	47,106,A75

TABLE 1. 2016 field sampling locations (continued)

NEW JERSEY DIVISION OF Fish and Wildlife

Bureau of Freshwater Fisheries
2016 Field Sampling Activities

- ● Funding source or reason of data collection
- ▲ Data are applicable to additional projects
- ■ Continuous Temperature Monitoring

	Federal Grant F-48-R (Project I or II)										Hunter & Angler Fund						
	Classification (I)	Wild Trout Stream Reg. (I)	Brook Trout Assess. (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Coolwater Assess. (I)	Invasive Species (II)	Fish Health (II)	Anadromous (I)	Miscellaneous	Warmwater Assessment	Black Bass Assessment	Reproduction Checks	Native Fishes	Miscellaneous	RBA Stream Sampling Protocol Applied*	Results Page #
Lower Atlantic Coastal (Boehm) (Sloop Creek to Dennis Creek watersheds) (continued)																	
Mullica River							●							▲		NA	109
New Brooklyn Lake														●		NA	87,106
Pickle Factory Pond													▲	●		NA	87,106
Pohatcong Lake													▲	●		NA	88,106,135
Ponder Lodge Lake											●	▲				NA	75
Skit Branch			▲											●		✓	47,106,A76
Stafford Forge Impoundment #1													▲	●		NA	90,106
Tuckahoe Lake													▲	●		NA	91,106,135
Wading River, W/Br			▲										▲	●		✓	47,106,A77

** The Bureau of Freshwater Fisheries strives to use established sampling protocols for all field sampling efforts. However, certain sampling objective adherence to established sampling protocols would be prohibitive to accomplishing project goals. In these instances, non-standardized surveys are performed and are identified in appropriate areas within this document.*

COLDWATER FISHERIES

Catch & Release Trout Regulation Assessment

Catch & Release fishing regulations were implemented in 2014 on sections of two trout-stocked streams – the Flat Brook/ Big Flat Brook and the Ken Lockwood Gorge on the S/Br. Raritan River. Both support reproducing trout populations. Electrofishing surveys have been conducted on these streams to provide data for evaluating the effect of the regulation change on these trout fisheries.

Flat Brook/Big Flat Brook- Four sites per year on the Flat Brook/Big Flat Brook *Catch and Release (C&R)* regulation section were electrofished in 2012, 2013, 2014, 2015, and 2016. Although this stream reach is trout-stocked in the spring and fall, and naturally reproducing trout occurs within this section, few trout were encountered during these surveys (see table below). The "Three Bridges" site yielded significantly more trout in both the 2015 survey and the 2016 survey (counting the observed trout in 2016 - see footnote in table). After five years of study it is clear that stocked trout are not holding throughout the *C&R* regulation area in good numbers. Some trout appear to be utilizing deep, non-wadeable, very difficult to survey, pools in this stream, as evidenced by the 2014 informal (non-standardized) electrofishing survey that was conducted in a large, deep pool (see footnote in table), while other trout may be migrating out of the *C&R* regulation area outright. (Shramko)

To help biologists understand if and when trout maybe migrating out of the areas conducive to sampling, six additional surveys were conducted in 2016. These six additional surveys were very different than the typical standardized 150m surveys conducted previously. In an attempt to sample a larger area, these surveys covered a total of 1,200 nearly contiguous meters, with only a few pools throughout the 1,200m that were too deep to sample with backpack electrofishing units. In these deeper pools, visual observations of the trout were counted. Only stocked trout were collected and counted while wild trout and other species were observed and noted only if they were rare or never encountered in the Flat Brook system. The 1,200m survey section encompassed 3 of the 150m standardize surveys previously sampled. These 150m surveys conducted in July / August each year from 2012 through 2015 were very consistent and found on average 11 stocked trout per 100m. The consistency of this data suggests that 11 trout/100m is an average summertime density for these locations (See Table below).

Electrofishing locations along the Big Flat Brook and Flat Brook from 2012 – 2016.

Year	Water Temp	Total Trout	Brook Trout		Brown Trout		Rainbow Trout	
			Wild	Stocked	Wild	Stocked	Wild	Stocked
Big Flat (between Rt. 206 & Rt. 560 bridges)								
2012	19.9°C (67.8°F)	3				2		1
2013	17.1°C (62.8°F)	8	2			1		5
2014	17.6°C (63.7°F)	3	3					
Big Flat (Old Police Barracks) (page A2)								
2015	18.6°C (65.5°F)	6	3					3
2016	19.3°C (66.7°F)	3	2					1**
Big Flat (Station 2 – upstream from Blewitt Tract)								
2012	20.8°C (69.4°F)	3	3					
2013	18.6°C (65.5°F)	7	5			1		1
2014	17.6°C (63.7°F)	8	5		3			
Big Flat (between Rt. 560 & "Warner's Hole") (page A3)								
2015	17.1°C (62.8°F)	10						10
2016	20.4°C (68.7°F)	8						8
Big Flat (Station 1 – upstream from Blewitt Tract) (page A4)								
2012	19.1°C (66.3°F)	8	7					1
2013								
2014	17.5°C (63.5°F)	2			2			
2015	19.3°C (66.7°F)	3	1					2
2016	19.5°C (67.1°F)	2	1					1
Flat Brook (above Roy Bridge - just downstream of rifle range pool)*								
2012	18.8°C (65.8°F)	6	1		1	2		2
2013	16.3°C (61.3°F)	4	1		1			2
2014	17.3°C (63.1°F)	2			1			1
Flat Brook (Three Bridges WMA) (page A9)								
2015	18.7°C (65.7°F)	48	1					47
2016	18.6°C (65.5°F)	8	1					7***

* In addition to this site, the "rifle range pool" was electrofished. Due to the large size of the pool (wide, long, and deep) not all the trout were captured, however, a total of 15 trout (14 Rainbow Trout and 1 Brook Trout) were netted. They ranged in size from 11.3 – 15.7 inches and all appeared to be of hatchery origin (stocked). The brook has many pools similar to this one that hold trout but are difficult to effectively sample.

** 8-10 stocked rainbow trout were seen but located in a pool too deep to effectively sample and escaped capture.

*** 35 to 50 stocked rainbow trout were seen, but not captured due to a deep hole that this year could not be sampled. This deeper location was able to be sampled in 2015 and accounts for the difference in trout captured from 2015 to 2016 found in the table.

The C*atch and Release* regulation area on the Big Flatbrook / Flatbrook receives a preseason stocking and seven successive weekly stockings during the spring trout program. The 1,200m survey section of the *C&R* regulation area receives about 2,500 trout per season (approximately 312 trout/week). The first 1,200m survey occurred on May 16, 2016, three days after the fifth week of the spring trout stocking program. Since the first 1,200m survey was three days after the fifth in-season stocking (plus the pre-season stocking) for a total of six stocking events, the area was stocked with around 1,875 trout since mid-March. If all of the trout remained in this study area, the area would be holding approximately 156 trout/100m at the time of the initial survey, however only 13 trout/100m were documented. A single pass backpack electrofishing survey is not expected to capture all fish in an area nor are all stocked trout expected to remain in the *C&R* section since March, but the 13 trout/100m survey results is extremely and alarmingly lower than what is expected.

The second 1,200m survey occurred one week later on May 23, three days after the week six trout stocking of an additional 300 trout. Interestingly, the overall trout density increased to 21 trout/100m. This is still an extremely low number of trout compared to what would be expected to find if trout did not move out of the area at all (182 trout/100m after 7 stocking events). This slight increase in trout density found may be attributed to the additional stocking and/or the low flow conditions, potentially inhibiting fish movement.

The third 1,200m survey occurred on May 31, one week later than the previous survey and again three days after the stocking of an additional 300 trout (week seven). Stream flows increased due to rainfall between the previous survey and this survey allowing for a higher freedom of fish movement. Interestingly, the density of trout found decreased to 13 trout/100m, which is in line with first survey and similar to the 11 trout/100m density found from 2012 to 2015 average summertime levels. This density is again far lower than expected after eight stocking events totaling approximately 2,500 trout (208 trout/100 m density).

The data from the three surveys indicate that stocked trout are moving out of the 1,200m sample area in less than three days post-stocking. Three additional surveys were conducted in June, August, and October. Overall trout density in the 1,200m survey area continued to decrease in 2016 as the summer months took hold. This is not surprising due to low stream flows and high stream temperatures in the Flat Brook in the summer of 2016. Both conditions are not favorable for trout survival. See the table on the following page for a breakdown of the data collected on the six 1,200m surveys along with other relevant survey data collected in the area. Additional information is compiled in Appendix A (pages A2-A4 and A9).

It is possible that some trout are residing in deep pools outside of the 1,200m study area, but it is also possible that the trout are swimming even greater distances and leaving the *C&R* regulation area outright and possibly the Flat Brook system entirely. To answer this question, beginning in the spring of 2017, a trout telemetry study will be initiated to identify when fish are moving, where the fish are moving to and possibly shed light on why the fish are moving. The information gained could help explain why historically, the Big Flat Brook / Flat Brook reputation of a great trout fishery remains unsubstantiated by survey /creel data collected by the Division of Fish and Wildlife. (Hunter and Angler Fund)

Flat Brook Catch & Release Regulation Area Electrofishing Surveys 2012 – 2016.

	Survey site 1 (trout/100m)	End of site 1 to Rt. 560 (trout/100m)	Rt. 560 to beginning survey site 2 (trout/100m)	Survey site 2 (trout/100m)	Old Police Barracks site (trout/100m)	Total area (trout/100m)
7/30/12 45 days after last stocking	-----	-----	-----	9	-----	**-----**
8/29/13 45 days after last stocking	-----	-----	-----	11	-----	**-----**
7/30/14 45 days after last stocking	-----	-----	-----	9	-----	**-----**
7/14/15 45 days after last stocking	13	-----	-----	-----	12	**-----**
5/16/16 3 days after stocking	14	8	15	10	13	**13**
5/23/16 3 days after stocking	32	10	21	23	24	**21**
5/31/16 3 days after stocking	15	2	12	5	39	**13**
6/22/16 25 days after last stocking	7	1	12	9	21	**10**
7/19/16 52 days after last stocking	5	-----	-----	-----	-----	**-----**
8/2/16 66 days after last stocking	-----	-----	-----	-----	7	**-----**
8/18/16 82 days after last stocking	5	1	9	5	10	**6**
10/4/16 129 days after last stocking	1	0	1	0	5	**1**

* Shaded areas indicate days in which the 1,200-meter surveys were conducted. Unshaded areas indicate independent 150-meter surveys.

** Only results for stocked trout are included in the table above.

South Branch of the Raritan River- Known for its great scenery and fish habitat, the 2.5-mile section of the South Branch of the Raritan River known as the Ken Lockwood Gorge is very popular among anglers looking for *Catch and Release* (and artificial lures only) opportunities. Wild Brown Trout are the foundation of the fishery in this section of river, with numbers that seem to greatly fluctuate. Brook Trout (soon to be listed state Special Concern) are rarely encountered, with never more than a few individuals. This section is stocked by NJDFW in both the spring and fall, and periodically privately stocked. Prior to 2014, this section was regulated as a Year Round Trout Conservation Area (TCA) (1 trout per day greater than 15 inches). The *Catch and Release* (*C&R*) regulations went into effect in 2014. The popularity of the Ken Lockwood Gorge has warranted NJDFW to monitor the fish assemblage in this area very closely over the years, with electrofishing surveys conducted at 2 established locations during the summers of 2006, 2007, 2013, 2015, and 2016. (Federal Grant F-48-R, Project I) (Crouse)

Bureau of Freshwater Fisheries Electrofishing Survey conducted in the Ken Lockwood Gorge Wildlife Management Area during the summer of 2006.

Routine survey locations are referred to as "the boulder field" in the upper section and "below the trestle" towards the middle of the Ken Lockwood Gorge. A summary of results is found in the table below and Appendix A (pages A53-A54). Surveys conducted since 2006 at the boulder field will be discussed first. 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 of almost exclusively wild fish. 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 increased (6, 11, 13, 139, 111).

The second of two survey locations is located below the railroad trestle in the middle of the KLG. Results from this location are similar to the boulder field site previously discussed. Over the last five sampling events since 2006, the total number of trout 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 of wild fish. Their numbers were trending upward (43, 29, 97) until the last two years in which 24 and 14 were caught. As with the boulder field site, when broken down by species, the greatest difference noted is in regards to Rainbow Trout, which have generally increased (3, 12, 37, 221, 68) over previous years.

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, since under both regulations these trout must be released. The number of trout over 9 inches has generally increased at the boulder field (25, 43, 40, 149, 120) and below the trestle (29, 39, 109, 231, 74), which meets 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.

Electrofishing locations within the Ken Lockwood Gorge from 2006 – 2016.

Year	Water Temp	Total Trout	Brook Trout		Brown Trout		Rainbow Trout	
			Wild	Stocked	Wild	Stocked	Wild	Stocked
Boulder Field (page A53)								
2006*	13.7°C (56.7°F)	49	2		41		6	
2007*	18.9°C (66.0°F)	73	18		44		11	
2013	19.8°C (67.6°F)	70		2	54	1	2	11
2015	25.0°C (77.0°F)	168	1		26	2	2	137
2016	20.6°C (69.1°F)	156	1		38		4	113
Below Trestle (page A54)								
2006*	13.7°C (56.7°F)	47	1		43		3	
2007*	18.9°C (66.0°F)	53	12		29		12	
2013**	18.4°C (65.1°F)	144 **		9	84	13		37
2015	22.8°C (73.0°F)	245	1		17	7		221
2016	19.6°C (67.3°F)	83	0	0	14	1		68

* Wild and stocked trout were not adequately differentiated during the 2006 and 2007 surveys.
** One wild Tiger Trout (Brook Trout X Brown Trout) was collected at this site.

In recent years, anglers have caught (and released) several stocked trout (as opposed to wild trout) with external lesions, in addition to several more collected by NJDFW staff, that were confirmed to have Furunculosis, a disease caused by the bacterium *Aeromonas salmonicida*. Stressful conditions persist in this section of the South Branch of the Raritan River during summer months and are exacerbated during drought conditions recently experienced. A high density of stocked trout (as seen in 2015 and 2016) does not help the situation. Concern for the sustainability (balance of wild trout to stocked trout and the possibility for disease outbreak) for this important fishery requires routine surveillance and management action.

Year Round Trout Conservation Area Assessment

South Branch of the Raritan River- 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* (1 trout greater than 15 inches / day and artificial lures only) regulations. This specially regulated area is less popular than many others, likely due to several factors, including proximity to parking areas and a lack of trout stocking. Ironically, the Claremont Stretch typically holds more trout than any other location. This year, two sites that are routinely monitored every few years (ie. 1998, 2001, 2006, 2007, 2013, 2016) were surveyed. The two locations are referred to as "the old stocking point" (upper end) and the "fiber optic crossing" (lower end). The most noteworthy finding is that the once abundant Brook Trout population (soon to be listed state Special Concern) seems to be declining. (Federal Grant F-48-R, Project I) (Crouse)

Data from the old stocking point indicates the total number of Brook Trout 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 were extremely abundant (n=746), indicating a stressed system.

Data from the fiber optic crossing is similar, as 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 of 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 to 13. Slimy Sculpin (soon to be listed state Threatened) numbers (n=108) are within the range of the previous five surveys (21-220). As with the previous survey location, White Suckers were abundant.

Claremont Stretch fiber optic crossing.

Water temperature was also elevated at both locations (23.4℃ and 20.3℃). River conditions since fall of 2015 have been stressful, as rainfall and subsequent flows have been very low. The decline in the fishery may also be due to a change in habitat. As the number and depth of pools have decreased at various locations in the upper section of this river as sand and other fine particles have increased in abundance. Recent habitat assessments indicate increasing percentages of sand and silt in the channel than those previously observed. The decline of this trout fishery is of concern and is believed to be related to habitat degradation, and subsequently exacerbated by drought conditions. Due to the presence of two species soon to be designated state Special Concern (Brook Trout and American Brook Lamprey) and another species soon to be listed as state Threatened (Slimy Sculpin) populations and habitats within the Claremont stretch should continue to be monitored. A summary of results is found in Appendix A (pages A51 - A52)

Inventory of Trout Production Streams

Waters used by trout for spawning and nursery areas are classified as *Trout Production* under the state's Surface Water Quality Standards. New Jersey has nearly 200 *Trout Production* streams and most of these are small tributaries and headwaters of larger rivers in the northern part of the state. Wild, naturally reproducing trout are important indicators of healthy ecosystems, requiring superior water quality and pristine habitat. Despite the protection that state regulatory programs afford *Trout Production* waters, ongoing changes in land use have impacted these coldwater fisheries populations. In particular, wild Brook Trout, New Jersey's only native trout species, have declined dramatically over the last century due to land use changes which have affected the quality of their habitat. Documenting the status of wild Brook Trout in New Jersey is important as this species will soon be designated state Special Concern.

Trout Production streams are monitored periodically to assess the status of their naturally reproducing trout populations (once every 20 years, or more frequently if wild Brook Trout were present or if regulated as a *Wild Trout Stream*). Surveys are conducted using established protocols which include electrofishing a 150 m reach, physicochemical measurements, and the EPA Rapid Bioassessment for habitat (with regional modifications) (Barbour et al. 1999) (Appendices C and D). The data collected through these surveys are evaluated to determine if population changes have occurred and are used in the development management strategies and fishing regulations to protect this fragile resource. The data are also used by the Eastern Brook Trout Joint Venture (a National Fish Habitat Partnership) as part of a range wide effort to conserve and manage Brook Trout in the eastern U.S. (Federal Grant F-48-R, Project I)

In 2016 a total of six surveys were conducted on five *Trout Production* streams in the Upper Delaware/Wallkill watershed at (or near) locations that had been surveyed in the past (see table below). These surveys can be summarized as follows:

- All five streams had wild trout, though one of two surveys conducted on the Little Flat Brook did not yield wild trout.
- 2 small tributary streams in the Flat Brook drainage, Tillman Brook and Big Flat Brook (trib.) (Lake Ashroe), continued to support populations of wild Brook Trout.
- Wild Brook Trout were documented for the first time in the Little Flat Brook near its confluence with the Big Flat Brook.
- Wild Brook Trout were not found in surveys conducted on Shawanni Creek and Black Creek (trib.) (McAfee), despite having been present in previous surveys conducted at the same locations in 2005. Only wild Brown Trout were detected in these two streams in 2016.

Results of six electrofishing surveys conducted on five streams in New Jersey during 2016 as part of a monitoring program for streams classified as *Trout Production*. An "*" following the species name indicates that only older than young-of-the-year trout were found and these were considered wild (not stocked) based upon a visual assessment of fin wear.

	2016			Prior to 2016	
Stream (County) and location	Survey date	Reproducing trout species	Results page #	Survey date	Reproducing trout species
Upper Delaware (North) & Wallkill watersheds					
Big Flat Brook (trib.) (Lk Ashroe) (Sussex) Brook Road bridge	7/1/16	Brook	A5	7/28/05	Brook
Black Creek (trib.) (McAfee) (Sussex) Rt. 517 bridge	8/26/16	Brown*	A6	7/26/05 7/29/70	Brook & Brown* Brook & Brown
Little Flat Brook (Sussex) Layton-Hainesville Road	8/9/16	Brook	A11	8/18/88 9/12/69	none none
Little Flat Brook (Sussex) Near confluence w Big Flat Brook	8/9/16	none	A12	8/18/88	Brown
Shawanni Creek (Sussex) Mountain Road bridge	7/29/16	Brown*	A18	8/19/05 8/11/70	Brook* Brook & Brown*
Tillman Brook (Sussex) Tillman Road	7/29/16	Brook	A20	8/19/05	Brook

Lake Trout Population Assessment

Lake Trout (*Salvelinus namaycush*) fisheries exist in two waterbodies within New Jersey, Round Valley Reservoir and Merrill Creek Reservoir. Although stocked for years, the Lake Trout populations in these two reservoirs are now entirely supported by natural reproduction and are no longer stocked by NJDFW's Hackettstown State Fish Hatchery. Surplus Lake Trout were periodically stocked into Monksville Reservoir from 2004 - 2012, however it did not develop into a significant fishery. As a result, Lake Trout are no longer stocked in NJ.

Round Valley Reservoir- The Lake Trout population in Round Valley Reservoir is closely monitored by NJDFW to evaluate the status of this trophy trout fishery. Lake Trout reared at the Hackettstown State Fish Hatchery were stocked in this deep reservoir (maximum depth 160 feet) from 1977 until 1995. In 1985, evidence that natural reproduction was occurring within the reservoir was documented. By 1995 it was determined that the population was capable of maintaining itself by natural reproduction, thus stocking was discontinued. Gill net surveys are conducted every fall, when mature Lake Trout seek out suitable spawning habitat along the boulders lining the reservoir's dams. Eight experimental gill nets, each net with varying mesh size openings, are used to capture a range of Lake Trout from juveniles to sub-adults. These nets are set at consistent locations in approximately 70 – 100 ft. of water. Eight additional large-mesh gill nets (6" stretch mesh) are set near the reservoir's north and south dams to capture mature Lake Trout as they begin congregating to spawn over the rocky substrate in approximately 50 ft. of water. Length and weight data are collected to assess physical condition of the fish using relative weight analysis. In addition, sex, fin clips, and sexual development information are also recorded. (Federal Grant F-48-R, Project I) (Crouse)

In 2016, large-mesh gill nets set overnight and retrieved on 11/15/16 and 11/16/16, resulted in the capture of 96 Lake Trout ranging from sub-adults to adults. Combined with 61 juveniles to sub-adults captured with experimental gill nets on 10/25/16 and 10/26/16, the 157 Lake Trout is average for surveys conducted since 2006. The majority of the Lake Trout (153 of 157) were less than 24 inches. The number of Lake Trout encountered during our monitoring program over 25 inches has steadily declined since 1996. During the mid-1990's more than 40 individual fish over 25 inches were documented. That number has decreased to single digits in recent years (see figure below).

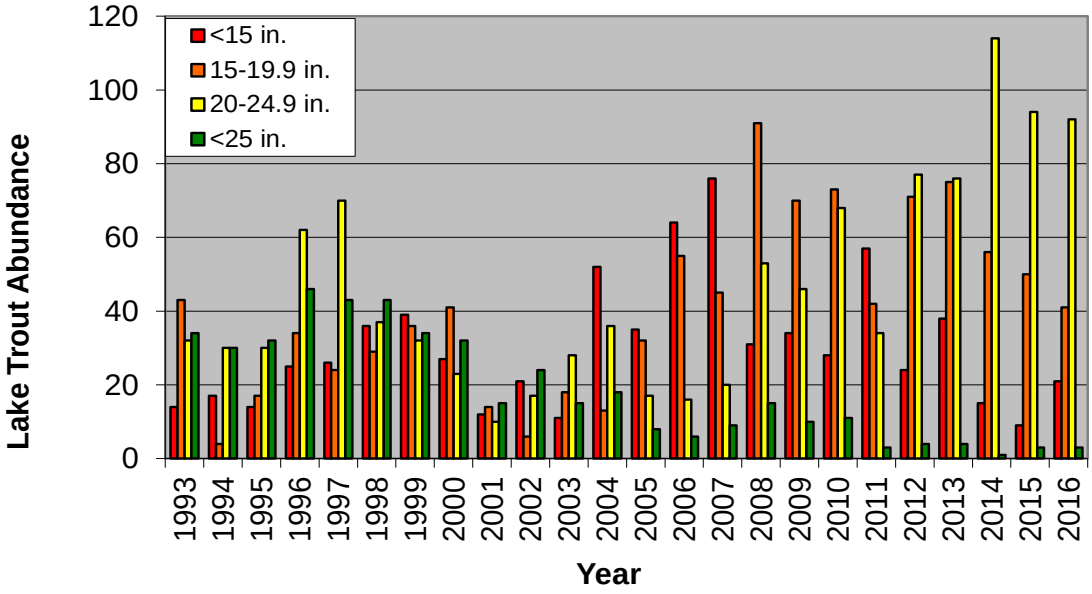
The largest Lake Trout collected during the 2016 RVR gill net surveys was this 21.2-lb. male

Unfortunately, the trend of decreasing numbers of large Lake Trout is resulting in a less-desirable trophy Lake Trout fishery. 2014 was the first year no Lake Trout over 30 inches or over ten pounds were caught, however two large Lake Trout were caught in both 2015 and 2016. The largest in 2016 was a male measuring 38.0 in. and weighing 21.2 lbs. (see photo above). Two additional noteworthy fish included a female measuring 30.7 in. and 11.9 lbs. and a male at 29.6 in. and 9.9 lbs.

In 2008 and then again in 2012, the regulations were modified to increase harvest, aiming to reduce competition and facilitate better condition and faster growth. This management strategy seems to have worked, as the number of Lake Trout from 15 to 20 inches has declined, while those from 20 to 25 inches have increased (see figure below). NJDFW plans to continue to encourage the harvest of Lake Trout from 15 to 24 inches with the intention of

achieving a more desirable trophy fishery. Despite few individuals reaching trophy proportions, the Lake Trout population is doing well. Data will be analyzed and compared to Lake Trout data collected in previous years.

Number of Lake Trout captured (by size) during annual gill net surveys at Round Valley Reservoir since 1993.



Round Valley Reservoir Salmonid Diet Study – In order to better understand the composition of trout diets in Round Valley Reservoir, NJDFW utilizes several methods of obtaining dietary data, including the examination of moribund Lake Trout captured during gill net monitoring and Round Valley Trout Association collection of trout stomachs from monthly tournaments. The primary purpose was to determine if the contribution of baitfish (primarily Alewives and Golden Shiners) in the diet of Rainbow, Brown, and Lake Trout. Interesting observations this year include the partially digested Rainbow Trout (12.8 inches) submitted from an angler who caught a 35-inch, 18.1-pound Lake Trout (see photo above). Another interesting observation is an increasing number of Lake Trout with a variety of small sunfish species in their stomachs, as compared to previous years. In fact, twelve trout had greater than 10 sunfish, with the most abundant coming from a 19-inch Lake Trout with 162 sunfish in its stomach (see photo to left). The data are used, in conjunction with other measures, to determine the status of the forage in the reservoir.

Merrill Creek Reservoir- Merrill Creek Reservoir is a 650-acre privately-owned reservoir located in Harmony Twp., Warren County that is open to public fishing. Following construction and filling in 1988, a variety of fish species have been stocked in this deep-water reservoir (200 ft deep) by NJDFW to establish and maintain desirable sport fisheries for Smallmouth Bass as well as Rainbow, Brown, and Lake Trout. The reservoir's fishery is managed by the Merrill Creek Owners Group in cooperation with Fish and Wildlife. This team meets annually to review and discuss fisheries data collected by the owner and their consultant, and to make management decisions. In recent years, Lake Trout have been the primary management focus and the owner's consultant annually monitors the Lake Trout population in the fall using gill nets. When the gill net survey data indicated that Lake Trout were naturally reproducing in the reservoir, stocking of this species was discontinued in 2013. (Federal Grant F-48-R, Project I) (Hamilton)

In 2016, to supplement fisheries data collected by the owners' fisheries consultant, the Bureau of Freshwater Fisheries deployed four experimental gill nets overnight (11/9/16 through 11/10/16) to target small Lake Trout. A total of 25 fish were captured, representing 3 species (Lake Trout, Yellow Perch, and Alewife). Only 18 Lake Trout were captured, compared to 20 in 2015 and 27 in 2014. The Lake Trout captured in the 2016 survey ranged in size from 202 – 629 mm (8.9 – 24.8 in). The largest laker weighed 4.8 kg (10.7 lbs). Four larger Lake Trout, size range 447 – 629 mm (17.6 – 24.8 in) were fin clipped which indicates that they were stocked (hatchery origin). The remaining 12 lakers captured, size range 202 – 620 mm (8.0 - 24.8 in) were not fin-clipped and these are generally considered to be the product of natural reproduction.

10.7 lb. Lake Trout from Merrill Creek Reservoir held by Charlie Dix of Normandeau Associates (2015)

Landlocked Salmon

Only a handful of deep lakes in New Jersey have suitable year round habitat for coldwater fish like trout and salmon. Landlocked Salmon (lake dwelling form of Atlantic Salmon *Salmo salar*) prefer water temperatures less than 21°C (70°F) and dissolved oxygen levels greater than 5 mg/L, but can withstand warmer, less oxygenated water conditions for short periods. Although not native to New Jersey, Landlocked Salmon were stocked in several NJ waters over a half-century ago, and the historical state record for Landlocked Salmon is an 8-pound fish caught from Lake Aeroflex in 1951.

In 2006, Fish and Wildlife began stocking Landlocked Salmon into two north Jersey lakes, Lake Wawayanda and Lake Aeroflex (Sussex), to provide anglers with an opportunity to fish for this unique coldwater sport fish close to home. The salmon stocked are surplus fish provided by Massachusetts Division of Fisheries and Wildlife in exchange for surplus Northern Pike from the Hackettstown State Fish Hatchery.

From 2006-2013, spring yearling salmon at about 200 mm (8 in) were stocked each May in lakes Wawayanda and Aeroflex immediately upon their arrival from Massachusetts. In 2013 the Hackettstown State Fish Hatchery began retaining some of salmon for 4-11 months and growing them to a much larger size (300-500 mm or 12-20 inches) before stocking. In 2014 Tilcon Lake (Morris) was added to the salmon stocking program. Our ability to stock salmon at a larger size has been making a big difference in both angler interest and angling success.

Tilcon Lake salmon stocking yields immediate results

No assessment activity was reported on this project for 2016. (Hunter and Angler Fund)

Stream Temperature Monitoring

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 is renewed annually. (Federal Grant F-48-R, Project I) (Collenburg)

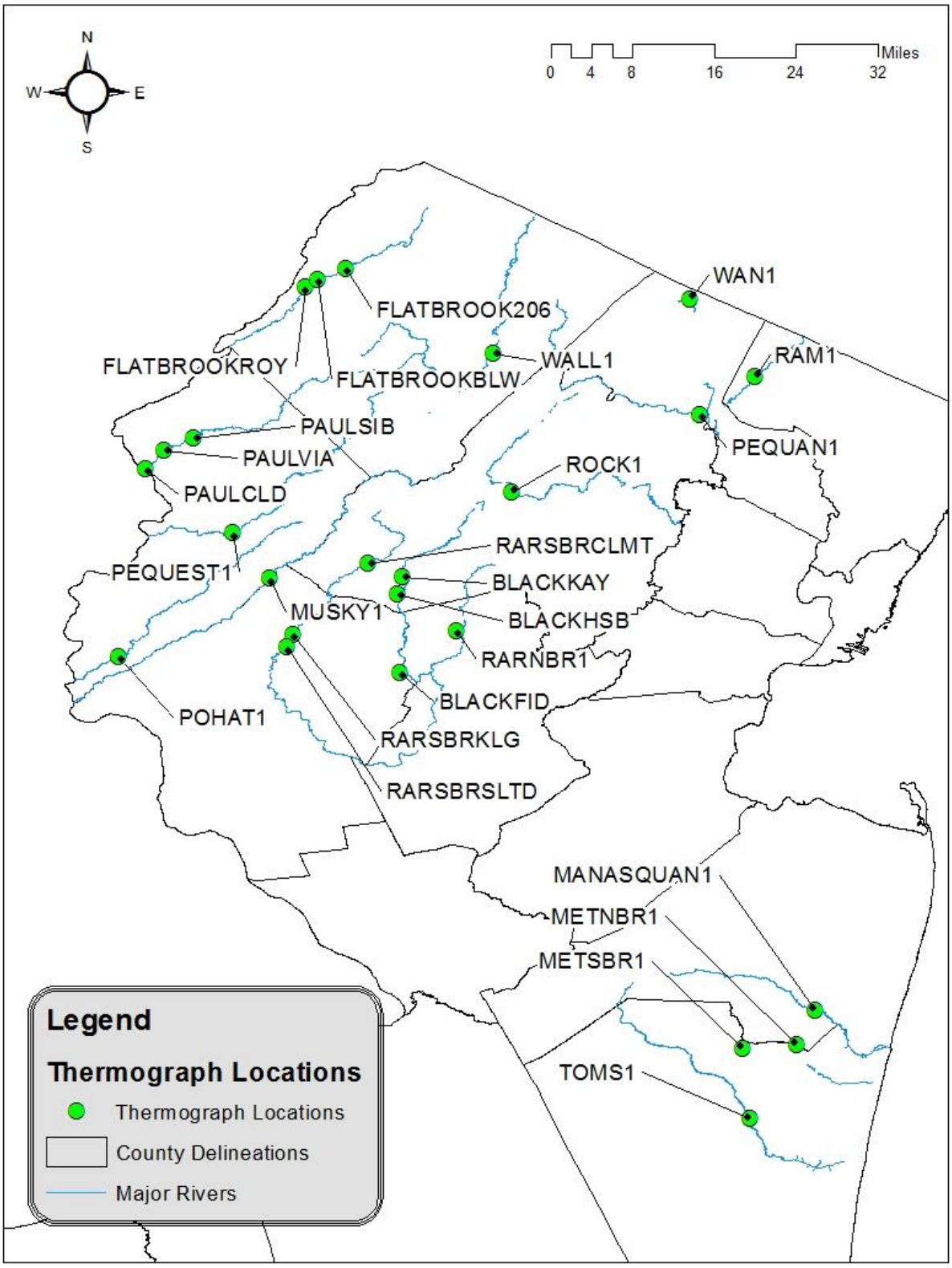
The Black River in Hacklebarney State Park

In 2016 water temperature was monitored at 39 sites (see table and figure below). 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. For full report, see Appendix E.

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

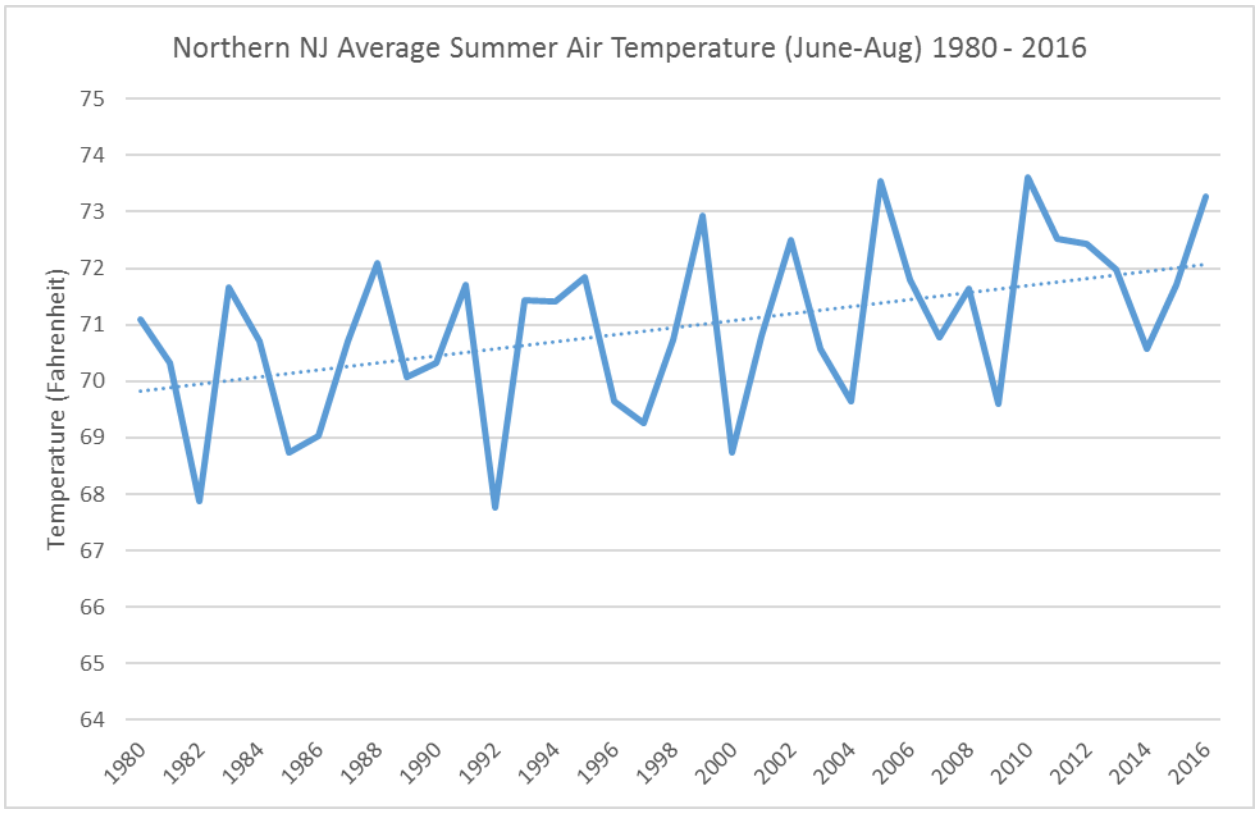
Stream	Site ID	Surface Water Classification	Monitoring Type
Black River	BLACKHSB	Trout Maintenance	water
Black River	BLACKKAY	Trout Maintenance	water
Black River	BLACKFID	Non-Trout	water
Big Flat Brook	FLATBROOK206	Trout Production	water
Big Flat Brook	FLATBROOKBLW	Trout Production	water
Flat Brook	FLATBROOKROY	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.



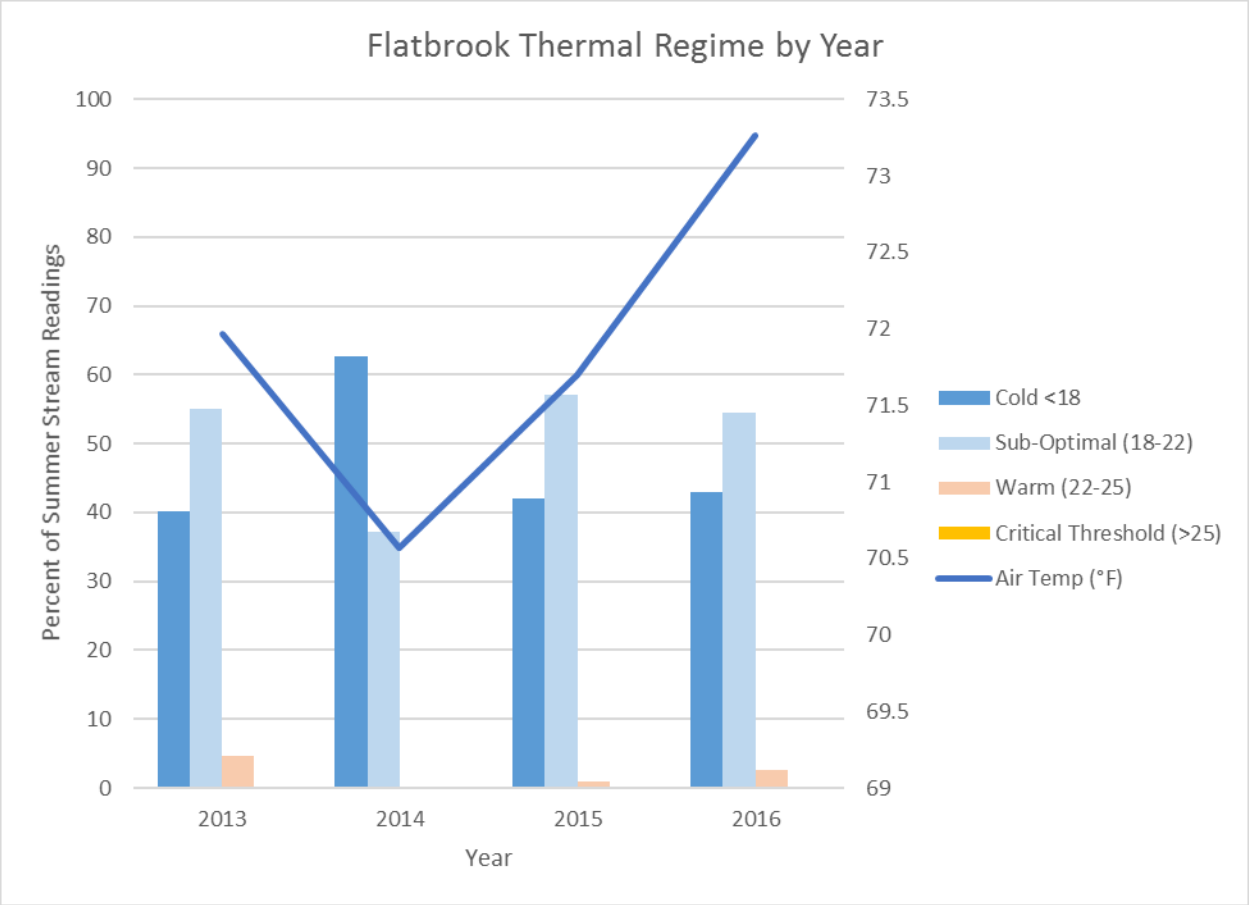
Locations of continuous stream temperature logger sites maintained by NJDFW in 2016 on recreationally important trout-stocked streams.

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 (see figure below).



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 (see figure below).



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 (see figure below).

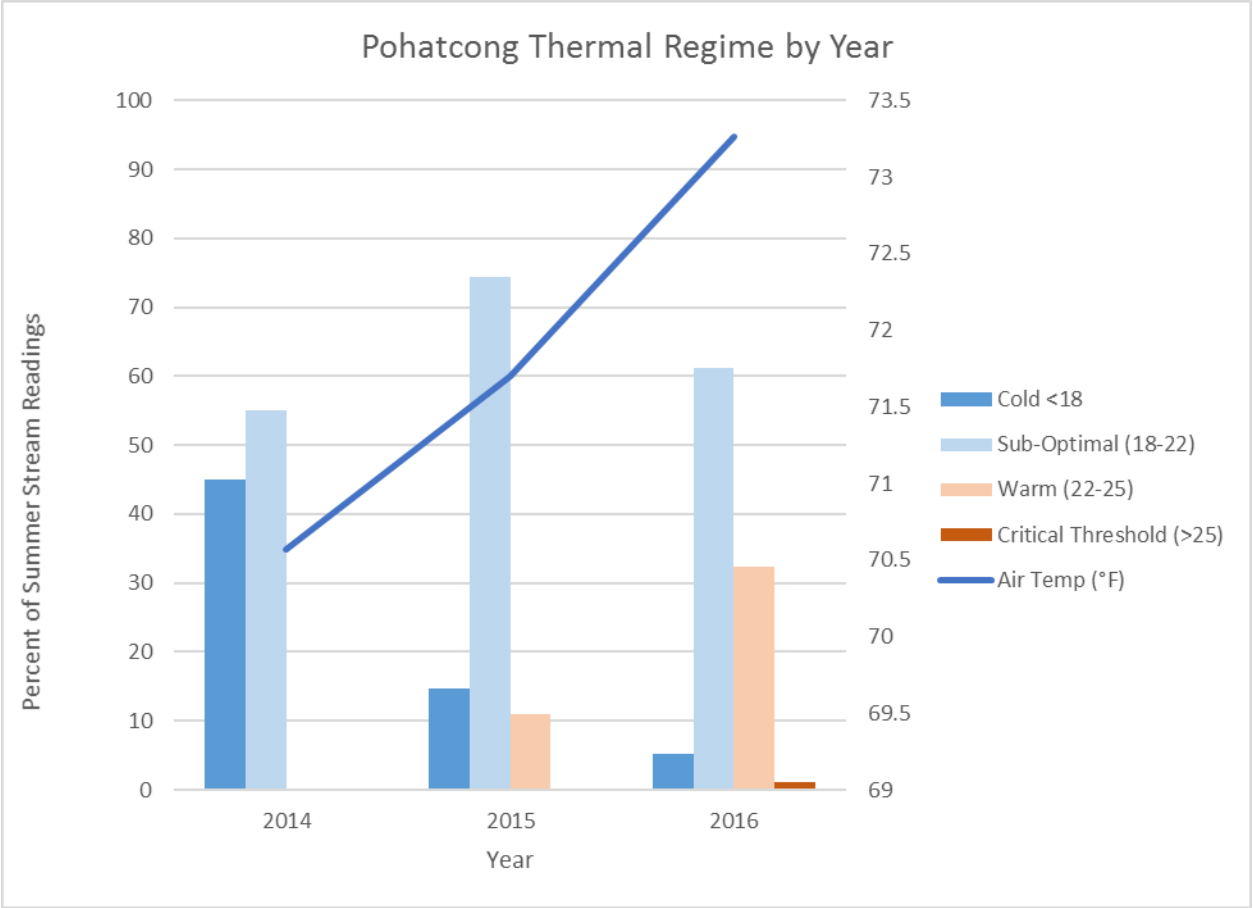


Figure. Pohatcong Creek's thermal regime from 2014-2016 compared to average summer air temperature data for northern New Jersey.

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.

Temperature Monitoring on Trout Production Streams

Due to continued human impacts, we know that unprotected habitats that are currently marginal for fish survival, in both space and time, will continue to degrade in temperature, flows, and other stream characteristics, and will exceed biological tolerances of sensitive species such as trout. Whether the causative factors of these abiotic responses are induced from climatic forces or from a localized disturbance, the necessity to monitor these changes closely is driven by their tendency to be subtle and virtually invisible unless monitored closely. Background data from stream temperature monitoring established in 2013 by NJDFW and fisheries surveys done in close proximity to temperature monitoring sites resulted in the following observations:

- Streams experiencing the coldest temperatures during trout egg incubation (i.e. Flat Brook) have low wild trout recruitment.
  Note: Emergence times are delayed by cold winter stream temperatures, which may have led to low survival of wild trout (less time/slow growth, more subjected to redd scour from spring flows)
- *Trout Production* streams with higher Growing Degree Days (GDD) had better recruitment (slightly warmer streams).

These observations suggested the next steps to determine the limiting factors of recruitment of trout in New Jersey and if metrics could be developed for use in the monitoring of stream temperatures and in management of *Trout Production* streams.

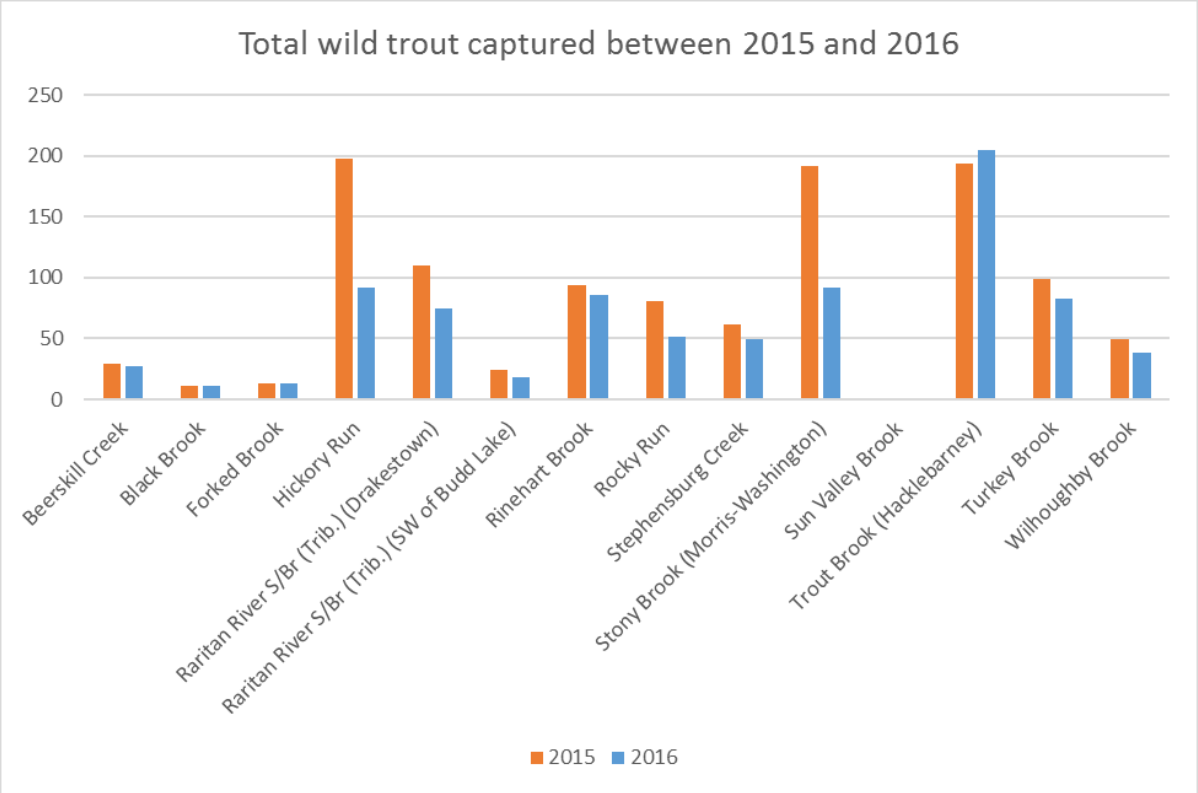
2015 marked the beginning of a three-year study to collect year-round continuous stream temperature data on wild *Trout Production* streams and assess their naturally reproducing trout populations. This study was initiated because excessively cold fall and winter temperatures (approaching 0°C) limit wild trout recruitment via late emergence and slow growth. The study was designed and fourteen *Trout Production* streams were picked, based on location (i.e. watershed, proximity to our office) and on population structure (struggling or well established trout populations) to help investigate this. On these streams, three years of year-round stream temperature monitoring and electrofishing surveys in these same locations will be conducted. The ultimate goals of the study are multi-faceted: (1) to develop a year to year analysis of how stream temperature is influencing New Jersey's wild trout populations, (2) submit data to NJDEP to determine if any streams qualify as part of 303(d) list, and (3) to develop metrics based on GDD, an understanding of emergence times, critical summer time temperatures, fall/winter/spring temperatures, and/or aerobic scope curves that can guide us in determining what streams are the best candidates for possible translocations.

Starting in the spring of 2015, 14 Trout Production streams were selected and stream temperature monitoring devices were placed. The fourteen streams include: Beerskill Creek, Black Brook, Forked Brook, Hickory Run, Raritan River S/Br. (Trib.)(Drakestown), Raritan River S/Br. (Trib.)(SW of Budd Lake), Rinehart Brook, Rocky Run, Stephensburg Brook, Stony Brook (Morris-Washington), Sun Valley Brook, Trout Brook (Hacklebarney), Turkey Brook, and Willoughby Brook. Subsequently, in the summer of 2015 and 2016, backpack stream electrofishing surveys were conducted on these streams following EPA bioassessment

protocols to determine abundance and sizes of wild trout present. A full report will be provided at the end of the study period.

The year 2016 was warm for this region. Summer air temperatures taken from Rutgers University NJ state climatologist dataset (nClimDiv) depict this, and since 1895, this was the warmest month of August recorded. This trend is expected to continue in the decades to come as greenhouse gas concentrations continue to increase. Not only did warm temperatures test the resilience of wild trout streams this summer, low flows and drought conditions presented themselves as well. As habitat becomes limited by lack of water and stream temperatures influenced by climatic forcing increase, the poikilothermic ectotherm trout either adjusts and finds thermal refuge or is limited within the space they are contained and struggle against sub-optimal conditions. The effect that conditions this summer and fall have on the recruitment and survivability of these populations will be evaluated. Data collected on fourteen streams in 2015 and 2016 have shown that total population abundance has decreased in 10 out of 14 streams, 3 showed no change, and one showed an increase (see figure below).

Total number of trout captured from stream temperature study sites between 2015 and 2016.



Trout Stocking Allocations

NJDFW's Bureau of Freshwater Fisheries annually determines which waterbodies and how many trout per waterbody to be stocked statewide. The allocation methodology uses a combination of biological, physical, and social factors to equitably allocate trout over a 10-week period in the spring, 2-week period in the fall, and 1-week period in the winter. A computerized database containing variables for each stream, lake, and pond is used in conjunction with a formula to calculate individual weekly allotments of trout. The database is annually reviewed and updated by biologists. (Hunter and Angler Fund) (Shramko)

Beginning in the spring of 2015 and continued into 2016, all of the fish stocked from the Pequest Trout Hatchery were Rainbow Trout only. In 2014, the Pequest Trout Hatchery had a serious Furunculosis outbreak occur that affected mostly Brook Trout and Brown Trout. Rainbow Trout in the hatchery showed a higher resistance to this Furunculosis outbreak. In an attempt to rid the hatchery of the Furunculosis bacterium, it was decided to raise only the more disease resistant Rainbow Trout out of the Pequest Hatchery for at least the next couple of years.

There were no changes to the Trout Formula methodology used to determine 2016 spring trout allocations. A spring baseline of 570,000 trout continues to be used to determine individual weekly allocations. Significant allocation changes for individual waterbodies are listed below.

Waterbodies dropped from Trout Stocking Program:

Hamilton Fire Pond (Monmouth Co.) Hamilton Fire Pond is a privately owned pond in Monmouth County. The property owners allowed fishing in the pond for years, but have decided to not allow fishing. Therefore, Hamilton Fire Pond has been dropped from the 2016 Trout Stocking Program.

Trout Brook (Hackettstown – Warren Co.) Trout Brook in Hackettstown, Warren County has had very low angler interest and usage for several years. In 2012, the opening day angler count did not record any anglers fishing it at all. Due to low angler usage, Trout Brook in Hackettstown, Warren County has been dropped from the Trout Stocking Program

Stream Mileage Updates:

Stocking locations for streams and rivers are ever changing. For example, when ownership of the land along a trout stocked stream changes, stocking locations may be gained or lost from the trout stocking program. This can affect the total stream stocking mileage used to determine trout allocations, and may result in more or less trout stocked in a particular stream. In addition to the adding or dropping of stocking locations, general stream mile database corrections occur due to continued communication with the Land Management Staff and the use of GIS mapping to assess stream mileage of trout stocked sections.

Little Flat Brook (Sussex Co) The Little Flat Brook trout stocking stream mileage was reduced from 3.7 miles to 2.7 miles due to the loss of a two stocking locations and recalculation of the total stream mileage based upon the remaining stocking locations. This 1-mile reduction results in a decrease of 850 fish in 2016.

Pohatcong Creek (above rt. 31) (Warren Co) The Pohatcong Creek (above Rt. 31) trout stocking stream mileage was reduced from 2.0 miles to 1.75 miles due to the loss of a stocking location and recalculation of the total stream mileage based upon the remaining stocking locations. This 0.25-mile reduction results in a decrease of 110 fish in 2016.

A summary of trout stocked from NJDFW's Pequest Trout Hatchery during 2016, by season and species, is found in the table below.

Spring 2016 Trout Stocking Summary				
Species	Type	Avg. Length	Lbs.	# Fish
Rainbow Trout	Production	11.3"	308,637	605,030
	Broodstock	15.5" & 22.2"	14,592	6,425
		Totals	**323,229**	**611,455**
Fall 2016 Trout Stocking Summary				
Species	Type	Avg. Length	Lbs.	# Fish
Rainbow Trout	Production	14.7"	30,125	20,770
	Broodstock	20.1"	3,060	765
		Totals	**33,185**	**21,535**
Winter 2016 Trout Stocked Lakes Program Summary				
Species	Type	Avg. Length	Lbs.	# Fish
Rainbow Trout	Production	14.6"	7,262	5,100
		Totals	**7,262**	**5,100**

In addition to the above stocking changes, there were also changes to the Fall and Winter Trout Stocking Programs this year. In 2016, the NJDFW expanded the fall trout fishing opportunities to a few more waterbodies. Stocking of the following six waterbodies were moved up several weeks from the Winter Program and are now be part of the Fall Trout Stocking Program: **Hook's Creek Lake, Lower Echo Park Pond, Mill Pond, Speedwell Lake, Verona Park Lake, and Woodcliff Lake**. As part of the Winter Program, these waterbodies were stocked in late November and most years it would only be a few weeks before ice would form on the surface of these lakes. For ice fisherman this is a perfect scenario as it would not be too long before the ice is thick enough to safely access the waterbody. Unfortunately, the owners of these six waterbodies do not allow ice fishing. This creates a problem as the fish are only accessible to anglers for a short time before the ice forms on the lakes. By incorporating these lakes into the fall stocking program, anglers now have several more weeks of additional angling opportunities on these waters.

A stocking allocation formula was also developed for the Fall and Winter Stocking Programs. This allocation formula uses metrics such as size of waterbody, length of stocked area in a stream, waterbody ownership, angler accessibility, angler interest, human population density of surrounding area, and ice fishing opportunities. All of these metrics are the same metrics that are used in the spring trout stocking program with the addition of the ice fishing metric. This change in allocation protocol resulted in minor individual waterbody allocations changes

Wild Brook Trout Assessment

Anthropogenic landscape changes and past management practices have negatively impacted New Jersey's freshwater resources, particularly Brook Trout, the state's only native trout species. Of the three species of trout that reproduce in New Jersey streams, Brook Trout are the least tolerant of habitat degradation. Habitat alteration and stream fragmentation, diminished water quality, and competition with non-native trout (Brown and Rainbow Trout) have contributed to the decline of wild Brook Trout in New Jersey. Wild populations of Brook Trout now persist in less than half their original range in New Jersey and this species will soon be designated state Special Concern.

NJDFW actively participates in the Eastern Brook Trout Joint Venture (EBTJV), a unique partnership initiated in 2004 under the National Fish Habitat Initiative (*www.fishhabitat.org*). EBTJV is a geographically focused, locally driven, and scientifically based effort to protect, restore, and enhance aquatic habitat throughout the range of the eastern Brook Trout. The Venture has produced a range-wide population assessment of wild Brook Trout; completed extensive work that identifies key threats to wild Brook Trout and their habitats; and developed conservation strategies to protect, enhance and restore wild Brook Trout. EBTJV has recently completed refining the subwatershed status map to the catchment scale and NJDFW conducts surveys to assess the status of Brook Trout in catchments that lack survey data. This data, as well as data from stream surveys conducted as part of other activities, is entered into FishTrack (NJDFW's computerized freshwater fisheries database) and shared with the EBTJV. (Federal F-48-R, Project I) (Hamilton)

In 2016 a total of 113 stream surveys conducted under a variety of jobs and/or funding sources provided data that can be used to document the occurrence of wild Brook Trout. Of these, 22 surveys were specifically initiated to determine if known wild Brook Trout populations had been extirpated or if wild Brook Trout might be present in stream catchments not previously surveyed (location selection based upon factors such as suspected presence in catchment upstream of a catchment having wild Brown or Rainbow Trout, general topography, and aerial photography). At 5 of the 22 sites the stream could not be electrofished due to the lack of water.

Wild Brook Trout from Barkers Mill Brook

The status of wild Brook Trout in these stream surveys is summarized below and followed by a table that lists the surveys conducted in 2016 with presence/absence of wild trout species indicated.

- 34 streams (63 surveys) documented the presence of wild trout (Brook, Brown, and/or Rainbow Trout).
- 25 streams (48 surveys) had wild Brook Trout. The wild trout species composition in these streams was: 16 had only Brook Trout, 7 had both Brook and Brown Trout, and 2 had Brook, Brown, and Rainbow Trout.

- 2 streams never before surveyed were inhabited by wild Brook Trout (Musconetcong River (trib.) (NW of Stephensburg) and Musconetcong River (trib.) (S of Asbury)). The S of Asbury tributary also had wild Brown Trout.
- Brook Trout was documented for the first time in the mainstems of 2 streams already classified as *Trout Production* - Buckhorn Creek and Little Flat Brook. Only wild Brown Trout had been previously documented in their mainstems.
- 5 streams, where past surveys documented the presence of wild Brook Trout, did not yield any wild Brook Trout. These streams are Black Brook (trib.) (McAfee), Shawanni Creek, Cresskill Brook, Black Brook, and Rinehart Brook.
- 18 streams (36 surveys) documented wild Brown Trout.
- 3 streams (6 surveys) documented wild Rainbow Trout.

Presence/absence of wild trout species in 113 stream surveys conducted during 2016, listed by major watershed (BKT= Brook Trout; BNT=Brown Trout; RBT=Rainbow Trout). Streams specifically surveyed to assess wild Brook Trout are boldfaced. Streams were surveyed using the standard sampling protocol (150 m stretch electrofished) unless noted by "+". *WTS* indicates the stream was regulated as a *Wild Trout Stream* in 2016. A trout species was considered wild when young-of-the-year fish were present ("X"). When only trout considered older than young-of-the-year were present, fin wear and erosion was used to distinguish between wild fish ("X*****") and fish of hatchery origin. Boldfaced "**X**" denotes new finding of wild Brook Trout.

Stream	County	Location	Wild trout species			Results
			BKT	BNT	RBT	page #
Upper Delaware (North) & Wallkill Region *(Shimers Brook to Paulins Kill and Wallkill River watersheds)*						
Beerskill Creek	Sussex	Cemetery Road	X			A1
Big Flat Brook	Sussex	Between Rt. 206 and Rt. 560	X*			A2
Big Flat Brook +	Sussex	Below Rt. 560 to near Rt. 206 (6 surveys)	X	X*	X	24
Big Flat Brook	Sussex	Downstream of Rt. 560				A3
Big Flat Brook	Sussex	Upstream Blewett Tract (St #1)	X*			A4
Big Flat Brook (trib.) (Lk Ashroe)	Sussex	Brook Road	X			A5
Black Creek (trib.)(McAfee)	Sussex	Rt. 517		X*		A6
Black Creek (trib.) (McAfee)	Sussex	Golf club access road		X*		A7
Black Creek (trib.) (McAfee) +	Sussex	Golf club water treatment area		X*		A8
Flat Brook	Sussex	Three Bridges (Flatbrook WMA)	X*			A9
Forked Brook	Sussex	Grau Road	X			A10
Little Flat Brook	Sussex	Layton-Hainesville Road	**X***			A11
Little Flat Brook +	Sussex	Layton-Hainesville Road				106
Little Flat Brook	Sussex	Near confluence w Big Flat Bk				A12
Mud Pond Outlet Stream +	Sussex	Mountain Road	X*			A13
Paulins Kill +	Warren	Rt. 94 – off Paulins Kill Trail				A14
Paulins Kill +	Warren	Lambert Rd. Bridge				A15
Paulins Kill +	Warren	Below Columbia Lake Dam (5 surveys)				100
Paulins Kill +	Warren	Rt. 46				A16
Shawanni Creek	Sussex	Strubble (Dimon) Road				A17
Shawanni Creek	Sussex	Mountain Road		X*		A18
Sparta Glen Brook	Sussex	Rt. 620 Sparta Glen Park	X*			A19
Tillman Brook	Sussex	Tillman Road	X			A20

(continued)

Upper Delaware (South) Region						
(Delawanna Creek to Lockatong Creek watersheds)						
Barkers Mill Brook	Warren	Barkers Mill Road bridge	X			A21
Barkers Mill Brook	Warren	Townsbury Road	X			A22
Barkers Mill Brook	Warren	Cemetery Road.	X			A23
Barkers Mill Brook	Warren	Near confluence w Pequest R.	X			A24
Beaver Brook (trib.) (E of Manunka Chunk)	Warren	Upper Sarepta Rd (Beaver Bk WMA)				A25
Buckhorn Creek	Warren	Rt. 519	**X**	X		A26
Buckhorn Creek	Warren	Roxburg Station Road		X		A27
Buckhorn Creek (trib.) (Hutchison) +	Warren	River Road				No water
Buckhorn Creek (trib.) (Roxburg)	Warren	Grist Mill Road		**X**		A28
Buckhorn Creek (trib.) (Summerfield)	Warren	Buckhorn Drive (Buckhorn Creek WMA)	X			A29
Hakihokake Creek	Hunterdon	Bridge Street, downstream of bridge		X		A30
Hakihokake Creek	Hunterdon	Bridge Street, behind library		X		A31
Jacobs Creek	Mercer	Pennington-Titusville Road				A32
Jacobs Creek	Mercer	Bear Tavern Road (Rt.579)				A33
Musconetcong River (trib.) (NW of Stephensburg)	Warren	Heiser Road	**X**			A34
Musconetcong River (trib.) (S. of Asbury)	Hunterdon	River Road	**X**	X*		A35
Musconetcong River (trib.) (W. of Asbury) +	Warren	Bloomsbury Road				A36
Pequest River (trib.) (SE of Shiloh) +	Warren	Shades of Death Road				No water
Pohatcong Creek +	Warren	Municipal Drive		X*		
Stephensburg Brook (WTS)	Morris	Stephensburg Road	X	X		A37
Trout Brook (Hope) (trib.) (Shiloh)	Warren	Shiloh Road				A38
Trout Brook (Hope) (trib.) (Shiloh) +	Warren	4 sites off State Park Road				No water
West Portal Creek +	Hunterdon	13 surveys at multiple locations	X	X	**X***	57,122
Upper Passaic Region						
(Pompton, Pequannock, Wanaque, Ramapo, Upper Passaic, Whippany, & Rockaway River watersheds)						
Whippany River (trib.) (Brookside)	Morris	Stoney Hill Road		X	X	A39
Whippany River (trib.) (W. of Watnong Brook)	Morris	Patriots Path off Inamere Rd				A40
Lower Passaic & Upper Atlantic Region						
(Lower Passaic, Saddle, Hackensack, Pascack, & Elizabeth River watersheds)						
Bear Brook (Park Ridge)	Bergen	Brae Road				A41
Bear Brook (Park Ridge)	Bergen	Laurel Hill/Arrowhead Roads				A42
Bear Brook (Park Ridge)	Bergen	Glendale Road				A43
Cresskill Brook	Bergen	Duck Pond Road				A44
Cresskill Brook	Bergen	Deer Hill Road				A45
Elizabeth River, W/Br +	Union	Threrau Terrace				148
Passaic River +	Morris	Columbia Turnpike, Florham Pk				64
Passaic River +	Essex	Camp Lane boat ramp, Fairfield				64
Passaic River +	Bergen	River Road, Elmwood Park				64

(continued)

		Raritan Region				
		(Raritan River watershed)				
Black Brook (*WTS*)	Hunterdon	Van Syckles Road		X*		A46
Hickory Run (WTS)	Hunterdon	Hickory Run Road	X			A47
Hickory Run (*WTS*)	Hunterdon	High Bridge-Califon Road	X*	X		A48
Millstone River	Somerset	Griggstown Causeway				A49
Millstone River	Somerset	Blackwells Mill Road bridge				A50
Raritan River S/B	Morris	Claremont Stretch (old stocking point)	X	X	X	A51
Raritan River S/B	Morris	Claremont Stretch (Fiber Optic)	X	X		A52
Raritan River S/B	Hunterdon	Ken Lockwood Gorge, Boulder Field	X*	X	X	A53
Raritan River S/B	Hunterdon	Ken Lockwood Gorge, below trestle		X		A54
Raritan River S/B (trib.) (Drakestown)	Morris	Joy Drive	X			A55
Raritan River S/B (trib.) (SW of Budd Lake)	Morris	Rt. 46	X			A56
Rinehart Brook (*WTS*)	Morris	Hacklebarney State Park		X		A57
Rockaway Creek	Hunterdon	Lamington Road				A58
Rockaway Creek, S/Br.	Hunterdon	Off Railroad Avenue				A59
Rockaway Creek, S/Br.	Hunterdon	Rt. 22				A60
Rocky Run (*WTS*)	Hunterdon	Rocky Run Road	X			A61
Stony Brook (WTS)	Morris	Columbia Trail Walking Bridge	X*	X		A62
Sun Valley Brook	Morris	Stedwick Road	X*			A63
Sun Valley Brook	Morris	Wolfe Road	X*			A64
Sun Valley Brook	Morris	Upstream of confluence w Raritan R, S/Br				A65
Trout Brook (*WTS*)	Morris	Hacklebarney State Park	X			A66
Turkey Brook (*WTS*)	Morris	Stephens Mill Road	X	X		A67
Willhoughby Brook (*WTS*)	Hunterdon	Rt. 31	X	X		A68
		Lower Delaware Region				
		(Assunpink Creek to Maurice River watersheds)				
Assunpink Creek	Mercer	Quaker Bridge Road				A69
Burnt Mill Branch	Gloucester	Rt. 40				A70
Masons Run (trib.) (Pine Hill)	Camden	Downstream of golf course access road				A71
Rancocas Creek, SW/Br	Burlington	Main Street Bridge				A72
Scotland Run	Gloucester	Rt. 40				A73
		Lower Atlantic Region				
		(Sloop Creek to Dennis Creek watersheds)				
Marsh Lake Branch	Atlantic	Downstream of Cedar Lake				A74
Morses Mill Stream	Atlantic	W. Moss Mill Road				A75
Skit Branch	Burlington	Carranza Road				A76
Wading River, W/Br	Burlington	Below Chatsworth Lake				A77

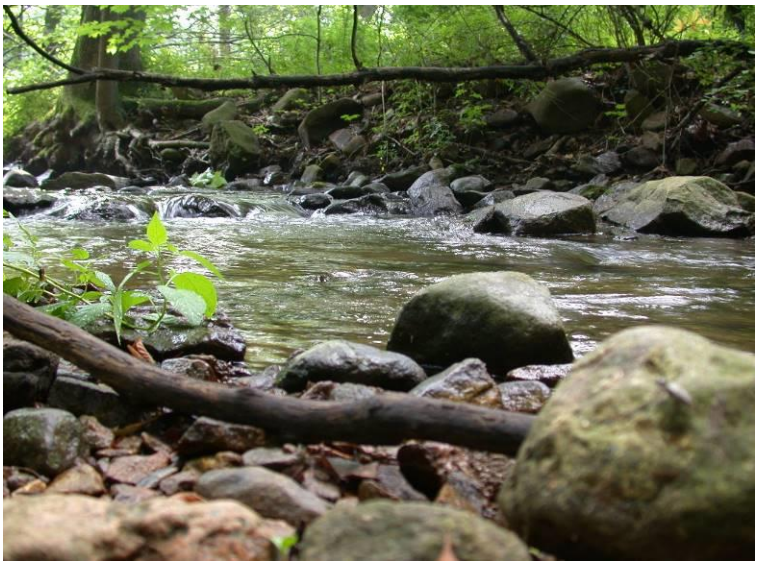
Wild Trout Stream Regulation Assessment

NJDFW has documented reproducing trout populations in nearly 200 streams (or stream segments) statewide, but only a handful of these (36) are currently designated as *Wild Trout Streams* (*WTS*). The majority of the *WTS* are tributaries to larger, trout-stocked streams. However, *WTS* are not stocked with hatchery trout, but rather rely upon their wild, naturally reproducing trout populations to provide a recreational fishery.

Wild Brown Trout Van Campens Brook (2015)

The *WTS* regulation is more stringent than the statewide general trout regulation and has changed little since it was adopted in 1990. Over time several streams have been added or taken off the *WTS* list. More notably, in 2008 when the general statewide minimum harvestable size for trout was increased from 178 to 305 mm (7 to 9 in) this change was also made to the *WTS* regulation. Currently the regulation provides for a limited harvest of only two trout daily, from the Opening Day of the trout season in April through September 15. The minimum size limit on trout is 229 mm (9 in), except for three streams (Van Campens Brook, Pequannock River, and Wanaque River) that produce large Brown Trout and must be at least 305 mm (12 in) to harvest. Fishing gear restrictions also apply (artificial flies/lures only, no bait or bait scent allowed).

Many of the streams currently designated as *WTS* are relatively small, contain limited numbers of (or no) harvestable-sized wild trout, and have limited (or no) public access. In 2014 a multi-year assessment was initiated to review the *WTS* regulation, collect and analyze data, and develop regulations that will better address recreational fishing opportunities for, and conservation needs of, the state's wild trout fisheries. This effort is being guided by a team of Bureau biologists. Fish population data were collected from streams in 2014 and 2015 using established sampling protocols (150 m stretch electrofished in July and August). In 2014, 46 electrofishing surveys were conducted on the 36 designated *WTS's*. In 2015, 48 electrofishing surveys conducted on 39 streams (18 *WTS*, and 21 other *Trout Production* streams not currently regulated as *WTS*). (Federal Grant F-48-R, Project I) (Collenburg, Hamilton, Shramko)



Willoughby Brook (Hunterdon), regulated as a Wild Trout

In 2016, five additional electrofishing surveys were conducted during the summer on three *Trout Production* streams (see table below) to supplement survey data previously collected in 2014 – 2015.

Results of 5 electrofishing surveys conducted on 3 streams during 2016 in New Jersey as part of a statewide *Wild Trout Stream* (*WTS*) regulation assessment project. All trout captured were considered wild (not hatchery) in origin (young-of-the-year fish considered wild; older fish determined to be wild based on fin wear and erosion). BKT= Brook Trout; BNT=Brown Trout; RBT=Rainbow Trout.

Stream	County	Location	Number of trout				Results page #
			BKT	BNT	RBT	Total	
Upper Delaware (South) Region *(Delawanna Creek to Lockatong Creek watersheds)*							
Buckhorn Creek	Warren	Rt. 519	20	1	0	21	A26
Buckhorn Creek	Warren	Roxburg Station Road	0	1	0	1	A27
Upper Passaic Region *(Pompton, Pequannock, Wanaque, Ramapo, Upper Passaic, Whippany, & Rockaway River watersheds)*							
Whippany River (trib.) (Brookside)	Morris	Stoney Hill Road	0	13	71	84	A39
Raritan Region *(Raritan River watershed)*							
Raritan River, South Branch	Morris	Claremont (Old stocking point)	7	44	1	52	A51
Raritan River, South Branch	Morris	Claremont (Fiber optic crossing)	19	13	0	32	A52

Underwater photograph of a wild Brown Trout from the Claremont Stretch of the South Branch of the Raritan River from 2013.

From January through June the team of Bureau biologists invested considerable time compiling, analyzing, and reviewing pertinent information including:

(1) Analysis of data from 94 stream surveys conducted in 2014 and 2015 (historical stream survey data (pre-2014) was also reviewed). The results of this analysis were presented at the annual public trout meeting held at the Pequest Trout Hatchery on February 27.

(2) Summary of fish stocking permits issued by the Bureau in 2015 and 2016 for private trout stockings, with breakdowns by species and stocking location.
(3) A review of scientific literature on hooking mortality of trout relative to gear types (artificials, bait, number of hooks, and hook style). This information was summarized in an article (*The Truth About Hooks & Lures*) published in the 2017 New Jersey Freshwater Fishing Digest
(4) The 2016 Wild Trout Survey, an online survey designed to obtain angler feedback concerning New Jersey's wild trout fishing opportunities.

The Wild Trout Survey, which was released to the public on March 2, 2016, had a total of 291 anglers participate in the 25 question survey. Anglers were asked if they supported or opposed the current Wild Trout Stream Regulations and how they felt about several possible new Wild Trout Stream Regulations. The following bullets are highlights from the survey.

- 90% of participating anglers felt that the most important attribute to having a good day of fishing for wild trout is not based on the number of trout caught or even the size of the trout caught, but just seeing evidence of wild trout in their stream.
- 87% said catching just one wild trout is important to having a good day fishing.
- 95% of the anglers said that a scenic location without a lot of other anglers was important to having that good day of fishing.
- In contrast, 60% of participants stated that catching big fish was NOT important to them when it comes to having a good day on the water.
- 61% are not in support of the current *2 fish per day creel limit* while only 26% support it.
- 75% answered that they want a *Catch & Release* Regulation on all wild trout streams (only 14% opposed this).
- 74% would like *Catch & Release* Regulations on Brook Trout streams, while 60% answered that they would support *Catch & Release* Regulations on wild Brook Trout, but allow harvest on wild Brown Trout & wild Rainbow Trout (19% oppose this).
- 78% of anglers were not in support of the current hook point regulation that allows up to 3 treble hooks or 9 hook points (8% supported).
- Anglers were asked about all different hook point combinations, but the most unified responses were: 65% of anglers support *single hook only* (15% oppose this) and 69% want *barbless hooks only* (13% oppose).
- 70% of participating anglers stated that they support the current *Artificials Only (No bait or scents)* gear restriction while only 19% oppose the current regulation.

GIS mapping was also an integral component of the regulation development process. Once the comprehensive review of information was completed, the team then formulated draft regulations which were presented to staff at a series of meetings held August through October. All Bureau professional staff participated and provided input during this internal review process. Multiple staff meetings were necessary to achieve consensus on various components of the draft regulations. The Bureau's recommendations will be finalized and presented to the Fish and Game Council early in 2017 for their review and comment. A legal process must then be followed before any changes can be made to the current *WTS* regulation (the Council proposes changes to the 2018-2019 Fish Code which are published in the New Jersey Register, initiating a sixty-day public comment period, followed by Council adoption). It is anticipated that in 2017 Bureau staff will give presentations to the angling public at various meetings to outline the proposed Wild Trout regulations and solicit their feedback.

Protection and Restoration of Inland Fisheries and Aquatic Habitats: Cold Water

To protect New Jersey's critical aquatic resources, fisheries biologists provide technical assistance to conservation, stream restoration, dam removal, and related Land Use projects each year. Land Use projects are coordinated through the Division's Environmental Review program. This input is directed towards minimizing land use change impacts to the state's fisheries resources. This is typically accomplished through the use of timing restrictions during critical fish spawning periods, protection of riparian buffers, and project modification, assuring best use practices are implemented at all times. However, at times a more in depth review and comments are necessary on specific projects.

Boulder placement during habitat improvement project at Sparta Glen Brook.

In 2016 staff provided technical assistance to the following projects related to our coldwater resources:

Cresskill Brook - This sole *Trout Production* stream in the Hackensack River drainage and tributary to Tenakill Brook had an on-stream cement swimming pool. In 2011, the swimming pool was demolished and the stream was restored through the cooperation of the property owner, the NJDFW, and Trout Unlimited. On 7/18/16 the restored section was backpack electrofished for the first time. One trout, estimated to be 178 – 229mm (7 – 9 in) was observed, but evaded capture (pages A44 - A45). 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. 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)

Eastern Brook Trout Joint Venture (EBTJV) - A diverse group of partners, including state fish and wildlife agencies, federal resource agencies, Indian tribes, academic institutions, and non-governmental organizations are working to conserve Brook Trout and their habitats in the eastern United States. Established as the Eastern Brook Trout Joint Venture (EBTJV) in 2005, this Fish Habitat Partnership has produced a range-wide population assessment of wild Brook Trout; identified key threats to wild Brook Trout and their habitats; and developed conservation strategies to protect, enhance and restore wild Brook Trout. In 2015 EBTJV used fish survey data collected over the previous decade (provided by partners) to update the range-wide population assessment to a fine scale (catchment rather than subwatershed level previously used). This assessment data has been used by EBTJV, its partners, and other scientists to identify Brook Trout patches and strongholds, to develop models that predict Brook Trout occurrence and habitats vulnerable to climate change, and to develop decision support tools for riparian and fish habitat restoration that can help guide conservation efforts. Trout Unlimited is finalizing their Brook Trout Conservation Portfolio Analysis, which is

another tool that will aid biologists and resource managers involved in making decisions on allocating resources to benefit Brook Trout conservation. In 2016 BFF staff attended two EBTJV meetings and also proposals submitted to EBTJV for funding were scored using EBTJV scoring criteria. (Federal Grant F-48-R, Project II) (Hamilton and Shramko)

Hakihokake Creek - Hakihokake Creek is classified Trout Production and is stocked annually with catchable-size trout in the spring. In 2011, during Hurricane Irene/Tropical Storm Lee, the flood waters surging down the creek through the town of Milford (Hunterdon County) carved a new stream channel. Local residents have expressed interest in having the channel restored back to its original location and Trout Unlimited is considering assisting them with this effort. In 2016 the new channel reach, and a reach immediately upstream, were electrofished to assess both the fishery and habitat..Wild Brown Trout were present in both sections and were more abundant in the newly created stream channel section. Restoring the stream to its original channel may not be warranted, from a fisheries management perspective, as the new channel section is generally providing good habitat for trout another fish species. However, the badly eroding stream banks in the new channel stretch should be stabilized to reduce sediment inputs, and the stream section upstream would benefit from in-stream habitat enhancement.

Sparta Glen Brook Restoration - 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 again 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. This Spring, in-stream habitat restoration was performed in an attempt to revert the stream back to what it was prior to the two flood / landslide events.

An electrofishing survey was done on July 15, 2016 to determine the status of the fish population and wild Brook Trout population after the restoration efforts. One would not expect to find an increase in the wild Brook Trout population this soon after habitat restoration efforts as there has not been enough time or a complete breeding cycle since the habitat work was completed. Multiple breeding cycles should occur before an assessment of success or failure of the restoration efforts can be determined. This survey was done to determine if wild Brook Trout are still in the area after the work was done, and to

One of two Brook Trout captured in 2015 within the 150 m survey on Sparta Glen Brook

assess the overall fish population post habitat restoration. Two adult/juvenile wild Brook Trout were found in 2016. This is exactly the same number of wild Brook Trout found in 2015 and indicates that the habitat restoration efforts did not have a negative impact on the small wild Brook Trout population found previously. Overall, the survey found 333 individual fish representing 5 different species. The 333 individual fish found is comparable but less than the 443 individual fish collected in 2015. This decrease in overall numbers is somewhat expected following extensive in-stream habitat manipulation, but should continue to be monitored to determine if individual numbers recover to pre-habitat restoration levels. Additional information is compiled in Appendix A (page A19). (Federal Grant F-48-R, Project II) (Shramko)

West Portal Creek: Brook Trout Restoration Project (Hunterdon County) - A catastrophic fish kill occurred on May 5, 2016 in West Portal Creek, a *Trout Production* tributary to the Musconetcong River. As a result of the clean-up associated with a truck fire on I-78, the truck's detergent cargo spilled into the creek killing thousands of fish residing in a three-mile section of the creek. The wild trout population in the creek had been dominated by Brown Trout, a non-native trout species, although some wild Brook Trout also resided in the creek. The Bureau of Freshwater Fisheries determined that the most prudent course of action would be to initiate management actions that would restore native fishes to the creek. Emphasis was placed on restoring wild Brook Trout, the only trout species native to New Jersey that is in decline statewide and soon to be designated state Special Concern, and Slimy Sculpin (a rare fish species soon to be listed state Threatened).

Detergent in West Portal Creek, May 5

Same location, May 6

Representative aquatic organisms killed

Electrofishing surveys conducted periodically in 2016 (May – September) in the section of the creek affected by the pollution event (as well as further upstream) documented a residual, but sparse fish population. The Bureau selectively removed all non-native trout encountered during these surveys (49 Brown Trout, 2 Rainbow Trout, and 1 hybrid Tiger Trout). Wild Brown Trout compete directly with wild Brook Trout for cover, food, and spawning habitat, and can negatively impact the occurrence and abundance of wild Brook Trout. Eliminating (or reducing the number of) Brown Trout from the creek will improve the chance of successful Brook Trout re-colonization. All native species encountered during electrofishing were returned to the creek, including 24 wild Brook Trout (other species returned included Slimy Sculpin, American Eel, Blacknose Dace, Longnose Dace, Creek Chub, White Sucker, and Common Shiner). Fish surveys to assess the recovery of the fishery, document reproduction of trout species, and remove non-native trout will continue in 2017. Additional information concerning the detergent spill is found on page 121. (Federal Grant F-48-R, Project II) (Hamilton)

COOLWATER / WARMWATER FISHERIES

Coolwater Fisheries Assessment

The Coolwater Fisheries Assessment was initiated in 2013 to assess coolwater fisheries that are maintained by annual stockings (Muskellunge, Northern Pike, Walleye, and Hybrid Striped Bass). In 2013 the focus was on developing sampling techniques and protocols for assessing Muskellunge, which are stocked in ten waterbodies statewide. Three of these lakes (Furnace Lake, Mountain Lake, and Carnegie Lake) were selected for sampling in 2013 using trap nets during the spring. In 2014 four waterbodies (Farrington Lake, Pompton Lake, Lake Hopatcong, and Monksville Reservoir) were selected for spring trap netting surveys, and in 2015, a total of seven waterbodies were sampled using a total of 73 trap nets, 9 gill nets, and 5 nights of boat electrofishing to capture the target species of interest from each waterbody. This year, surveys were conducted at 12 waterbodies including, Budd Lake, Canistear Reservoir, Carnegie Lake, Cranberry Lake, Deal Lake, Echo Lake, Greenwood Lake, Little Swartswood Lake, Manasquan Reservoir, Monksville Reservoir, Mountain Lake, and Pompton Lake using a variety of sampling techniques to best capture the species of interest on each waterbody. A full report will be completed this year (Federal Grant F-48-R, Project I) (Collenburg)

Budd Lake (Morris) - Budd Lake is a 376-acre lake in Mount Olive Township that was sampled for Northern Pike using trap nets between March 8 to 11, 2016. A total of 12 trap nets were set and 99 Northern Pike were captured, ranging from 643 - 890 mm (25.3 – 35.0 in) and 1.4 - 4.9 kg (3.1 – 10.7 lbs.), indicating an abundant population. A number of Northern Pike were sent to Hackettstown Hatchery to augment brood stock collection efforts. Eggs and milt were collected from 17 Northern Pike and the fish were later returned to the lake. Crappie and perch populations were abundant and representing many size classes which provides additional recreational opportunities and a strong forage base for higher level predators. (Collenburg)

Budd Lake Northern Pike

Canistear Reservoir (Sussex) - Canistear Reservoir is a 308-acre reservoir and one of five major water supply reservoirs located within Newark-Pequannock Watershed. Sampling targeted Walleye, but Smallmouth Bass were also collected. Sampling for Walleye was done in the Fall of 2015, but in general, catch rates were low across multiple waterbodies and timing played a major role. Therefore, additional sampling was conducted this year via nighttime electrofishing on May 16, 2016. The sampling effort lasted 1 hour with a total of 32 Walleye captured ranging from 447-660 mm (17.6-26.0 in) and the largest weighing 5.6 lbs. Thirty-five Smallmouth Bass larger than stock size (180 mm) were captured ranging from 195-489 mm (7.7-19.3 in) and the largest weighing 3.4 lbs. The CPUE of both Walleye and Smallmouth Bass here indicate that this reservoir is supporting a great fishery for both. See page 67 for additional information on the Smallmouth Bass population. (Collenburg)

Walleye (26 in./5.7 lbs.)
from Canistear Reservoir

Carnegie Lake (Mercer) - Carnegie Lake is a 237-acre impounded section of the Millstone River owned by Princeton University. Primarily used for their crew teams, it is open to the public with a concrete boat ramp, ample parking, and fishing is allowed among other forms of recreation. Trap netting surveys were conducted at Carnegie Lake between April 18 -20, 2016. The target species was Muskellunge which are annually stocked by NJDFW. Unfortunately, the trap netting survey coincided with a significant die-off of mostly Gizzard Shad which are overly abundant in the lake. The die-off was caused by a protozoan that causes ick (a common freshwater fish disease) coupled with sudden temperature increases and the abundant Gizzard Shad population. Gizzard Shad, by the thousands, ended up in the trap nets interfering with the survey. Therefore, trap netting ceased after the second day of sampling. Trap netting was also conducted in 2013, which indicated White Perch and Bluegill were the most abundant species sampled in the trap nets, cumulatively 78.5% of the species composition (unlike 2016, where Gizzard Shad were, by far, the most abundant species sampled). During the 2013 sampling effort, a total of seventeen species of fish were collected during the survey, including one Tiger Muskellunge. The Tiger Muskellunge was 715 mm (28.1 inches) long and 1.85 kg (4.08 lbs.). The catch of the target species was poor with an average of only one Tiger Muskellunge caught in 11 nets. This is far below the Pennsylvania Fish and Boat Commission standard for a quality fishery of one Muskellunge for every 4 nets. Angler reports about Muskellunge fishing at Carnegie Lake are limited and when coupled with recent data indicates that the Muskellunge are struggling in this waterbody. (Collenburg)

Gizzard Shad packed trap nets in Carnegie Lake

Cranberry Lake (Sussex) - Cranberry Lake is a 179-acre lake in Sussex County. A large portion of the shoreline is developed with private residences, but a public boat launch and an abandoned railroad right-of-way atop the earthen embankment provides access. This spring, the target species was Northern Pike. A total of 15 trap nets were set and two Northern Pike were captured during the four days of sampling between March 1 - 4, 2016. Northern Pike ranged from 661 – 760 mm (26.0 – 30.0 in) in length and weighed 1.7 – 2.6 kg (3.8-5.7 lbs.). This low catch rate indicates a low population abundance. Furthermore, angler reports have not indicated much success when fishing for Northern Pike on Cranberry Lake. However, an abundant population of Chain Pickerel, a native game species, was captured during the survey with 78 individuals ranging from 295 – 592 mm (11.6-23.3 in) and 0.1 – 1.5 kg (0.3-3.4 lbs.). (Collenburg)

Chain Pickerel (23.3 in./3.3 lbs.) from Cranberry Lake

Deal Lake (Monmouth) - Deal Lake is a 158-acre lake that drains directly to the Atlantic Ocean. Shoreline fishing is limited by private residences in the western end of the lake but some exists in the eastern end and a public boat ramp is available. Sampling this spring focused on the target species of Northern Pike using trap nets between March 16 – 18, 2016. Northern Pike are annually stocked into this lake located in Asbury Park but has not been assessed in over 10 years. Three trap nets were set daily for a total of 9 trap nets. Five Northern Pike were captured, ranging from 560 – 707 mm (22.8 - 27.8 in) and 1.1 – 2.5 kg (2.8 - 5.6 lbs.), indicating low population abundance. Of additional note, 62 Common Carp were captured in the trap nets and removed from the waterbody. Residents around the lake and familiar with the waterbody mentioned the abundance of Common Carp and the town holds an annual fishing tournament specifically targeting them to try to control the overly abundant population. Yellow and Brown Bullhead and Black Crappie were also found in abundance. Many Black Crappie were of impressive size. (Collenburg)

Echo Lake Reservoir (Passaic) - Echo Lake Reservoir is one of five major water supply reservoirs located within Newark-Pequannock Watershed and is also one of two "Trophy Musky" waters in the state where the minimum size limit is 40 inches to encourage the growth of Muskellunge. This waterbody is a popular destination for Musky anglers and access is granted by permit only. The target species for trap netting on April 6 – 8, 2016 was Muskellunge and the catch was good, with 10 Muskellunge captured and a CPUE of 0.6 fish/net. This exceeds the trap netting standard of a quality Muskellunge fishery set by Pennsylvania of one Muskellunge for every four nets set (0.25 fish/net). The Muskellunge were large, which is reflected by a PSD of 100, PSD_p of 90, and PSD_m of 50. They ranged in size from 927 – 1275 mm (36.5 – 50.2 in) and weighed 5.5 – 15.2 kg (12.1 – 33.5 lbs.). The Muskellunge fishery here appears to be abundant and will continue to provide plenty of excellent recreational opportunities. (Collenburg)

Echo Lake Muskie (50.2 in./33.1 lbs.) brought back to Hackettstown State Fish Hatchery for broodstock

Greenwood Lake (Passaic) - Greenwood Lake is a 1,920-acre lake located in New Jersey and New York. Sampling this spring focused on Muskellunge and Walleye. Hackettstown State Fish Hatchery crews set trap nets between April 5 and 16, 2016 to collect Muskellunge for broodstock. This data, along with historical broodstock collection data, was used to assess the Muskellunge and Walleye fishery. Catch of the target species, Muskellunge, was great, with a total of 38 captured with a Catch per Unit Effort (CPUE) of 2.7 fish/net. Although the broodstock collection effort of Muskellunge did not follow the same standard protocol set by Pennsylvania, it greatly exceeded the Pennsylvania trap netting standard for a quality Muskellunge fishery of one Muskellunge for every four nets set (0.25 fish/net), which is an impressive number of Muskellunge regardless. Walleye were also captured during spring broodstock collection at a CPUE of 3.9 fish/net which meets the standard for spring trap netting for Walleye on large reservoirs (>500 acres) set by Pennsylvania of 3.6 fish/net representing a quality fishery. Walleye were also specifically targeted during nighttime electrofishing on April 25, 2016. A total of 18 Walleye ranging from 200 – 678 mm (7.9 – 26.7 in) and 0.06 – 3.09 kg (0.1 – 6.8 lbs.) for a CPUE of 13.7 Walleye/hour. Of the 17 Walleye that were larger than stock size (250 mm), all of them exceeded 15 inches, 41% exceeded 20 inches, and 24% exceeded 25 inches. Walleye seem to be doing well and angler reports and past broodstock collection show indications that their catch rates are increasing. For bass assessment information see page 71. (Collenburg)

Walleye (26.7 in./6.8 lbs.)
from Greenwood Lake

Dual Smallmouth Bass
from Greenwood Lake
(both over 18 inches & 2.6 lbs.)

Little Swartswood Lake (Sussex) - Little Swartswood Lake is an 82-acre natural lake located partially in Swartswood State Park with a free boat ramp and small parking area. At Little Swartswood Lake the target species was Tiger Muskellunge and was sampled using trap nets between March 29 – 31, 2016. A total of nine trap nets were set and no Tiger Muskellunge were captured. The NJDFW annually stocks Tiger Muskellunge here, but catching none is an indication that the population is low in abundance. Anglers indicated to crews, they see Tiger Muskellunge being caught, but not in a great abundance and ice fishing is composed of primarily Chain Pickerel or Yellow Perch. As the coolwater assessment is becoming finalized, further investigation into stocking rates, sizes, and the population structure is necessary to determine the causative factors of the low numbers of Tiger Muskellunge in Little Swartswood Lake. See page 85 for 2016 electrofishing data. (Collenburg)

7.6-lb. Largemouth Bass from
Little Swartswood Lake

Manasquan Reservoir (Monmouth) - Manasquan Reservoir is a 720-acre reservoir located within the Monmouth County Parks system. The waterbody has a large concrete boat ramp, ample parking, as well as a visitor center located adjacent to the ramp. A total of four gill nets were set between October 18 – 19, 2016 to target and assess the Hybrid Striped Bass population. During sampling last year, a total of three Hybrid Striped Bass were captured indicating low population abundance. In casual conversations with anglers, many indicated catching few, if any. The gill nets this year were set in different locations to sample other areas of the lake. A total of nine Hybrid Striped Bass were captured. These numbers are still low and provide additional evidence that is adding to the growing concern of a struggling Hybrid Striped Bass population, providing only marginal recreational opportunities. For bass assessment data see page 73. (Collenburg)

Hybrid Striped Bass from Mansquan Reservoir (2015)

Monksville Reservoir (Passaic) – Monksville Reservoir is a 505-acre reservoir located in Longpond Ironworks State Park in West Milford Township. It has great access with two boat ramps, parking for approximately 100 cars and trailers, and trails around portions of its perimeter. A spring nighttime electrofishing survey was conducted on April 14, 2016 to assess the Walleye that are annually stocked by NJDFW. A total of 1.25 hours of electrofishing was conducted and 23 Walleye were captured ranging from 460 – 667 mm (18.1-26.3 inches) and 0.860 – 3.036 kg (1.9-6.7 lbs.). This is a good catch rate for Walleye indicating a quality fishery. Coupled with trap netting data collected in 2015 where 41 Walleye were captured at a Catch Per Unit Effort (CPUE) of 2.6/net, the Walleye population is doing well. (Collenburg)

Trophy Monksville Reservoir Walleye

46.9 in. and 29 lbs. Muskie from Monksville Reservoir (2015)

Mountain Lake (Warren) - At Mountain Lake the target species was Muskellunge. This 122-acre lake located in Liberty Township was sampled for Muskellunge using trap nets between March 29 – 31, 2016. A total of nine trap nets were set and nine Muskellunge were captured ranging from 264-947 mm (10.4-37.3 inches) and 0.77-6.62 kg (1.7-14.6 lbs.). This catch rate indicates a very abundant Muskellunge population. Despite this being one of the waterbodies regulated as a Trophy Musky Water (having a minimum keeper size of 40 inches), no Muskellunge captured exceeded that size. Electrofishing was also conducted on October 3 to investigate the Largemouth Bass population. During electrofishing for 1.29 hours, seven Muskellunge were encountered, four landed on the boat, and three others effected by the electrical current, but were not netted. This additional sampling further indicates the abundant numbers of Muskellunge. Still, one concern is that the Muskellunge are not surpassing the 40-inch threshold the Trophy Musky regulation is intended to create. The forage base appears fine, however such an abundance of Muskellunge may be limiting growth through intraspecific competition for resources. (Collenburg)

Muskie (37.3 in / 11.6 lbs. from Mountain Lake

Muskie (35.9 in / 14.6 lbs. from Mountain Lake

Pompton Lake (Passaic) - Pompton Lake is a 147-acre lake created in 1776 by impounding a section of the Ramapo River. Shoreline access is relatively limited, but there is a public municipal boat ramp. Sampling this spring focused on the target species of Northern Pike between March 22 – 25, 2016. A total of 12 trap nets were set and 16 Northern Pike were captured ranging from 636 – 890 mm (25.0 – 35.0 in) and 1.4 – 4.9 kg (3.1 – 10.9 lbs.). This catch rate indicates a low to moderately abundant Northern Pike population. There is an abundance of panfish and Yellow Perch representing many age classes which indicates a great forage base supports the fishery. (Collenburg)

General Fisheries Surveys

Northern Pike Electrofishing Surveys on Passaic River

Beginning in the year 2000, the Passaic River has received 2,200 six-inch fingerling Northern Pike, annually. It also receives additional surplus pike, ranging in size from two to four inches. The pike are stocked at more than 25 locations from the Lower Chatham Bridge at the Morris-Essex County line to Pennington Park in Paterson. Locations from Hawthorne to Garfield, above the Dundee Dam on the Bergen County side of the river, are also stocked. In recent years, this fishery has become very popular, with anglers reporting pike weighing up to 20 pounds and measuring in the low 40-inch range. Sampling was conducted in 2016 to quantify the pike's population in the river. The below three sampling sites were chosen for their access (boat ramp) and will be resampled in future years.

Passaic River Northern Pike

Passaic River (Morris) – A boat electrofishing (0.64 hours) survey was conducted on the Passaic River, Florham Park on October 11, 2016. The fish assemblage consisted of 11 species including Northern Pike (4), Black Crappie (15), Yellow Perch (50), Common Carp (35), Common Shiner (100), Largemouth Bass (5), Brown Bullhead (10), American Eel (5), Channel Catfish (1), and White Sucker (35). The length range of the Northern Pike was 558 – 837mm (22.0 – 33.0 in). The weight range of the Northern Pike was 0.96 – 4.19 kg (2.1 – 9.2 lbs.). The relative weights (73, 82, 83 and 102) of the four Northern Pike collected indicate that three were of sub-optimal weight for their length. One was slightly above the optimal weight for its length. It is recommended that annual electrofishing to monitor the fishery be conducted. (Boriek)

Passaic River (Essex) – A boat electrofishing (1.46 hours) survey was conducted on the Passaic River, in the area of Fairfield on October 11, 2016. The fish assemblage consisted of 8 species including Northern Pike (8), Brown Bullhead (5), Common Carp (10), Yellow Perch (35), White Sucker (10), Largemouth Bass (3), Chain Pickerel (1) and Bluegill (17). The length range of the Northern Pike was 370 – 921 mm (14.5 – 36.3 in). The weight range of the Northern Pike was 0.46 – 6.522 kg (1.0 – 14.4 lbs.). The relative weights (69, 69, 72, 77, 84, 91, 100 and 118) of the eight Northern Pike collected indicate that six were of sub-optimal weight for their length. Two were of optimal weight for their length. It is recommended that annual electrofishing be conducted. (Boriek)

Passaic River (Passaic) – A boat electrofishing (0.74 hours) survey was conducted on the Passaic River, in the area of Elmwood Park on October 12, 2016. The fish assemblage consisted of 9 species including Brown Bullhead (20), Common Carp (13), Yellow Perch (5), Smallmouth Bass (4), Black Crappie (2), American Eel (3), Bluegill (6), and White Sucker (7). An Angel Fish, undoubtedly stocked illegally, was observed but evaded capture. No Northern Pike were collected or observed. It is recommended that annual electrofishing be conducted. (Boriek)

Lake Inventories

Successful management of New Jersey's warm and cool water fisheries resource is based upon specific knowledge of their physical, chemical, biological, and use characteristics. Such knowledge may serve to direct immediate management recommendations or be used as a baseline, upon which to recognize future changes, requiring remedial management efforts. Under this activity physical, chemical, and biological data is collected utilizing standard sampling techniques. Physical parameters include morphometry, bathymetry, access, watershed, and aquatic vegetation characteristics. Chemical parameters include general water chemistry and sediment nutrient characteristics. Biological parameters include fish species composition, abundance (catch-per-unit-effort), length frequency distribution, and calculated indices of population structure and dynamics such as proportional stock density (PSD), relative weight (W_r), age, and growth. The data are analyzed and results are used to develop management recommendations and prepare an individualized fisheries management plan for the waterbody. These plans are summarized and published for dissemination to the angling public. (Federal Grant F-48-R, Project I) (Smith)

Lake Inventory: Round Valley Reservoir

In 2016 a lake inventory was conducted on Round Valley Reservoir. Sampling and management recommendations focused on the warmwater fish population. Construction of Round Valley Reservoir began in 1965 and water levels reached 97.3% capacity by 1973. The reservoir was opened to public shoreline fishing in 1968 and to boat anglers in 1969. The reservoir is formed by earthen dams and water is pumped in from the South Branch Raritan River. The reservoir is rather unique for New Jersey supporting both coldwater and warmwater fish populations. The reservoir has been stocked with Rainbow and Brown Trout since its creation and supports an abundant reproducing Lake Trout populations. (Smith and Crouse)

Round Valley Reservoir is one of the most popular fishing locations in Northern New Jersey, due in part to its size and the ability to utilize gasoline powered outboard motors. Boaters are restricted to outboards less than 10 hp. There are two public boats ramps, both are maintained by the Division of Fish and Wildlife. One is double wide concrete ramp and paved parking areas the other a gravel ramp with an unpaved parking area.

Photo by John Young

Round Valley Reservoir's Lake Trout population has been intensively managed and monitored since the program's inception in the 1970's. Trout angling and stocking remain the most popular at the reservoir, though a rather substantial warmwater fish population exists.

Materials and Methods

Water quality parameters were measured in the lake at various locations, including dissolved oxygen, conductivity, pH, and temperature. A total of four electrofishing surveys were completed. Night surveys were conducted in the spring (May 23 and June 8) and in the fall (October 13). One daytime survey was completed on November 7. Length and weight measurements were taken on all game and panfish species collected and proportional stock densities (PSD), relative stock densities (RSD), and relative weights (W_r) were calculated. Scales were removed from a sub-sample, mounted, and aged. Back-calculation was used to obtain information on the growth history of year classes. A total of 80 locations were sampled by shoreline seining on November 6. The annual Lake Trout population assessment was also conducted (page 32).

Largemouth Bass (8.85 lbs.) caught in Round Valley Reservoir in 2016 via electrofishing

Fisheries Results

Round Valley has rich species diversity with twenty-three species collected during the 2016 sampling at this lake. Complete results of the inventory can be found in Appendix G (Round Valley Reservoir Fisheries Management Plan). The following management objectives and recommendations were drafted.

Management Objectives

1. Continue to manage Round Valley Reservoir's the two-story fishery.
2. Improve the size structure and growth of Lake Trout and Rainbow Trout.
3. Improve the size structure and growth of both Largemouth and Smallmouth Bass.
4. Improve the forage base for all sportfish and reduce biological demand on all prey species, including Bluegill.The management objectives for Round Valley Reservoir have been established to provide the best recreational fishing opportunities for anglers. Management objectives are most often achieved through regulatory changes, stocking, and habitat manipulation.

Recommendations

1. Maintain current Lake Trout regulations to reduce the density of 15 to 24-inch Lake Trout to increase growth and reduce predation pressure on prey species.
2. Continue to monitor Lake Trout population, on a biennial basis (as opposed to the existing annual monitoring schedule) and evaluate current regulations and potential regulation changes.
3. Maintain Trophy Trout regulations for Rainbow and Brown Trout (minimum size of 15 inches / daily limit of 2 combined species).
4. Continue to stock approximately 6,500 trout in 2017, with consideration to adjust stocking rates in response to changing factors such as food availability, documented trout growth, lowered pool elevation, etc.
5. Additional sampling should be conducted during the spring of 2017 to further evaluate the Largemouth Bass Population. Subsequent sampling should be conducted in three to five years.
6. Continue to stock Golden Shiners in the short-term, until a determination is made as to whether it has resulted in the establishment of a reproducing population, otherwise stocking by NJDFW should be discontinued.
7. Consider potential fish habitat projects to benefit warmwater fish assemblage including, but not limited to bass, sunfish, and shiners.

Warmwater Fisheries Assessments via Electrofishing

New Jersey has over 400 impoundments open to the general public for fishing and thousands more in private ownership scattered throughout the state. These lentic environments offer excellent fishing opportunities for a variety of species such as bass, sunfish, crappie, and pickerel. These species naturally reproduce in the waterways and often do not require active stocking to sustain their populations. The Bureau of Freshwater Fisheries conducts abbreviated fisheries surveys on lakes and ponds throughout the state to assess the status of popular game species, compared to full inventories on others. Electrofishing surveys are conducted at various waterbodies throughout the state to assess the current status of the bass populations. Lakes are assessed based on the catch per unit effort (CPUE) for stock size fish (Largemouth Bass ≥ 8 in.) as determined from the electrofishing survey. CPUE is a measure of the number of fish caught per hour. Fish populations are further evaluated utilizing stock density indices that provide a numerical descriptor of length-frequency data. These indices include PSD, PSD-P, and PSD-M (formerly PSD, RSD_p, and RSD_m). Calculations for each parameter are made to determine a proportional size distribution of certain size fish that is within the stock size. The PSD-P is simply the percentage of fish sampled greater than the "preferred" size (Largemouth Bass ≥ 15 in.). Standard lengths are used for each species. The PSD-M is the percentage of fish sampled greater than the "memorable" size (Largemouth Bass ≥ 20 in.). Sampling results are used to determine if supplemental stockings or adjustments to current regulations are necessary.

Surveys were completed at 32 locations in 2016. Assunpink Lake had the highest CPUE for Largemouth Bass at 111 bass/hour during daytime electrofishing. The two largest bass encountered electrofishing, not including those from the Round Valley Reservoir Inventory, were from Parvin Lake on October 24, weighing 7.35 and 7.40 lbs. (Hunter & Angler Fund)

Assunpink Lake (Monmouth) – Assunpink Lake is a 225-acre impoundment located within the Assunpink Wildlife Management Area, Upper Freehold Township. The lake is one of the five waterbodies managed as a *Lunker Bass Lake* and one of the most utilized Wildlife Management Areas in the state. Two daytime electrofishing surveys were completed in 2016. The first survey was completed on March 23, 2016 to assist pathologist Dr. Jan Lovy with the collection of Bluegill for testing as a follow-up to the spring 2015 fill kill. Assunpink Lake has annual fish kills during the spring, occurring after ice out when temperatures begin to rise. Kills of varying species have been attributed to both bacteria and parasites. The electrofishing survey revealed that Yellow Perch were more abundant than during previous sampling. Largemouth Bass were observed in good number (n=24) and in good condition. Not all Largemouth Bass were collected, hence a CPUE was not calculated. A daytime boat electrofishing survey was conducted on October 21, 2016 to assess the Largemouth Bass population. Sampling occurred around the perimeter of the lake concentrating on the dam, island, and aquatic vegetation edges. A total of 139 Largemouth Bass were collected, in 1.0 hours of electrofishing, of which 115 were >200 mm (8 in) stock size. The CPUE was 115 bass/hour. A PSD of 36 and a PSD-P of 12 were calculated for Largemouth Bass, indicating a slightly unbalanced population. In comparison a daytime electrofishing survey was completed in July of 2015 resulting in a total of 47 Largemouth Bass collected. The CPUE was 33 bass/hour for stock sized bass. A PSD of 47 and PSD-P of 23 indicated a balanced population. The Largemouth Bass population should continue to be monitored regularly to determine the effects of fishing pressure and changes in habitat. An electrofishing survey is planned for spring 2017 to determine possible effects of ice fishing. The primary management objective should be to maintain and improve the Largemouth Bass population. No additional stocking of Largemouth Bass is recommended at this time. Stocking of Channel Catfish should be evaluated to determine possible negative effects on the bass population. (Smith)

Burnt Mill Pond (Cumberland) - A boat electrofishing survey was completed at Burnt Mill Pond to evaluate the fish population on July 12, 2016. Burnt Mill Pond, also known at Arbor Lake is approximately 20-acres and owned by the City of Vineland. A dam replacement was completed in the spring of 2016 and the lake was refilled. The City of Vineland created an improved boat launching area during the reconstruction of the dam, however parking is extremely limited. The lake was significantly lowered following a dam failure (approximately five years ago), allowing the growth of willow trees and cattails throughout the lake. Narrow channels through the willow trees provide good habitat for fish recently stocked by NJDFW. There were no adult Largemouth Bass collected or observed during the 30-minute survey. Young-of-the-year (YOY) Chain Pickerel, a species not stocked by NJDFW, were observed to be rather abundant, but not collected. Additional species collected include Pumpkinseed, Creek Chubsucker, Golden Shiner, and Pirate Perch. Brown Bullhead, Bluegill, and Largemouth Bass YOY were recently stocked. No additional sampling or stocking is planned at this time. (Smith)

Canistear Reservoir (Sussex) - Canistear Reservoir is a 308-acre reservoir and one of five major water supply reservoirs located within Newark-Pequannock Watershed. In 2015, sampling for Walleye was done, but in general, catch rates were low across multiple waterbodies and it was presumed that timing played a major role in the low catch rates. In 2016, sampling focused on targeting Walleye, but Smallmouth Bass were also collected. The nighttime boat electrofishing survey on May 16, 2016 lasted 1 hour and a total of 32 Walleye were captured ranging from 447-660 mm (17.6-26.0 in) and the largest weighed 2.5 kg (5.6 lbs.). Thirty-five Smallmouth Bass larger than stock size (180 mm) were captured ranging from 195-489 mm (7.7-19.3 in) and the largest weighed 1.5 kg (3.4 lbs.). The CPUE of both Walleye and Smallmouth Bass indicate that this reservoir is supporting a great fishery for both. See page 57 for more information. (Collenburg)

Cedar Lake (Cumberland) – Cedar Lake is a 57-acre impoundment of Cedar Creek located in the town of Cedarville. Two surveys were completed in 2016 to assess the fish population. A seining survey was completed during the summer to evaluate the native fish population and a daytime boat electrofishing survey was completed on October 28, 2016 to evaluate the Largemouth Bass population. A major dam reconstruction project is planned in the near future. The bass population has not been evaluated in recent years by NJDFW despite reports of good bass fishing. A total of 18 Largemouth Bass were collected in 1.0 hours of electrofishing, of which 15 were >200 mm (8 in) stock size. The CPUE was 15 bass/hour for stock size bass. The CPUE was rather low and most likely attributed to weather conditions. A PSD of 93 and a PSD-P of 67 were calculated for Largemouth Bass indicating an unbalanced population. Despite being unbalanced, the current bass population should provide good fishing opportunities. Other species encountered include Creek Chubsucker, Black Crappie, Golden Shiner, Chain Pickerel, American Eel, Bluegill, Brown Bullhead, Gizzard Shad, Yellow Perch, and Common Carp. The dam reconstruction project should be completed utilizing a coffer dam to protect the existing fish population. A seining and electrofishing survey should be completed after the dam reconstruction project is completed. No stocking is recommended at this time. Seining was also conducted in 2016 (page 80). (Smith)

Columbia Lake (Warren) - Columbia Lake (48 acres) was electrofished on July 22, 2016 to determine the status of the fish population. The sampling was done as part of the Paulins Kill Restoration Project (page 99). This pre-dam removal assessment of the fish population found 95 individual fish, comprised of 12 different species. The lake temperature was 24.2ºC. Fish species found included Largemouth Bass (17), Smallmouth Bass (5), Bluegill (7), Pumpkinseed Sunfish (10), Redbreast Sunfish (3), Black Crappie (1), Chain Pickerel (5), Yellow Bullhead (1), Yellow Perch (21), White Sucker (18), and Common Carp (6). Not surprisingly, no American Shad, no Blueback Herring and no American Eels less than 200mm were found in Columbia Lake. A boat electrofishing survey was conducted last year as well and also found no American Shad, no Blueback Herring, and only 3 American Eels of which all were larger than 200 mm. The result from these two surveys, and the seven other surveys conducted upstream of the Columbia Lake Dam since 2015, continues to document that the Columbia Lake Dam is an impediment to fish movement. A dissolved oxygen / temperature survey was also completed on July 27, 2016 at two different locations. One survey was done near the deepest part of the lake near the dam and the other survey was performed at a location where a large spring enters the lake. Both surveys showed no holdover capacity for cold water species such as trout. The survey done near the dam showed oxygen levels high enough to support trout, but lacked the cold temperatures that trout need. The spring area had low enough water temperatures to support trout, but lacked adequate dissolved oxygen levels for trout. Profile data can be found on page 134. (Shramko)

Cresse Lane Ponds (Cape May) – Cresse Lane Ponds are located in Lower Township. A day time boat electrofishing survey was conducted on August 17, 2016 to evaluate the warmwater fishery. High conductivity prevented the use of electrofishing as a sampling method. Young-of-the-year (YOY) Largemouth Bass and Bluegill were collected using seines indicating successful reproduction of both species. Mosquitofish were also present. Water chemistry was recorded; pH measured 7.99, conductivity 1223 us/cm, and salinity was 0.53 ppt. This location has not been previously sampled by the NJDFW. Sampling during a wet time of year should decrease the salinity level within the pond and make electrofishing a more effective sampling method. Additional assessment of the warmwater fishery is recommended. (Boehm)

Davis Millpond (Cumberland) – Davis Millpond is a 40-acre impoundment located within the Stowe Creek Drainage, Greenwich Township. A daytime boat electrofishing survey was conducted on October 28, 2016 to assess the Largemouth Bass population. Sampling occurred around the perimeter of the lake. A total of 38 Largemouth Bass were collected, of which 36 were greater than the 200 mm (8 in) stock size. The CPUE was 36 bass/hour, based on one hour of electrofishing. A PSD of 69, RSD-P of 44 and PSD-M of 14 were calculated for Largemouth Bass indicating an unbalanced population that should provide excellent fishing opportunities. Noteworthy was the PSD-M of 14, indicating individuals greater than the memorable size of 510 mm (20 in). Five individuals fit this category and weighed 2.798 kg (6.17 lbs.), 2.782 kg (6.13 lbs.), 2.610 kg (5.75 lbs.), 2.6 kg (5.73 lbs.) and 2.516 kg (5.55 lbs.). The population appears to be making a strong rebound after impacted by suspected Largemouth Bass Virus. Previous electrofishing surveys were completed in 2011, 2012 and 2015. Stocking of young-of-the-year (YOY) Largemouth Bass was completed in 2013, 2014, and 2015. Davis Millpond has an excellent forage base comprised of Gizzard Shad and Bluegill. The bass population will be resampled over the next few years to monitor condition and any signs of Largemouth Bass Virus. No additional stocking is necessary at this time. (Smith)

Delaware Lake (Warren) – This 36-acre lake is located within the Paulins Kill WMA near the town of Columbia, and has been regulated as a *Lunker Bass Lake* since 2000. The lake is regularly stocked with Channel Catfish and was also stocked with Largemouth Bass in 2012. A boat ramp and dock are present and anglers have good shoreline access along the long, earthen spillway. The lake was previously electrofished on October 8, 2015 to assess the Largemouth Bass fishery. Because the PSD and RSD values were below the accepted ranges for a "big bass" (i.e. "lunker bass") lake it was recommended that the lake be resurveyed in 2016 and scale samples be taken to obtain age and growth data. On October 15, 2016 nearly the entire perimeter of the lake was electrofished at night. The results from this survey are summarized below and compared to the 2015 survey. A total of 108 Largemouth Bass were collected in 1.0 hours of electrofishing and of these, 92 were stock size (20 cm (8-in) or greater). In 2015, 83 bass were collected, 72 were stock size or greater. The CPUE for bass (stock size or greater) was 92 bass/hr, significantly higher than in 2015 (38 fish/hr). The largest bass captured in 2016 was 44 cm (17.5 in) and weighed 1.8 kg (3 lbs). In 2015 the largest bass captured was 491 mm (19.3 in) and weighed 2.13 kg (4.7 lbs). Considering *Lunker Bass* regulations are in effect it is surprising that larger bass were not collected in either survey. It should be noted that conductivity of the lake water is exceedingly high (specific conductance 664 uS/cm in 2016 and 597 uS/cm in 2016) and during both electrofishing surveys it was noted that bigger fish sensed the approaching electric field and avoided capture. In 2016 the water clarity was very poor due to an algal bloom and wide expanse of floating duckweed. The PSD (Proportional Size Distribution) for bass was 41 in 2016 (the same as in 2015). PSD is a numerical index used to characterize the length-frequency data and provide insight about population dynamics. Although bass PSD values for both years indicate a balanced bass population, these values barely fall within the range that indicates a balanced bass population (40–70 is the accepted range). The PSD-P for bass (Preferred $\geq$ 38 cm (15 in)) was 5 in 2016 and 6 in 2015. The PSD-M for bass (Memorable $\geq$ 51 cm (20 in)) was 0 in both 2016 and 2015. These values, as well as the PSD values for both years, are well below the accepted ranges for a "big bass" (i.e., *Lunker Bass*) lake (PSD 50–80; RSD–P 30-60; and RSD–M 10-25). More than half (60%) of the stock size bass caught in 2016 (55 fish) measured 20 – 30 cm (8 – 11.9 in). Similar results were obtained in 2015 (42 fish, 58%). This suggests smaller bass are stockpiling. Large sunfish (primarily Bluegill, and some Pumpkinseed) were noticeably prevalent during the 2015 and 2016 surveys. Other species captured (or seen but not captured) during the 2016 electrofishing survey included Black Crappie, Brown Bullhead, Channel Catfish, White Sucker, Creek Chubsucker, American Eel, Golden Shiner, and Common Carp. The results of the 2016 survey are remarkably similar to the 2015 results. The age and growth of bass collected during fall electrofishing will be determined from their scales, and relative weight (a measure of fish condition) will also be calculated for bass collected both years. Daytime electrofishing in the spring is recommended to better sample larger bass. The data collected must be further analyzed before fisheries management recommendations can be made for this waterbody. Seining data from 2016 can be found on page 83 and dissolved oxygen and temperature profile information can be found on page 134. (Hamilton)

Delaware River (Mercer) – Two boat electrofishing surveys were completed during the summer of 2016 to monitor the invasive Northern Snakehead and Flathead Catfish populations. In addition, Largemouth Bass were collected when encountered. Past electrofishing surveys have been rather unsuccessful at capturing snakeheads in the Delaware River. Electrofishing has proved most successful in backwater areas and tributary creeks where snakeheads appear to be more concentrated. A boat electrofishing survey was completed on August 24, 2016 to evaluate the Northern Snakehead and Largemouth Bass populations in the vicinity of Trenton. A total of 19 Largemouth Bass were collected with eight individuals greater than 200 mm (8 in) collected. There were no snakeheads collected or observed during the survey, however one Flathead Catfish measuring 410 mm (16.1 in) was collected. An electrofishing survey completed in 2014 also produced two Flathead Catfish just downstream around Bordentown. This section of the river should continue to be monitored for the presence of Flathead Catfish. (Smith)

Delaware River (Camden) - A boat electrofishing survey was completed on August 29, 2016 to evaluate the Northern Snakehead and Largemouth Bass populations in the vicinity of Pennsauken. A total of 13 species were observed during the survey however were no snakeheads and only three Largemouth Bass were collected. Boat electrofishing during high tide appears to be rather ineffective on the Delaware River. Future sampling should be conducted during the lower stages of the tide cycle. This site should be included in future sampling efforts to evaluate both Northern Snakeheads and Largemouth Bass as habitat appears to be favorable for both species. (Smith)

DOD Lake (Salem) – The DOD Lake WMA is a 120-acre borrow pit located in Penn Grove. A lake inventory and management plan was completed in 2002. The Largemouth Bass population has fluctuated since acquired by NJDFW in 1999. Boat electrofishing surveys to monitor the Largemouth Bass population were completed in 2010, 2011, 2014, 2015, and 2016. DOD Lake has been stocked with Musky, Tiger Musky, Smallmouth Bass, Channel Catfish, White Crappie, Largemouth Bass and Striped Bass at various times over the years. DOD Lake has received surplus stockings of Smallmouth Bass, Channel Catfish, Tiger Musky, and Musky since 2013. These stockings are not part of the annual stocking schedule. None of these species were encountered during sampling in 2016. The stocking of these species should continue in order increase diversity of the fish population and provide additional fishing opportunities. A boat electrofishing survey was completed on June 28, 2016 to evaluate the Largemouth Bass and Northern Snakehead population. A total of 45 Largemouth Bass were collected in 1.5 hours of daytime electrofishing. There were 35 bass greater than the 200 mm (8 in.) stock size indicating a CPUE of 23 bass/hour. The PSD was 89 and PSD-P was 11 indicating the population is slightly unbalanced. Northern Snakeheads were first reported in 2014 and the presence confirmed by NJDFW in 2015. Eight Northern Snakeheads were collected in 2016, measuring 225 - 530 mm (8.9 – 20.9 in). In comparison two Northern Snakeheads were collected in 2015. The snakehead population appears to be growing and will continue to be monitored to determine the impact on the Largemouth Bass population. (Smith)

Game Creek (Salem) – Game Creek is a small tributary of the Salem Canal, located in Penns Grove. A lake inventory and management plan was completed on the Salem Canal in 1999. Electrofishing surveys to monitor the Largemouth Bass were completed at either Salem Canal or Game Creek in 2007, 2010, 2012, 2013, 2014, 2015, and 2016. Salem Canal is one the most popular bass fishing locations in southern New Jersey. In 2016 a boat electrofishing survey was completed on July 22, 2016 to evaluate the Largemouth Bass and Northern Snakehead population. Previous reports by anglers suggested that Northern Snakehead may be present in the Salem Canal and Game Creek. Two adult snakeheads were captured and removed from Game Creek. A total of 38 Largemouth Bass were collected of which 35 were greater than 200 mm (8 in.) stock size. The CPUE was 35 bass/hour as determined from one hour of electrofishing. The Largemouth Bass and Northern Snakehead populations will continue to be monitored. No additional stocking is necessary at this time. (Smith)

Green Turtle Pond (Passaic) – This is a 43-acre lake located inside Long Pond Iron Works State Park. A gravel boat ramp and adequate parking are available and previous surveys indicated a good Largemouth Bass and Yellow Perch fishery despite anoxic conditions below 10-foot depth. A survey was conducted here last year and the results indicated that the population is out of balance and dominated by smaller sized individuals. Therefore, the recommendation was made to follow up in the Fall of this year to gather more data to determine a management strategy. On September 26, 2016 a nighttime boat electrofishing survey at Green Turtle Pond was conducted to evaluate the Largemouth Bass population. This year's survey lasted 0.99 hours and a total of 83 Largemouth Bass were captured ranging from 91 – 452 mm (3.6 – 17.8 in) in length and had a PSD of 26. Of the 83 individuals captured, 53 were larger than 200 mm (CPUE of 53 bass/hour). A sample of twenty Largemouth Bass were aged using scales and 15 out of 20 were age 3 or less (11 at age 3). The concern after electrofishing this waterbody last year was that the population was dominated by smaller sized Largemouth Bass with a PSD of 12. The PSD is still indicating a population dominated by smaller individuals with a PSD of 26 but recruitment, the abundant number of bass, and the available forage base are good signs that this fishery will continue to develop larger bass in the future. Sampling should continue here in the near future to monitor the fishery. See page 83 for 2016 seining information. (Collenburg)

Greenwood Lake (Passaic) – The 1,920-acre Greenwood Lake was sampled for Walleye and bass via nighttime electrofishing on April 25, 2016. The sampling effort lasted 1.25 hours and a total of 18 Walleye ranging from 200 – 678 mm (7.9 – 26.7 in) and 0.06 – 3.09 kg (0.1 – 6.8 lbs.) for a CPUE of 13.7 Walleye/hour. Of the 17 Walleye that were larger than stock size (250 mm), all of them exceeded 15 inches, 41% exceeded 20 inches and 24% exceeded 25 inches. Walleye seem to be doing well and angler reports and past broodstock collection show indications that their catch rates are increasing. Additionally, thirty-seven Largemouth Bass were captured ranging from 208 – 465 mm (8.2-18.3 in) and the largest weighing 1.7 kg (3.8 lbs.). This is a good sign for the Largemouth Bass fishery at Greenwood Lake after it was hit with Largemouth Bass Virus in 2007. Supplemental stocking of Largemouth Bass was done in the last three years and may have assisted to boost the numbers of a population that had declined. The sampling effort indicates both a Walleye and Largemouth Bass fishery that is well balanced. Other noteworthy catches were many sizable Black Crappie, six Smallmouth Bass, and one Muskellunge exceeding 40 inches that was not netted. This effort consisted of the southern end of Greenwood Lake but additional sampling may be done next year to collect more data on the bass fishery. For Coolwater Assessment data see page 60. (Collenburg)

Jersey City Reservoir # 3 (Hudson) - A former water supply reservoir, it has been preserved as a natural space and is open to public fishing. Robert O'Donnell, Jr., Science Educator at Christa McAuliffe School (P.S. #28), Jersey City has involved the reservoir in a number of school projects. Recently, receiving The NJ Governor's Environmental Excellence Award (GEEA) for his program, Project Reservoir (http://projectreservoir.wixsite.com/2014).

In 2014, the Hackettstown State Fish Hatchery stocked the reservoir with Largemouth Bass, Brown Bullhead, and Channel Catfish. A boat electrofishing (0.55 hours) survey was conducted on the six-acre reservoir on November 1, 2016. This was the first time that this reservoir was electrofished by NJDFW. The fish assemblage consisted of 5 species including Largemouth Bass (62), Black Crappie (4), Bluegill (24), Common Carp (1), and Channel Catfish (1). Young-of-the-year (YOY) Largemouth Bass were abundant. Largemouth Bass ranged in size from: 63 - 420 mm (2.5 – 16.5 in), and their weights were to 2.0 lbs. The 62 Largemouth Bass were collected in 0.55 hours of electrofishing, of which 55 were greater than the 200 mm stock size, resulting in a CPUE of 100 bass/hour. The PSD was 96 and RSD-P was 13, indicating an unbalanced population of bass with the majority in the 325 – 374mm (12.8 – 14.7 in). These fish are, undoubtedly, from the previous stocking mentioned above. Jersey City has a "*Catch & Release*" policy at the reservoir. It is recommended that limited harvest of the Largemouth Bass be allowed to establish a more balanced population. No further sampling is recommended at this time. (Boriek)

Lake Audrey (Cumberland) – Lake Audrey is a 120-acre borrow pit acquired by NJDFW in 2004. When acquired the lake was unable to support fish, due to extremely low pH levels. NJDFW initiated a project to enhance the water quality by adding lime to the lake in 2006. The project was funded by a grant through the Cumberland County Utilities Authority and labor was provided by members of the South Jersey Bass Club Association and NJ Federation of Sportsmen Clubs. A total of 136 tons of lime was added to Lake Audrey to neutralize the pH. Artificial habitat structures, formed from wooden pallets and evergreen trees were deployed to provide much needed fish habitat. In 2007 the lake was stocked with Smallmouth Bass, Yellow Perch, Bluegill, Pumpkinseed, and Golden Shiner. A boat electrofishing survey was completed at Lake Audrey on June 30, 2016 to evaluate the Largemouth Bass and Smallmouth Bass populations. The Largemouth and Smallmouth Bass populations have steadily declined since 2012 and is directly attributed to declining pH levels. The pH level in 2016 was 4.44 and generally too low for bass and sunfish to successfully spawn. A total of four Largemouth Bass were collected during one hour of daytime electrofishing. There were no Smallmouth Bass collected or observed. The Cumberland County Federation of Sportsman has recently inquired regarding the status of Lake Audrey and future management by NJDFW. Future management activities should concentrate on the Largemouth Bass population. Should funds become available, a supplemental lime application to raise the pH is recommended. The current *Catch and Release* regulation on bass is unnecessary and should be removed during the next Fish Code cycle. No additional stocking is recommended for Lake Audrey unless the pH is increased. (Smith)

Manasquan Reservoir (Monmouth) – Manasquan Reservoir is a 720-acre water supply reservoir in Howell, maintained by the Monmouth County Park System. It is one of the state's most popular bass fishing locations. A daytime boat electrofishing survey was conducted on November 2, 2016 to assess the Largemouth and Smallmouth Bass populations. The reservoir was about six feet below normal pool, which assisted in navigating the standing timber around the perimeter. A total of 50 Largemouth Bass were collected, of which 48 were greater than 200 mm (8 in) stock size. The CPUE was 24 bass/hour, based on two hours of electrofishing. A PSD of 88, PSD-P of 54 and PSD-M of 6 were calculated for Largemouth Bass indicating a slightly unbalanced population that should provide exceptional fishing opportunities. Noteworthy was the PSD-M of 6, indicating those individuals greater than memorable size of 510 mm (20 in). Three individuals fit this category and weighed 2.630 kg (5.80 lbs.), 2.470 kg (5.45 lbs.) and 2.384 kg (5.26 lbs.). Yellow Perch and Alewife were observed to be rather abundant indicating ample forage. A total of nine Smallmouth Bass were collected. All individuals were greater than the stock size 180 mm (7 in). The largest collected measured 469 mm (18.46 in) and weighed 1.92 kg (4.23 lbs.). Supplemental young-of-the-year Smallmouth Bass should be stocked whenever available. The lake should continue to be monitored on a regular basis. For Coolwater Assessment data see page 61. (Smith)

Menantico Sand Ponds (Cumberland) – Menantico Sand Ponds WMA is a 62-acre complex of interconnected borrow pits directly attached to the tidal Maurice River. An inventory and management plans was prepared in 1997, which identified a robust Largemouth Bass population with a CPUE of 53 bass/hour for all bass. CPUE is now calculated for only those individuals greater than the 200 mm (8 in) stock size. An electrofishing survey completed in August 10, 2016 indicated a rather marginal Largemouth Bass population (n=10) ranging from 164-452 mm (6.46-17.80 in). A total of nine bass greater than the 200 mm (8 in) stock size were collected in 1.48 hours of electrofishing, indicating a CPUE of 6 bass/hour. An additional boat electrofishing survey was completed on July 11,2016 to evaluate the Largemouth Bass population. A total of 26 Largemouth Bass were collected, 23 of which were greater than the 200 mm (8 in) stock size. A CPUE of 23 bass/hour was calculated based on one hour of electrofishing. The largest bass collected was 485 mm (19.09 in) and 1.79 kg (3.95 lbs.). A total of 15 species of fish were collected electrofishing. Adult American Eels were observed to be rather abundant. A seining survey was completed on August 22, 2016 to evaluate the native fish population. Habitat within the sand ponds has significantly changed since the lake inventory was completed in 1997 and subsequently altered the fish population, as reflected during the seining survey. For 2016 seining information see page 86. (Smith)

Mercer Lake (Mercer) – Mercer Lake is a 275-acre impoundment of Assunpink Creek located within Mercer County Park. A daytime boat electrofishing survey was conducted on October 18, 2016 to assess the Largemouth Bass population. Sampling occurred around the perimeter of the lake. A total of 63 Largemouth Bass were collected, of which 61 were greater than the 200 mm (8 in) stock size. The CPUE was 40 bass/hour based on 1.5 hours of electrofishing. A PSD of 45, PSD-P of 19 and PSD-M of 4 were calculated for Largemouth Bass indicating a balanced population. Three memorable size bass (RSD-M) were collected and weighed 2.412 kg (5.32 lbs.), 2.28 kg (5.03 lbs.) and 2.254 kg (4.97 lbs.). A Bigmouth Buffalo, a species not native to New Jersey was also collected. Recently stocked Tiger

Musky were observed but not collected along with Bluegill, Pumpkinseed, Redbreast Sunfish, White Perch, Yellow Perch, Chain Pickerel, Golden Shiner, Common Carp, Brown Bullhead, American Eel, and Gizzard Shad. In comparison a daytime electrofishing survey was also completed in July 15, 2016, at which time the CPUE was 16 bass/hour for bass greater than the 200 mm (8 in) stock size. Thirty-two bass under the stock size were also collected in 2015. The PSD of 65 and PSD-P of 38 in 2015 indicated a balanced population. Electrofishing surveys from 2015 and 2016 suggest that the population has made a good recovery from Largemouth Bass Virus. Supplemental young-of-the-year Largemouth Bass were stocked in 2015 to enhance the recovery of the Largemouth Bass population. No additional stocking or sampling is necessary at this time. An electrofishing survey should be completed in spring 2018. (Smith)

Mountain Lake (Warren) - This 122-acre public lake has a public boat launch, but limited shoreline access due to numerous lakefront homes. The 2016 electrofishing survey was prompted by concern about the low number of centrarchid fish species (bass and sunfish) captured during sampling conducted earlier in the spring with trap nets to assess the Muskellunge fishery. The lake is stocked annually with Muskellunge (*Trophy Musky* fishing regulations apply; 40-inch minimum size, instead of 36-in). Catchable-sized trout are also stocked in the spring (one stocking prior to Opening Day of the trout season in April). Largemouth Bass have also been stocked, most recently in 2013. Nearly the entire perimeter of the lake was electrofished at night on 10/3/16 and a total of 85 Largemouth Bass were captured in 1.3 hours of electrofishing. Of these bass, 62 were stock size (20 cm (8-in) or greater). The CPUE for bass (stock size and greater) was 48 bass/hr. The largest bass captured was 46 cm (18.1 in) and weighed 1.8 kg (4.1 lbs). The PSD (Proportional Size Distribution) for bass was 48. PSD is a numerical index used to characterize the length-frequency data and provide insight about population dynamics (40–70 is the accepted range for a balanced Largemouth Bass population). The PSD-P for bass was 16 (Preferred $\geq$38 cm (15 in); 10–40 is the accepted range for a balanced Largemouth Bass population). Other fish species captured during the survey were Muskellunge, Chain Pickerel, Black Crappie, American Eel, Alewife, Bluespotted Sunfish, and Common Carp. The sunfish (Bluegill and Pumpkinseed) appeared to be fairly abundant, but small. The number of Muskellunge encountered (7) was considered high compared to surveys conducted by staff on other lakes that are stocked with this species. The large size of the four Black Crappies captured (34 cm (13.6 in) and 0.7 kg (1.5 lbs)) was notable. Bluespotted Sunfish is one of New Jersey's less common native sunfish species and its continued presence in this lake (first documented in 1950) is noteworthy. Interestingly, Yellow Perch were not encountered during the survey. This species, a preferred prey of Muskellunge, was last documented in the lake during trap netting conducted in 2001 by the Hackettstown State Fish Hatchery. The age and growth of bass collected during fall electrofishing will be determined from their scales, and relative weight (a measure of fish condition) will also be calculated for bass collected in 2016. In addition to the 2016 fall electrofishing survey, additional data was collected in the spring (trap nets used) to assess the Muskellunge fishery (page 63) and in the summer (shoreline seining) to assess warmwater fish reproduction (page 88). A temperature/dissolved oxygen profile conducted on at the deepest part of the lake (40 feet) indicated a one-foot layer of trout supporting water was present 16-17 feet below the surface (page 134). Fisheries management recommendations will be prepared following a collective analysis and review of all data from these recently conducted surveys. (Hamilton)

Newton Lake (Camden) – Newton Lake is a 40-acre impoundment of Newton Creek bordered by Collingswood, Oaklyn and Haddon Townships. Much of the lake is maintained by the Camden County Parks System. Newton Lake has a small paved boat ramp, ample trailer parking, and good shoreline access for anglers. The lake is family friendly with a playground and temporary restrooms nearby. A fish ladder to increase spawning habitat for Alewife and Blueback Herring was installed in the early 2000's and subsequently deemed a pathway for the invasive Northern Snakehead. A boat electrofishing survey was completed on July 19, 2016 at Newton Lake to evaluate the Largemouth Bass and Northern Snakehead populations. A total of 42 Largemouth Bass were collected, of which 39 were greater than the 200 mm (8 in) stock size. The CPUE was 39 bass/hour based on one hour of daytime electrofishing. The largest bass measured 480 mm (18.90 in) and weighed 1.695 kg (3.74 lbs.). A PSD of 56 and PSD-P of 36 indicate a slightly unbalanced population. A total of six Northern Snakeheads were collected ranging in size from 320-675 mm (12.6 - 26.6 in) and weighed 0.260-3.140 kg (.57 - 6.92 lbs.). Submerged aquatic vegetation is rather abundant in Newton Lake and provides excellent habitat for both Largemouth Bass and Northern Snakeheads. The lake will continue to be monitored for the presence of Northern Snakeheads and any impact on the Largemouth Bass population. (Smith)

Parvin Lake (Salem) – Parvin Lake is a 95-acre impoundment of Muddy Run located within Upper Pittsgrove Township. Parvin Lake is one of five lakes managed under *Lunker Bass* Regulations. It is second only to Assunpink Lake in popularity among *Lunker Bass* lakes. A daytime boat electrofishing survey was conducted on October 24, 2016 to assess the Largemouth Bass population. Sampling occurred around the perimeter of the lake. A total of 76 Largemouth Bass were collected, of which 65 were greater than 200 mm (8 in) stock size. The CPUE was 43 bass/hour for stock size bass based on 1.5 hours of sampling. A PSD of 72, PSD-P of 46 and PSD-M of 4 were calculated for Largemouth Bass indicating a slightly unbalanced population that should provide exceptional fishing opportunities. Three memorable size (PSD-M, 20") Largemouth Bass weighing 3.34 kg (7.35 lbs. 3.36 kg (7.40 lbs.) and 2.51 kg (5.54 lbs.) were collected during the survey. The Yellow Perch and Bluegill populations appear to be rather abundant compared to past sampling and may be attributed to the Centerton Lake dam failure in 2009. Centerton Lake was the next upstream impoundment of Muddy Run. Gizzard Shad of multiple year classes were observed during the electrofishing survey, which provide good forage for trophy-sized Largemouth Bass. The abundant forage and size structure of the bass were good signs of a thriving fish population. Parvin Lake was last sampled in 2012 with similar results. No additional electrofishing is necessary until spring 2018. No additional stocking is necessary at this time. A seining survey should be completed in 2017 to assess the native fish population. (Smith)

Ponder Lodge Pond (Cape May) – Ponder Lodge Pond is an 8-acre waterbody located within the Cox Hall Creek Wildlife Management Area in Lower Township. The pond is a NJDFW trout stocked waterbody and has not been previously sampled in the past. A day-time boat electrofishing survey was conducted on August 17, 2016 to assess the Largemouth Bass population. Sampling occurred around the perimeter of the lake. Total electrofishing time was 0.50 hours. A total of 25 Largemouth Bass were collected, of which 24 were >200 mm (8 in) stock size, indicating a CPUE of 48 bass per hour. A Largemouth Bass measuring 569 mm (22.4 in) and weighing 2.710 kg (5.97 lbs.) was collected during the survey. Bluegill and Pumpkinseed were also collected. Young-of-the-year (YOY) Largemouth Bass and Bluegill were collected using seines indicating successful reproduction of both species. Additional stocking of Largemouth Bass is not required at this time. Stocking of surplus Largemouth Bass in the future may be beneficial. Mosquitofish sp. were also present. (Boehm)

Prospertown Lake (Ocean) – Prospertown Lake WMA is an 80-acre impoundment of Lahaway Creek, a tributary of Crosswicks Creek in Jackson Township. The lake is bordered by Six Flags Great Adventure on one side and private forested land on the other. A lake inventory and management plan was completed in 1997. The Prospertown Lake dam failed in 2011 was reconstructed in 2012 and refilled by spring 2013. The lake was restocked with Largemouth Bass, Bluegill, Black Crappie, and Brown Bullheads in 2013. A boat electrofishing survey completed in 2014 determined that an undesirable number of Brown Bullheads were present. Only one electrofishing survey was completed from 1997 to 2011. In 2007, 27 Largemouth Bass ranging from 170 – 347 mm (6.7 – 13.7 in) were collected and tested negative for Largemouth Bass Virus. A boat electrofishing survey was completed at Prospertown Lake on June 27, 2016 to evaluate the Largemouth Bass population and remove Brown Bullheads. A total of 49 Largemouth Bass were collected in 1.25 hours of daytime boat electrofishing. The CPUE for those bass greater than 200 mm (8 in) stock size was 36 bass/hour. A PSD of 80 and PSD-P of 44 indicate a slightly unbalanced population. The PSD and PSD-P were both higher that that observed in 2015 (PSD of 50 and PSD-P of 25). Approximately 350 Brown Bullheads ranging in size from 150 – 250 mm (5.9 – 9.8 in) were removed from Prospertown Lake and relocated to Turnmill Pond, Colliers Mill WMA. No additional stocking is required at this time. Additional sampling should be completed in 2017 to monitor the Largemouth Bass population and remove additional Brown Bullheads from the lake. A seining survey should be completed to evaluate the native fish population. (Smith)

Rainbow Lake (Salem) – Rainbow Lake WMA is a 77-acre impoundment of Muddy Run, a tributary of the Maurice River in Pittsgrove Township. Rainbow Lake is annually one of the most popular WMA lakes for bass tournaments. A lake inventory and management plan was completed in 2001 soon after it was acquired by NJDFW. The lake had a good bass and sunfish population at that time. The high hazard dam failed in May 2007 and was replaced later that fall. The lake was restocked with adult fish collected from Harrisonville Lake in December 2007. A boat electrofishing survey was completed on July 1, 2016 to evaluate the Largemouth Bass population. A total of 39 Largemouth Bass were collected during 1.5 hours of electrofishing. There were 27 bass greater than the stock size indicating a CPUE of 18 bass/hour. A PSD of 52 and PSD-P of 33 indicate a balanced population. No additional electrofishing sampling is necessary at this time, however a seining survey to assess the native fish population is recommended for 2017. Stocking of surplus young-of-the-year (YOY) Largemouth Bass is recommended to enhance the bass population. (Smith)

Rising Sun Lake (Monmouth) – Rising Sun Lake is a 38-acre impoundment located within the Assunpink Wildlife Management Area near the town of Roosevelt. A daytime boat electrofishing survey was conducted on 10/20/16 to assess the Largemouth Bass population. Sampling occurred around the perimeter of the lake. A total of 116 Largemouth Bass were collected, of which 107 were greater than 200mm (8 in) stock size. The CPUE was 184 bass/hour based on 0.58 hours of electrofishing. A PSD of 39 and PSD-P of 2 were calculated for Largemouth Bass indicating an unbalanced population. The size structure has improved since 2015, at which time the CPUE was 34 bass/hour, PSD was 13 and PSD-P was 4. Stocking of Golden Shiners and Yellow Perch is recommended in 2017 to improve the forage base. The lake should be resampled in the fall 2017 to evaluate the Largemouth Bass population size structure and condition. Rising Sun Lake should be removed from the bi-annual Channel Catfish stocking list to alleviate competition with Largemouth Bass. (Smith)

Shaws Mill Pond (Cumberland) – Shaws Millpond WMA is a 30-acre impoundment of Pages Run, a tributary of Nantuxent Creek in Lawrence Township. A boat electrofishing survey was completed on July 12, 2016 to evaluate the Largemouth Bass population. Electrofishing proved rather unsuccessful with only four adult Largemouth Bass collected. A total of nine species were collected during the 30-minute survey. Adult Golden Shiner and young-of-the-year (YOY) Largemouth Bass were observed to be abundant, but were not collected. A lake inventory was completed in 2002 that indicated the lake had a good bass population. The CPUE was 36 bass/hour in 2002 for all bass, including those smaller than the 200 mm (8 in) stock size. For seining summary see page 91. A supplemental electrofishing survey should be completed during the spring or fall when less vegetation is present to further evaluate the bass population. No additional stocking of warmwater fish is necessary at this time. (Smith)

Split Rock Reservoir (Morris) – On October 11, 2016 a nighttime boat electrofishing survey was conducted on this 550-acre lake to evaluate the Largemouth and Smallmouth Bass populations. The reservoir is one of Jersey City's water supply reservoirs and the DEP recently (2015) purchased land around the reservoir to allow additional access via shoreline. A lake inventory was conducted here in 2007 to determine the status of the lake and help guide management. It was determined that an excellent Largemouth and Smallmouth Bass fishery was present (CPUE of Largemouth Bass and Smallmouth Bass was 40 fish/hour and 52 fish/hour, respectively). At that time, it was determined that the lake should be managed strictly for its excellent bass fishery. The survey conducted this year lasted 2.0 hours and a total of 35 Largemouth Bass greater than stock size (200 mm) and 10 Smallmouth Bass greater than stock size (180 mm) were captured. This CPUE (17 Largemouth Bass/hour and 5 Smallmouth Bass/hour) was much lower than when the last survey was conducted here. The cause of the low catch rate in bass here may be due to multiple factors including sampling time. An additional survey will be conducted in 2017 to determine if any action is necessary. (Collenburg)

Stone Tavern Lake (Monmouth) – Stone Tavern Lake is a 52-acre impoundment located within the Assunpink Wildlife Management Area. A daytime boat electrofishing survey was conducted on October 17, 2016 to assess the Largemouth Bass population. Sampling occurred around the perimeter of the lake. A total of 56 Largemouth Bass were collected, of which 53 were greater than 200mm (8 in) stock size. The CPUE was 53 bass/hour based on one hour of electrofishing. A PSD of 83 and PSD-P of 24 indicate a slightly unbalanced Largemouth Bass population. Stone Tavern was last stocked with Largemouth Bass in 2011. Stone Tavern should be removed from the Channel Catfish stocking list to maintain and enhance the Largemouth Bass condition and size structure. (Smith)

Union Lake (Cumberland) – Union Lake WMA is an 898-acre impoundment of the Maurice River and the largest lake in southern New Jersey. A boat electrofishing survey was completed on September 2, 2016 to evaluate the Largemouth Bass population. A total 14 Largemouth Bass were collected during the 1.33-hour survey. The largest individual was 507 mm (20.5 in) and 2.255 kg (4.97 lbs.). Thirteen of the fish were greater than the 200 mm (8 in) stock size. A rather significant algae bloom was present, including large areas of filamentous algae, which is not typical for Union Lake. It is presumed that the hot dry summer could have contributed to the conditions. A lake inventory was completed in 2015, which failed to adequately asses the Black Crappie and Smallmouth Bass populations. Sampling utilizing trap nets during the spring of 2017 is recommended to ascertain the current status of the Black Crappie population. A supplemental electrofishing will be completed in March targeting Largemouth and Smallmouth Bass. No additional stocking is required at this time however stocking of surplus Smallmouth Bass is recommended. (Smith)

Wheaton Glass Works Pond (Cumberland) – A boat electrofishing survey was completed at the Wheaton Glass Works Pond in response to a council request. The privately owned borrow pit pond is approximately 1.5 acres and wooded around its perimeter. Laydown trees, willows, and bladderwort serve as the primary habitat in the pond. A total of 55 Largemouth Bass were collected in 0.66 hours of daytime electrofishing. Fifty-one of the bass were greater than the 200 mm (8 in) stock size. There were no bass greater than 380 mm indicating the population is not balanced. The bass population is rather abundant and unbalance based on limited angler harvest. A total of 19 adult Bluegill were collected during 0.25 hours of electrofishing. The population consists mainly of larger individuals greater than 200 mm indicating the population is unbalanced. The current fish population should provide good angler success, however few larger bass are present. Pumpkinseed, Yellow Perch, and Mosquitofish sp. were also present. The pond is currently not open to the public for fishing. No additional management activities are required unless the pond is opened to public fishing. (Smith)

Wilson Lake (Gloucester) – Wilson Lake is a 58-acre impoundment of Scotland Run, a tributary of the Maurice River located within the county owned Scotland Run Park. Wilson had a major dam repair and the lake was significantly lowered during the winter of 2014/2015. Largemouth Bass were restocked in 2015. A daytime boat electrofishing survey was conducted on November 3, 2016 to assess the warmwater fish population. A total of 18 Largemouth Bass were collected, of which 16 were greater than 200 mm (8 in) stock size. The CPUE was 21 bass/hour for stock size bass based on 0.75 hours of electrofishing. A PSD of 56 and PSD-P of 19 indicate a balanced population. The Chain Pickerel population appears to be rather abundant, but most were small and less than the harvestable size (15 in). The forage base is rather limited in the lake with only a few large Bluegill and Yellow Perch observed. Stocking of Golden Shiners is recommended to enhance the forage base. Seining was also conducted in 2016 (page 92). No additional sampling is planned for 2017. (Smith)

Warmwater Fisheries Assessments / Reproduction Checks / Native Fishes via Seining

Shoreline seining was conducted in 49 lakes and ponds in July through mid-September to assess the status of warmwater fish reproduction, which aids in the management of their fisheries and helps assess stocking success or need. These data are also beneficial in documenting the presence of both native and invasive species. (Hunter and Angler Fund)

Bluegill (top) and Pumpkinseed (bottom) collected with a 20' x 4' seine.

Allamuchy Pond (Warren) - This 49-acre lake is within the Pequest River watershed and located off County Rt. 517, within Allamuchy Mountain State Park. The fishery was surveyed by NJDFW in 1979 and Largemouth Bass (5), Pumpkinseed (5), and American Eel (1) were documented (sampling gear unknown). The owner at the time (Catholic Sisters) operated a convent, and public access to the lake was restricted to the steep bank adjacent to the highway. Once the property changed hands (now owned by the Allamuchy Township Board of Education) Parks and Forestry constructed a small car top ramp for boating (electric motors only). Sampling to obtain current data on the fishery was conducted on August 8, 2016. Eight locations were sampled using a 20'x 4' seine to assess fish reproduction. This effort was hampered by dense aquatic vegetation and steep drop-offs. Species and number of fish collected included Largemouth Bass (11), Bluegill (343), Pumpkinseed (3), and Mosquitofish sp. (7). A temperature/dissolved oxygen profile conducted at the deepest part of the lake (27 feet) indicated trout supporting water was not present (page 134). More information about the fishery is needed before specific fishery management and/or fish stocking recommendations can be made for this lake. Shoreline electrofishing is recommended, however, the absence of a formal boat launch may preclude this sampling activity. (Hamilton)

Ames Lake (Morris) – This 14-acre lake located in Rockaway Township has not been assessed since an electrofishing survey was done here in 1987, with little data collected. This lake is stocked with Channel Catfish. During this sampling event 15 seine pulls were conducted and a number of Largemouth Bass (55) were collected. Only a small amount of young-of-the-year sunfish (17) were present, although it may have been too early in the season to collect them. However, a good number of adults and immatures were captured (41), indicating that the population of Largemouth Bass and sunfish species are well balanced. Creek Chubsucker (6), Yellow Perch (14), and Chain Pickerel (5) were also found. Of note, a species that was not originally found in the surveys conducted in the 80's was a common native Bluespotted Sunfish (12). In the near future, an electrofishing survey should be conducted to monitor this small but popular waterbody. (Collenburg)

Atsion Lake (Burlington) – Atsion Lake is a 62-acre impoundment of the Mullica River located within Wharton State Forest. The lake is a popular recreational area offering camping, swimming, fishing, and paddling opportunities. Sampling for native pinelands fishes was conducted on August 12, 2016. A total of 12 locations were sampled using a 20'x4' seine around the perimeter of the lake. Eleven species were collected which consisted of Pumpkinseed (321), Swamp Darters (63), Blackbanded Sunfish (55), a species soon to be designated state Special Concern, Black Crappie (27), Creek Chubsucker (7), 7 young-of-the-year (YOY) Largemouth Bass, 7 YOY Chain Pickerel, Bluespotted Sunfish (6), Pirate Perch (3), American Eel (2), and Yellow Bullhead (1). YOY, intermediate, and adult Pumpkinseed were all collected. Water chemistry was recorded; pH measured 4.50. The presence of YOY Black Crappie was of interest. Further sampling is required to assess the fishery. No stocking is planned at this time based on the present native fish community present, and location within pinelands. (Boehm)

Cedar Lake (Atlantic) – Cedar Lake is an impoundment on the Great Egg Harbor River watershed. The lake is located within Cedar Lake Wildlife Management Area, and is approximately 30 acres in size. This location has not been previously sampled by the NJDFW. Sampling for native pinelands fishes was conducted on July 14, 2016. A total of six locations were sampled along the perimeter of the lake using a 20'x4' seine. A total of six species were collected which included Blackbanded Sunfish a species soon to be designated state Special Concern (17), Chain Pickerel (2), Golden Shiner (4), Enneacanthus sp. (19), Bluegill (73), and Swamp Darter (5). Water chemistry was recorded; pH measured 5.98 and conductivity was 56.4 us/cm. No further sampling is needed at this time, and stocking is not recommended in the future. (Boehm)

Cedar Lake (Cedarville, Cumberland) – Cedar Lake is a 57-acre impoundment of Cedar Creek located in the town of Cedarville. A dam restoration or removal is currently being discussed at this location. Two surveys were completed in 2016 to assess the fish population. A seining survey was completed on July 28, 2016 to evaluate the native fish population and a daytime boat electrofishing survey was completed in the fall to evaluate the Largemouth Bass population. Cedar Lake was previously sampled in 2005 for native fishes utilizing minnow traps. This method was determined to be rather ineffective, with only Bluegill and Pumpkinseed collected. The abundant filamentous algae limited seining locations in the lake. A total of eight species consisting of Largemouth Bass (1), Brown Bullhead (25), American Eel (1), *Enneacanthus* sp. (2), Yellow Perch (3), Chain Pickerel (1), Bluegill (81), and Pumpkinseed (2), were collected from eight seining locations. An electrofishing survey was also conducted in 2016 (page 67). A seining and electrofishing survey should be completed after the dam reconstruction project is completed. No stocking is recommended at this time. (Smith)

Chatsworth Lake (Burlington) – Chatsworth Lake is an impoundment of the West Branch of the Wading River located in the town of Chatsworth. The lake is within the 10,243-acre Franklin Parker Preserve owned by the New Jersey Conservation Foundation, and is approximately 50 acres in size. This location has not been previously sampled by the NJDFW. Sampling for native pinelands fishes was conducted on June 21, 2016. The lake does not have a boat ramp or suitable launching area for trailered boats which limited access to sampling locations. A total of three locations were sampled using a 20'x 4' seine. Species collected included Blackbanded Sunfish (23), Bluespotted Sunfish (5), Banded Sunfish (3), Chain Pickerel (3), Pirate Perch (1), and Swamp Darter (42). Swamp Darters were most numerous with 25 young-of-the-year (YOY) and 17 adults collected. YOY, intermediate, and adult Blackbanded Sunfish were all collected. All species collected during this survey are considered native pinelands fishes. Water chemistry was collected and pH measured 4.40. The absence of non-native fish collected during sampling can be attributed to the physiological effects of low pH. Low pH can act as a barrier preventing the establishment of non-native fishes within pinelands waters. This waterbody should not be stocked due to the native fish community present, which includes Blackbanded Sunfish a species soon to be designated state Special Concern. Additional sampling is not needed at this time. (Boehm)

Clint Mill Pond (Cape May) – Clint Mill Pond is a 10-acre impoundment of Sluice Creek located within Beaver Swamp Wildlife Management Area. Sluice Creek is tidal up to the base of Clint Mill Pond. The pond itself is small and boggy in nature which lends support that it was originally constructed for waterfowl habitat in the past. Sampling for native pinelands fishes was conducted on August 15, 2016. A total of four locations were sampled using a 20' x 4' seine around the perimeter of the lake. Two species were collected which included Redfin Pickerel (1) and Brown Bullhead (4). Limited access and a soft lake bed made effective seining difficult. Water chemistry was recorded; pH measured 4.07. This location was last sampled in June 1972. Seining results in 2016 were similar to the 1972 survey, consisting of Redfin Pickerel, Chain Pickerel, Mud Sunfish, and Eastern Mudminnow. No further sampling is needed. Based on the lack of potential to develop a recreational fishery and the present native fish community no stocking is planned in the future. (Boehm)

Coopers Park Pond (Bergen) – Previously seined by NJDFW in 1995, only one Largemouth Bass and no sunfish were collected at that time. A reproductive check was conducted at Coopers Park Pond (3 acres) in Bergenfield on August 25, 2016. Nine seine (20' x 4') hauls around the perimeter of the pond revealed Banded Killifish (1), Pumpkinseed (2), invasive Green Sunfish (6), and Mosquitofish sp. (14). It is recommended that the Hackettstown State Fish Hatchery stock Largemouth Bass, Bluegill, and surplus Channel Catfish in 2017. (Boriek)

Cresse Lane Ponds (Cape May) – Cresse Lane Ponds are located in Lower Township. Young-of-the-year (YOY) Largemouth Bass and Bluegill were collected using seines indicating successful reproduction of both species. Mosquitofish were also present. Water chemistry was recorded; pH measured 7.99, conductivity 1223 us/cm, and salinity was 0.53 ppt. This location has not been previously sampled by the NJDFW. Additional assessment of the warmwater fishery is recommended. (Boehm)

Cumberland Pond (Cumberland) – Cumberland Pond is a 26-acre impoundment of the Manumuskin River located in the town of Millville. This location has not been previously sampled by the NJDFW. An anadromous fish assessment was conducted in the spring of 2000 directly below the dam on the Manumuskin River. This location is equipped with a fish ladder. No river herring were collected in the 2000 survey. Sampling for native pinelands fishes was conducted on July 20, 2016. The pond provided limited sampling locations along the Route 49 shoreline. Deep water and dense beds of water lily and bladderwort along the shoreline made effective seine pulls difficult. A total of two locations were sampled using a 20' x 4' seine. Species collected included the soon to be designated state Special Concern Blackbanded Sunfish (1), Banded Sunfish (5), Bluespotted Sunfish (5), *Enneacanthus* sp. (1), Pirate Perch (6), Swamp Darter (8), and Creek Chubsucker (4). All three *Enneacanthus* species native to New Jersey were collected, and the entire fish assemblage consisted of native pinelands fishes. Additional sampling was conducted on August 2, 2016 to further evaluate the native fish population. Only six seining locations were sampled via boat due to poor access. A total of nine species were collected which included Pumpkinseed (1), Pirate Perch (1), Eastern Mudminnow (9), Swamp Darter (25), Yellow Bullhead (1), Banded Sunfish (87), *Enneacanthus* sp. (20), Chain Pickerel (2), Blackbanded Sunfish, a species soon to be designated state Special Concern (8), and Mud Sunfish, a species soon to be designated state Special Concern (1). Banded Sunfish were the most abundant species collected. The pH of 4.83 and lack of non-native Centrarchids provide ideal habitat for these native species. All fish collected during sampling are considered native pinelands species. No further sampling is necessary at this time. There should be no stocking of this waterbody in order to preserve the integrity of the native fish populations. (Boehm)

Delaware Lake (Warren) - This 36-acre lake, visible from Interstate 80, is located within the Paulinskill WMA. Delawanna Creek flows through this lake before emptying directly into the Delaware River south of Columbia. Upstream of Delaware Lake the creek is classified as *Trout Maintenance*; downstream of the lake's dam the creek is classified as *Trout Production* (wild Brown Trout present). A gravel boat launch and dock are present (electric motors only) and the lake is managed as a *Lunker Bass Lake*. Fish reproduction was assessed on August 10, 2016 by shoreline seining 12 stations using a 20'x 4' seine. Fish were captured at all but one site. Species collected included Largemouth Bass (28), Bluegill (734), Pumpkinseed (22), Black Crappie (66), Golden Shiner (7), Brown Bullhead (1), Banded Killifish (10), Mosquitofish sp. (3), and 797 sunfish that were too small to individually identify to the species level. A temperature/dissolved oxygen profile was conducted at the deepest part of the lake (14 feet) and trout supporting water was not present (page 134). The lake was also electrofished in the fall to further assess the bass fishery (page 69). The abundance of warmwater fishes encountered during these surveys indicates that supplemental stocking of warmwater fish is not warranted. (Hamilton)

Durand Park Pond (Monmouth) – A reproductive check was conducted at Durand Park Pond (4 acres) in Freehold on August 29, 2016. This pond had never been previously sampled by NJDFW. Eight seine (20' x 4') hauls around the perimeter of the pond revealed Pumpkinseed (16), Bluegill (138), and Largemouth Bass (2). It is recommended that the Hackettstown State Fish Hatchery stock Largemouth Bass and surplus Channel Catfish in 2017. (Boriek)

East Creek Lake (Cape May) – East Creek Lake is a 62-acre impoundment of East Creek located within Belleplain State Forest. Sampling for native pinelands fishes was conducted on 8/4/16. A total of 12 locations were sampled using a 20' x 4' seine around the perimeter of the lake. Bluegills were the most abundant species collected totaling 211. Blackbanded Sunfish, a species soon to be designated state Special Concern totaled 111, and were collected at each of the 12 sampling locations. Only one young-of-the-year (YOY) Largemouth Bass was collected. Chain Pickerel (5), Creek Chubsucker (28), Yellow Perch (7), Pumpkinseed (8), Golden Shiner (6), *Enneacanthus* sp. (64), Bluespotted Sunfish (3) and Yellow Bullhead (5) were also collected. Water chemistry was recorded; pH measured 5.18. Largemouth Bass (3,000) were last stocked in 2001. Stocking of Largemouth Bass at this time is not recommended. However, taking into consideration the limited freshwater angling opportunities of the surrounding area, location within a State Forest, and a public boat ramp all lend support to additional stocking of Largemouth Bass in the future. (Boehm)

Frelinghuysen Forest Preserve Pond (Warren) – On July 29, 2016, division staff performed a reproductive check on a small pond (1.7ac) on recently acquired public property in Warren County. The NJDFW was contacted earlier in the year by the municipality to sample the pond and evaluate the fish population. The pond's water level was very low and was dominated by plant growth making sampling very difficult to near impossible. The sampling crew performed 13 seine pulls but only captured 5 Largemouth Bass and 5 Bluegills. It is difficult to assess the fish population with the pond in this condition. More sampling is necessary to determine the health of the fishery, but if these water level fluctuations are normal for this waterbody, it is likely that a "good" fishery will never fully develop. Stocking of any additional fish should not occur until further data can be gathered about the amount of water typically found in this pond especially during the summer months and more information on the existing fish population in the pond. (Shramko)

Green Turtle Pond (Passaic) – This 43-acre lake located in West Milford Township was boat electrofished in 2015 and a majority of the Largemouth Bass captured were below stocked size. Seining was conducted to provide supplemental information. A total of 16 seine pulls were conducted and not many young-of-the-year Largemouth Bass (11) were captured, but many were visible to seining crews. A number of sunfish (264) were also found indicating a well-balanced fishery. It is anticipated strong Largemouth Bass year classes will continue to follow. For electrofishing information see page 71. (Collenburg)

Harrisville Lake (Burlington) – A 40-acre impoundment of the Oswego River located within Wharton State Forest. Sampling for native pinelands fishes was conducted on July 8, 2016 using a 20'x4' seine. A total of eight locations around the perimeter of the lake were sampled. A total of six species were collected which included Chain Pickerel (3), Blackbanded Sunfish (20), Bluespotted Sunfish (3), Pirate Perch (1), Swamp Darter (6) and Creek Chubsucker (31). Dense areas of bladderwort and rush were abundant along the perimeter of the lake. All species collected during this survey are considered native pinelands fishes. Water chemistry was recorded and pH measured 4.50. The low pH and lack of non-native Centrarchids provide ideal habitat for these native species. Based on the present native fish community, which includes Blackbanded Sunfish a species soon to be designated state Special Concern, no stocking is planned in the future. (Boehm)

Haworth Park Pond (Bergen) – A reproductive check was conducted at Haworth Park Pond (8 acres) in Haworth on August 30, 2016. The fish assemblage consisted of three species including Pumpkinseed (424), Bluegill (421), Largemouth Bass (1), and unidentified Lepomis sunfish sp. (575). Previously seined in 1971, Golden Shiner, Bluegill, and Pumpkinseed were found. It is recommended that the Hackettstown State Fish Hatchery stock Largemouth Bass and Channel Catfish in 2017. (Boriek)

Hyper Humus Ponds (Sussex) - Hyper Humus Ponds were originally created in the 1900's by a peat and humus mining operation belonging to the Hyper Humus Company. The ponds are only a couple of feet deep with high levels of decomposing vegetation. In the spring of 2015, a large fish kill occurred due to a process known as "winter kill". Winter kill occurs when dissolved oxygen levels decrease, which can occur when a shallow pond with large snow and ice accumulations on the surface limits the amount of sunlight to reach plants in the lake limiting photosynthesis. The plants die and decompose, which uses oxygen dissolved in the water. Dissolved oxygen levels plummet and fish die. After attempting to sample a few of the ponds in 2015 and the remaining ponds in 2016 it has been determined that all of the ponds are only a few feet deep with large amounts of decaying plant material. Hyper Humus Ponds will most likely suffer from re-occurring winter kills in the future preventing a fishery to fully develop. Sampling of the pond with a seine was attempted this summer, but the substrate, dominated by decaying plant matter, made it nearly impossible to seine in most locations. The only area capable of surveying was in a location where a dike failed. The failed dike made the substrate firm enough for staff to sample. The dike failure also concentrated the fish in this area probably due to flowing water between the two impoundments and slightly higher dissolved oxygen found in the flowing water. 12 Largemouth Bass and 52 Sunfish (43 Bluegill, 4 Pumpkinseed, 4 Bluespotted Sunfish and 1 Hybrid Sunfish) were collected. Many large Common Carp were also seen but not collected. Management of the Hyper Humus Wildlife Management Area ponds should be directed towards birds and other wildlife and not as a recreational fishery. (Shramko)

Iona Lake (Gloucester) – Iona Lake is a 36-acre impoundment of Still Run, a tributary of the Maurice River. This municipally owned lake has been annually stocked with trout since 1986 and bi-annually with Channel Catfish since 1993. No additional warmwater species have been stocked at Iona Lake. A seining survey was completed on August 9, 2016 to evaluate the native fish and Largemouth Bass population in Iona Lake. A total of 10 species were collected from 11 seining locations. Largemouth Bass (7), Pirate Perch (2), Blackbanded Sunfish (12), *Enneacanthus* sp. (22), Bluespotted Sunfish (1), Chain Pickerel (1), Golden Shiner (4), Swamp Darter (13), Brown Bullhead (4), unknown *Enneacanthus sp*. (10), and Bluegill (4) were present. Due to the presence of some of state's rare native fish species; including Blackbanded Sunfish (soon to be designated state Special Concern) and historical records Ironcolor Shiner (soon to be listed state Endangered), the stocking of warmwater fish including Largemouth Bass and Channel Catfish is not recommended. (Smith)

Lake Absegami (Burlington) –Lake Absegami is a 63-acre impoundment of the upper Bass River watershed located within Bass River State Forest. The lake is a popular recreational area offering camping, hiking, swimming, and paddling opportunities. Sampling for native pinelands fishes was conducted on July 8, 2016 using a 20' x 4' seine. A total of eight locations around the perimeter of the lake were sampled. A total of three species were collected which included Banded Sunfish (23), Chain Pickerel (12), and Swamp Darter (4). All fish collected are considered native pinelands fishes. Water chemistry was recorded and pH measured 4.38. The absence of non-native fish and low biodiversity within the lake can be attributed to the physiological effects of low pH. Lake Absegami's waters are extremely clear which is usual for the area as the majority of pinelands waters typically are tannin stained and have a light brown hue. No additional sampling is needed at this time. Based on the present native fish community and water chemistry this water should not be stocked. (Boehm)

Lake Lenape (Atlantic) – Lake Lenape is a 350-acre impoundment of the Great Egg Harbor River located in the town of Mays Landing. Sampling looking for the presence of Ironcolor Shiner, a soon to be listed state Endangered species, as well as native pinelands fishes was conducted on July 21, 2016. Fowler 1905 documented Ironcolor Shiners in Mare Run, a tributary of the Great Egg Harbor River above Lake Lenape. Additional records from 1951 indicate Ironcolor Shiners were present within the watershed. A total of eight locations were sampled using a 20' x 4' seine. A total of 11 species were collected which included Largemouth Bass (11), Chain Pickerel (3), Pumpkinseed (1), Bluegill (84), Golden Shiner (59), Black Crappie (6), Blackbanded Sunfish; a species soon to be designated state Special Concern (8), Banded Sunfish (1), Pirate Perch (1), White Catfish (1), and Swamp Darter (1).

Additional sampling for native fishes was conducted on July 26. A total of 12 locations were sampled using a 20' x 4' seine. A total of 12 species were collected which included Largemouth Bass (11), Chain Pickerel (5), Pumpkinseed (2), Bluegill (37), Golden Shiner (3), Black Crappie (3), Blackbanded Sunfish (33), Banded Sunfish (4), Bluespotted Sunfish (6), Pirate Perch (4), Swamp Darter (10), Yellow Bullhead (5), and Brown Bullhead (6). Native fishes appear to be relegated to the headwater portion of the lake near the confluence of the Great Egg Harbor River which creates more favorable habitat for them. Annual winter drawdowns significantly impact and reduces main lake habitat availability. Lake Lenape has a fish ladder with successful anadromous fish passage documented. Management geared towards the benefit of the Largemouth Bass and Black Crappie populations should continue as Lake Lenape is a very popular recreational fishery in Southern New Jersey. No supplemental stocking of warmwater fish is required at this time. Additional sampling for native fishes on the Great Egg Harbor watershed is recommended. (Boehm)

Lake Neepaulin (Sussex) - On July 22, 2016, division staff performed a reproductive check on Lake Neepaulin (25 acres) located in Wantage Township Sussex County. The Bureau was contacted last fall about the possibility of stocking warmwater fish species in Lake Neepaulin by a citizen of Wantage Township. Lake Neepaulin has been under private ownership until recently, when it changed ownership and now is a public waterbody. Subsequently, the Division of Fish and Wildlife has little background information concerning the lakes habitat, water quality and fish population. Lake Neepaulin does have a public boat launch, but it is fairly small and parking is limited to only a few vehicles and trailers. Freshwater fisheries staff collected 15 Largemouth Bass and over 300 Bluegill and Pumpkinseed Sunfish in 17 seine pulls around the perimeter of the lake. About a dozen or so additional Largemouth Bass were seen but evaded capture. No other species were collected. Survey results show a fairly balanced population between Largemouth Bass and Sunfish with no need to stock any additional warmwater fish at this time. (Shramko)

Lake Nummy (Cape May) – Lake Nummy is a 26-acre impoundment of East Creek located within Belleplain State Forest. A fish kill consisting of 200 Yellow Perch was reported in July 2011. One hundred Bluegill were stocked on 6/28/03, and 200 were stocked the following year on 6/6/02. The lake was totally drained in 2014 to repair the dam. Sampling for native pinelands fishes was conducted on 8/23/16. A total of twelve locations were sampled using a 20' x 4' seine around the perimeter of the lake. A total of three species were collected consisting of Blackbanded Sunfish; a species soon to be designated state Special Concern (18), Banded Sunfish (62), and Yellow Bullhead (4). Young-of-the-year (YOY), intermediate, and adult Banded Sunfish were all collected. All species collected are considered native pinelands fishes. Water chemistry was recorded; pH measured 4.95. Mud Sunfish, a species soon to be designated state Special Concern, were not collected during the survey but have been reported at this location in the past. Additional sampling in the future is recommended to confirm the presence of Mud Sunfish within the lake. Due to the native fish assemblage present stocking is not recommended. However, due to the lakes location within a State Park future stocking on a limited basis may be considered. (Boehm)

Lefferts Lake (Monmouth) –Last sampled in 1998, Lefferts Lake has a minimal recreational fishery due to the greatly fluctuating pH of the water. A 1975 survey found the lake to be inhabited by Largemouth Bass, Black Crappie, Bluegill, Brown Bullhead, Banded Killifish, Golden Shiner, Pumpkinseed, and Goldfish. At the request of the Director of Recreation, a reproductive check was conducted at Lefferts Lake (69 acres) in Matawan on August 22, 2016. Sixteen seine (20' x 4') hauls around the perimeter of the pond revealed Pumpkinseed (17), Bluegill (33), Largemouth Bass (4), Black Crappie (1), Bluespotted Sunfish (2), and Chain Pickerel (1). The pH was 7.59. It is recommended that boat electrofishing be conducted before stocking any warmwater fish. (Boriek)

Little Swartswood Lake (Sussex) – On August 8, 2016, division staff performed a reproductive check on Little Swartswood Lake (83 ac) in Sussex County. Staff collected 9 Largemouth Bass, 1 Redfin Pickerel, and 33 Sunfish (9 Bluegill, 6 Pumpkinseed, 4 Redbreast Sunfish, and 14 Bluespotted Sunfish) and 10 Mosquitofish sp. from 15 seine pulls. Several adult Largemouth Bass and Sunfish were observed, but not captured. Finding adequate seining locations is difficult in this waterbody as much of the shoreline drops off quickly compromising the effectiveness of the seine pull. No fish were collected due to habitat constraints on 7 of the 15 seine pulls performed. Due to the sampling difficulty, the seining data is less conclusive than usual and other sampling techniques must be used to have a better understanding of the fish population of the lake. Little Swartswood Lake was also sampled using a South Dakota style trap-net in the spring of this year (page 60). (Shramko)

Makepeace Lake (Atlantic) – Makepeace Lake is a 300-acre impoundment of the Great Egg Harbor River located within Makepeace Lake Wildlife Management Area. Sampling for native pinelands fishes was conducted on August 3, 2016. A total of eight locations were sampled using a 20'x4' seine around the perimeter of the lake. Blackbanded Sunfish (14) a species soon to be designated state Special Concern, Banded Sunfish (79), Swamp Darter (38), and Yellow Bullhead (6) were all collected during the survey. Water chemistry was recorded; pH measured 4.01, temperature 28.9 C and dissolved oxygen 6.99 mg/L. The absence of non-native species collected during sampling can be attributed to the low pH of the lake. Low pH can act as a barrier preventing the establishment of non-native fishes within pinelands waters. Additional sampling in 2017 is planned to assess *Enneacanthus* species diversity. Based on the present native fish community, and lack of potential to develop a recreational fishery no stocking is planned in the future. (Boehm)

Menantico Sand Ponds (Cumberland) – A seining survey was completed on August 22, 2016 at Menantico Sand Ponds WMA to evaluate the native fish population and reproduction of Largemouth Bass. A total of 12 locations were sampled using a 20' x 4' seine around the perimeter of the lake. Eleven species were collected which included Largemouth Bass (1), Swamp Darter (2), American Eel (7), Eastern Mudminnow (9), Chain Pickerel (2), Banded Sunfish (55), Blackbanded Sunfish (23), Bluespotted Sunfish (2), Bluegill (15), Pumpkinseed (1), Redbreast Sunfish (56), and *Enneacanthus sp*. (77). Blackbanded Sunfish, a species soon to be listed as state Special Concern, was frequently encountered in the 2016 survey, however was not found during the 1997 inventory. Another notable difference from 1997 to 2016 was the lack of Largemouth Bass. A total of 91 young-of-the-year (YOY) bass were collected from 10 seining locations in 1997, whereas only one YOY was collected in 2016 from 12 locations. An additional seining survey should be completed in 2017 targeting areas that are more favorable for Largemouth Bass and less favorable for natives. No additional stocking is recommended at this time. For 2016 electrofishing summary see page 73. (Smith)

Mill Pond (Atlantic**)** **–**Mill Pond is a 30-acre impoundment of Nacote Creek located in the town of Port Republic. The pond is the first upstream impediment encountered on Nacote Creek. Sampling for native pinelands fishes was conducted on July 6, 2016. A guard rail along Mill Road prevents launching of trailered boats into the pond. A total of six locations were sampled along Mill Road using a 20' x 4' seine. A total of nine species were collected which included Largemouth Bass (97), Chain Pickerel (4), Pumpkinseed (2), Bluegill (2), Creek Chubsucker (80), Blackbanded Sunfish (40), Bluespotted Sunfish (2), Swamp Darter (2), and Mummichug (1). Ninety-seven young-of-the-year (YOY) Largemouth Bass were collected on three seine pulls which suggests excellent recruitment for the species. Only two YOY Bluegill were collected which suggests spawning had not yet taken place at the time of sampling. Two adult Pumpkinseeds were collected, and several were observed on beds. Water chemistry was collected and pH measured 5.32 and salinity was 0.05 ppt. Juvenile Bluefish <100mm (3.937 in) were being caught by anglers below the dam and suggests the dam acts as a salinity barrier for the pond. Additional sampling is not needed at this time. This lake should not be stocked as it appears to be reverting back to a native fish assemblage, which includes Blackbanded Sunfish a species soon to be designated state Special Concern, and offers a limited fishery for Largemouth Bass due to the low pH. (Boehm)

Mountain Lake (Warren) - This 122-acre lake has a variety of warmwater fishes and is stocked annually with Muskellunge, and also with trout in the spring (stocked one time, before the Opening Day of the trout season in April). Although Parks and Forestry is the lake owner, the shoreline is dotted with private residences and public access for shoreline fishing is limited to the municipal property, which includes a fee-based swimming beach and boat launch. Only electric motors are permitted on the lake. Fish reproduction was assessed on July 27, 2016 by shoreline seining using a 20'x 4' seine. Fish were captured at 14 of the 19 sites selected for survey (no fish were found at 2 sites and 3 sites could not be seined). Species collected included Largemouth Bass (32), Bluegill (25), Pumpkinseed (6), Redbreast Sunfish (3), Bluespotted Sunfish (6), Spotfin Shiner (49), Banded Killifish (288), Mosquitofish sp. (50), and 3 sunfish (species unknown). Bluespotted Sunfish is one of New Jersey's less common native sunfish species and its continued presence in this lake (first documented in 1950) is noteworthy. A temperature/dissolved oxygen profile conducted on at the deepest part of the lake (40 feet) indicated a one-foot layer of trout supporting water was present 16-17 feet below the surface (page 134). In addition, the lake was surveyed in the spring with trap nets to assess the Muskellunge fishery (page 62) and electrofished in the fall to further assess the warmwater fishery (page 74). Fisheries management recommendations will be prepared following a collective analysis and review of all recently collected data. (Hamilton)

New Brooklyn Lake (Camden) – New Brooklyn Lake is a 40-acre impoundment on the Great Egg Harbor River watershed located in the town of Sicklerville. Sampling looking for the presence of Ironcolor Shiner, a soon to be listed state Endangered species, as well as native pinelands fishes was conducted on June 23, 2016. A total of three locations within the lake were sampled using a 20'x4' seine. A total of 10 species were collected which included Largemouth Bass (7), Pumpkinseed (2), Chain Pickerel (5), Blackbanded Sunfish (2), Bluespotted Sunfish (56), Mud Sunfish (1), Mosquitofish sp. (1), Eastern Mudminnow (2), Pirate Perch (2), and Swamp Darter (2). No Ironcolor Shiners were collected during the survey. Filamentous algae and freshwater shrimp were abundant within the lake. Water chemistry was recorded and pH measured 6.35. Within the pinelands as pH increases; generally associated with land use changes, the occurrence of non-endemic fishes also increases and may negatively impact native fish populations. This location has been sampling several times in the past with similar results and fish assemblages present. Stocking is not recommended at this time due to limited potential to develop a recreational fishery, and to emphasize the conversation of the native fish community present which includes Blackbanded Sunfish, a species soon to be designated state Special Concern. (Boehm)

Pickle Factory Pond (Cape May) – Approximately 60 acres in size, Pickle Factory Pond is an impoundment of West Creek located along the border of Belleplain State Forest. This location has not been previously sampled by the NJDFW. Sampling for native pinelands fishes was conducted on August 15, 2016. A total of 12 locations were sampled using a 20' x 4' seine around the perimeter of the lake. Eight species were collected consisting of Blackbanded Sunfish, a species soon to be designated state Special Concern (6), Banded Sunfish (9), Bluespotted Sunfish (22), Pumpkinseed (107), Chain Pickerel (1), Pirate Perch (2), Creek Chubsucker (11), and Yellow Bullhead (7). All fish collected during sampling are considered native species. Water chemistry was recorded; pH measured 4.81. Based on the present native fish community no stocking is planned in the future. (Boehm)

Pohatcong Lake (Ocean) – Pohatcong Lake is a 33-acre impoundment of Tuckerton Creek located within the town of Tuckerton. The lake is a NJDFW trout stocked waterbody. Sampling for native pinelands fishes was conducted on August 8, 2016. A total of five locations were sampled using a 20'x4' seine around the perimeter of the lake. Six species were collected which included Banded Sunfish (51), Bluespotted Sunfish (65), Largemouth Bass (5), Chain Pickerel (2), Eastern Mudminnow (1), and Pumpkinseed (3). Bluespotted Sunfish and Banded Sunfish were most abundant. With the exception of Largemouth Bass all species collected are considered native fishes. Numerous groups of young-of-the-year (YOY) Largemouth Bass were observed but not collected. A viable recreational Largemouth Bass fishery has been reported. Water chemistry was recorded; pH measured 5.51. Abundant aquatic vegetation and acidic conditions provide excellent habitat for native *Enneacanthus* species. No stocking of warmwater fish species is recommended at this time. (Boehm)

Pondside Park Pond (Bergen) – A reproductive check was conducted at Parkside Park Pond (5 acres) in Harrington Park on July 17, 2016. This pond had never been previously sampled by NJDFW. Eleven seine (20' x 4') hauls around the perimeter of the pond revealed Pumpkinseed (9), Bluegill (63), Common Carp (1), invasive Green Sunfish (2), and Mosquitofish sp. (117). It is recommended that the Hackettstown State Fish Hatchery stock Largemouth Bass and surplus Channel Catfish in 2017. (Boriek)

Roosevelt Commons Pond (Bergen) – Previously seined by NJDFW in 1965, only Goldfish were found at that time. A reproductive check was conducted at Roosevelt Commons Pond (0.59 acres) in Tenafly on August 25, 2016. The steep banks made seining difficult. Four seine (20' x 4') hauls around the perimeter of the pond revealed only 2 species, including the invasive Green Sunfish (6) and Mosquitofish sp. (1). It is recommended that the Hackettstown State Fish Hatchery stock Largemouth Bass, and Bluegills in 2017. (Boriek)

Round Valley Reservoir (Hunterdon) – In a continued effort to inventory the fisheries of Round Valley Reservoir, reproductive checks were conducted on July 6, 2016. Two seining teams of three conducted a combined 80 hauls around the perimeter of the reservoir. A total of 696 fish were captured, consisting of 13 species. The most numerous species was Banded Killifish (n=420 or 5.3 per seine haul), followed by Spotfin Shiners (n=206 or 2.6 per seine haul). The remainder of species were not very abundant, with no more than 18 individuals (0.2 per seine haul). Largemouth (n=8) and Smallmouth (n =5) were captured, indicating limited reproductive success, however electrofishing surveys conducted earlier this year indicate a high juvenile abundance of both species. It should be noted that 28 of 80 seine hauls produced no fish, which is expected with shorelines consisting primarily of pebbles and sand and that lack cover such as submerged aquatic vegetation, woody debris, and boulders. Additional surveys were conducted during 2016, including three spring and one fall electrofishing surveys (page 64), annual gillnet surveys to monitor the Lake Trout population (page 32), and three dissolved oxygen/temperature profiles (page 134). The Round Valley Reservoir Fisheries Management Plan is found in Appendix G. (Crouse)

Young-of-the-year Largemouth Bass (left) and Smallmouth Bass (right) from Round Valley Reservoir next to a No. 2 pencil for scale

Saffin Pond (Morris) - This county-owned 13-acre pond, located in the Highlands, was drained for dam repairs and refilled in 2012. Shoreline access for fishing is good and boaters must park in the lot by the main road and portage their boats. The pond's features (rocky dam surface, scattered rocks in pond bed, minimal aquatic vegetation, and 1,110 ft. elevation) made it a good candidate location for establishing Smallmouth Bass. The lake has been stocked with Smallmouth Bass fingerlings for four years (2012 – 2015) in an effort to establish a fishery for this species. Shoreline seining conducted in 2013 and 2014 revealed little in terms of successful SMB reproduction. In 2014 the perimeter of the pond was electrofished during the daytime and it was apparent that Largemouth Bass not only survived the drawdown, but were reproducing successfully, and dominating the fishery. The pond was surveyed on August 8, 2016 to assess warmwater fish reproduction and evaluate reproductive success of Smallmouth Bass. Shoreline seining using a 20' x 4' seine was attempted at 15 stations, but of these only 10 were suitable for seining. Five fish species were encountered, including Largemouth Bass (2, both YOY), Bluegill (117), Pumpkinseed (95), Yellow Perch (7), and Banded Killifish (1). A temperature/dissolved oxygen profile was also conducted at the deepest part of the lake (13 feet) and not surprisingly, trout supporting water was absent (page 134). The surveys conducted in recent years indicate that this pond is better suited for Largemouth Bass and the stocking of Smallmouth Bass was discontinued in 2016. Bridle Shiner (soon to be listed state Endangered) was found here in 2013, but not in 2014 or 2016. Weldon Brook flows through Saffin Pond and it is recommended that other locations within the watershed be sampled to determine if this native fish is presence elsewhere. (Hamilton)

Sawmill Pond (Sussex) – On June 30, 2016, division staff sampled Sawmill Pond (33ac) with a seine at 10 different sampling locations to determine the current fish species composition of the pond. Historical records show that Bridle Shiner, a rare native species soon to be listed state Endangered, were last found in the pond in 1971. Unfortunately, no Bridle Shiners were found during this survey. Largemouth Bass (24), Bluegill (76), Pumpkinseed (21), and Redbreast Sunfish (2) were the only species collected. Division staff also sampled Sawmill Pond in 2008 with a seine and did not find any Bridle Shiner. After two unsuccessful attempts to find Bridle Shiners in Sawmill Pond, it is likely that the species has been lost from this location. (Shramko)

Scarlet Oak Pond (Bergen) – This 16-acre lake located inside Ramapo Valley Reservation in Mahwah Township has not been assessed since an inventory was conducted here in 1994. Trout were stocked here annually until 2009 and Channel Catfish are stocked here on occasion. Seining was done to provide insight into the fishery's population structure and make a determination on any necessary management actions. A total of 16 seine pulls were conducted and a number of young-of-the-year Largemouth Bass (40) and Bluegill (183) were captured. The fishery appears to be well balanced and no management actions are necessary. (Collenburg)

Silver Creek Pond (Bergen) – A reproductive check was conducted at Silver Creek Pond (4 acres) in Mahwah on July 13, 2016. This pond had never been previously sampled by NJDFW. Four seine (20' x 4') hauls around the perimeter of the pond revealed Pumpkinseed (3), Bluegill (8), and Largemouth Bass (2). It is recommended that the Hackettstown State Fish Hatchery stock Largemouth Bass, Bluegill, and surplus Channel Catfish in 2017. (Boriek)

Shaws Mill Pond (Cumberland) – Shaws Millpond WMA is a 30-acre impoundment of Pages Run, a tributary of Nantuxent Creek in Lawrence Township. A seining survey was completed on July 28, 2016 to evaluate the Largemouth Bass and native fish population. A total of nine species including Largemouth Bass (15), Brown Bullhead (1), *Enneacanthus sp*. (5), Eastern Mudminnnow (2), Pirate Perch (1), Yellow Perch (7), Chain Pickerel (3), Golden Shiner (3), Banded Sunfish (38), Bluegill (108), Pumpkinseed (22), and unknown *Lepomis sp*. (78). were collected from ten seining locations. Noteworthy was the absence of the Mud Sunfish, a species soon to be listed as state Special Concern, from the survey. A boat electrofishing survey was also completed at Shaws Mill Pond WMA on July 12 to evaluate the Largemouth Bass population (page 77). An additional seining survey is recommended for 2017. (Smith)

Stafford Forge Impoundment #1 (Ocean) - Stafford Forge Impoundment #1 is a 48-acre impoundment of Westecunk Creek located within the Stafford Forge Wildlife Management Area. Sampling for native pinelands fishes was conducted on August 8, 2016. A total of four locations were sampled using a 20' x 4' seine around the perimeter of the lake. Four species were collected which included Banded Sunfish (12), Swamp Darter (1), Largemouth Bass (8), and Chain Pickerel (2). With the exception of Largemouth Bass all species collected are considered native pinelands fishes. Water chemistry was recorded; pH measured 4.49. This lake should not be stocked as the acidic conditions are ideal for native pinelands fishes. Low pH prevents the development of a Largemouth Bass fishery as spawning success is greatly reduced, and often sporadic under acidic conditions. No further sampling is needed at this time. (Boehm)

Thielke Arboretum Pond (Passaic) – At the request of the Director of the Arboretum, a reproductive check was conducted at the "*Catch & Release*" regulated Thielke Arboretum Pond (3 acres) in Glen Rock on August 19, 2016. This pond had never been previously sampled by NJDFW. The steep banks and rip-rapped walls made seining difficult. Ten seine (20' x 4') hauls around the perimeter of the pond revealed Largemouth Bass (16) and Bluegill (3). It is recommended that the Hackettstown State Fish Hatchery stock Bluegill, surplus Channel Catfish, and Largemouth Bass in 2017. (Boriek)

Tuckahoe Lake (Cape May) – Tuckahoe Lake is a 10-acre impoundment located within Tuckahoe Wildlife Management Area. The lake is a NJDFW trout stocked waterbody. Sampling for native pinelands fishes was conducted on August 3, 2016. A total of eight locations were sampled using a 20' x 4' seine around the perimeter of the lake. Eight species were collected which included Bluegill (56), Banded Sunfish (21), Mosquitofish sp. (11), Creek Chubsucker (7), Yellow Bullhead (6), Chain Pickerel (2), Pumpkinseed (1), and 1 young-of-the-year (YOY) Largemouth Bass. YOY, intermediate, and adult Bluegill were all collected. Water chemistry was recorded; pH measured 5.09, temperature 29.9 ℃, and dissolved oxygen 7.10 mg/L. Additional sampling in 2017 is planned to assess *Enneacanthus* species diversity. (Boehm)

Twin Lakes (Sussex) - The fish population in this 29-acre lake, located within Kittatinny Valley State Park, not far from Aeroflex Lake, had not been previously sampled by NJDFW. Sampling to obtain data on the fishery was conducted on August 11, 2016. Shoreline seining (20' x 4' seine) was very difficult due to the abundance of lily pads and milfoil, and fish were captured at only 6 of the 10 sites seined. Species collected included Largemouth Bass (2), Pumpkinseed (10), Bluegill (23), and Bluespotted Sunfish (16). Bluespotted Sunfish, one of New Jersey's less common native sunfish species, was not previously known to occur in this lake. Temperature/dissolved oxygen profiles were also conducted at the deepest part of the lake (36 feet) on 8/11/16 and 9/1/16 (page 134). On both occasions unusually low levels of dissolved oxygen (<3 mg/L) were documented in the metalimnion (middle of the water column). In most New Jersey lakes dissolved oxygen levels during the daytime are typically highest in the metalimnion during the summer due to photosynethetic activity of algae. Water transparency (secchi disk measurement) was low (3.3 ft. on 8/11/16) and then higher (11.5 ft. on 9/1/16) and it could not be determined if photosynthetic activity was responsible for this phenomenon. Although trout supporting water was documented in the 8/11/16 profile, it was not found on 9/1/16, therefore lake surface water is not recommended for upgrade from *Nontrout* to *Trout Maintenance* (page 134). The fishery in this lake must be further assessed (electrofished by boat in the spring before aquatic vegetation has fully emerged) before specific fishery management recommendations can be made. (Hamilton)

Van Saun Pond (Bergen) – Previously seined by NJDFW in 1969, only Tessellated Darters and Golden Shiners were found. A reproductive check was conducted at Van Saun Pond (3acres) in Paramus on August 11, 2016. Twelve seine (20' x 4') hauls around the perimeter of the pond revealed Pumpkinseed (18), Bluegill (2), Golden Shiner (1), Bluespotted Sunfish (2), and Mosquitofish sp. (1). It is recommended that the Hackettstown State Fish Hatchery stock Largemouth Bass, Bluegill, and surplus Channel Catfish in 2017. (Boriek)

Veterans Park Pond (Monmouth) – At the request of the Director of Recreation, a reproductive check was conducted at Veterans Park Pond (2 acres) in Hazlet on August 30, 2016. This pond had never been previously sampled by NJDFW. The rear portion of the pond was not seined due to heavy aquatic vegetation. Four seine (20' x 4') hauls around the perimeter of the pond revealed Bluegill (6) and Brown Bullhead (7). It is recommended that the Hackettstown State Fish Hatchery stock Largemouth Bass, Bluegill, and surplus Channel Catfish in 2017. (Boriek)

Whites Pond (Bergen) – A reproductive check was conducted at Whites Pond (6 acres) in Waldwick on August 18, 2016. NJDFW stocks this pond with trout in the spring. Eleven seine (20' x 4') hauls around the perimeter of the pond revealed Pumpkinseed (1), invasive Green Sunfish (7), Bluegill (60), invasive Oriental Weatherfish (7), and Mosquitofish sp. (4). It is recommended that the Hackettstown State Fish Hatchery stock Largemouth Bass and surplus Channel Catfish in 2017. (Boriek)

Wilson Lake (Gloucester) – Wilson Lake is a 58-acre impoundment of Scotland Run, a tributary of the Maurice River located within the county owned Scotland Run Park. A seining survey was completed at Wilson Lake on August 10, 2016 to evaluate the native fish population and reproduction of Largemouth Bass. A total of seven species including Largemouth Bass (10), Bluegill (474), Banded Sunfish (29), Bluespotted Sunfish (2), Swamp Darter (16), *Enneacanthus* sp. (31), Banded Killifish (1), and Black Banded Sunfish (4) a species soon to be listed as state Special Concern, were collected from 14 locations. A daytime boat electrofishing survey was also conducted on November 3, 2016 to assess the warmwater fish population (page 78). (Smith)

Zabriske Pond (Bergen) – Previously sampled by NJDFW in 1984, Carp, sunfish, and Yellow Perch were collected at that time. A reproductive check was conducted at Zabriske Pond (4acres) in Wyckoff on August 24, 2016. Twelve seine (20' x 4') hauls around the perimeter of the pond revealed Pumpkinseed (19), Bluegill (226), Largemouth Bass (12), and Black Crappie (3). It is recommended that the Hackettstown State Fish Hatchery stock Largemouth Bass and surplus Channel Catfish in 2017. (Boriek)

ANADROMOUS FISHERIES

A number of New Jersey's river systems serve as important migratory pathways for fish. Each spring anadromous species such as American Shad, Alewife, Atlantic Sturgeon, Blueback Herring, Sea Lamprey, Shortnose Sturgeon, and Striped Bass navigate from marine waters to fresh waters of the state to spawn. In late summer and early fall, their young return home to marine waters to remain until maturity. In contrast, catadromous species such as American Eel reside in fresh waters throughout the state and migrate to open ocean waters to spawn.

With perhaps the exception of lampreys, these species are of great ecological, recreational, and commercial value to New Jersey and many other Atlantic coast states. The monitoring and restoration of these fisheries is a fundamental aspect in ensuring the population's well being. As these species reside in both fresh and marine waters they are cooperatively management between the Bureau of Freshwater Fisheries and the Bureau of Marine Fisheries. As stocks migrate up and down the entire east coast, the management of species falls under the jurisdiction of the Atlantic States Marine Fisheries Commission (ASMFC). As a result, for New Jersey, primary management of these species falls to the Bureau of Marine Fisheries.

In March 2012 the recreational and commercial harvest of migratory river herring (Alewife and Blueback Herring) was prohibited. These regulations were put in place due to concerns about the significant coast-wide decline of river herring stocks and to comply with federal mandates outlined by the Atlantic States Marine Fisheries Commission. In 2013 a similar moratorium was placed on American Shad with the exception of the Delaware River, its bay and estuaries. The exact cause for these coast-wide declines remains uncertain, but numerous factors such as loss of spawning habitat, impediments to fish passage (i.e. dams), water quality degradation and fishing all likely played a role.

American Shad caught by angler below the Columbia Lake Dam

Freshwater efforts consist of monitoring fish passage through fish ladders, technical assistance for dam removal projects on migratory pathways, periodic confirmation of historic migratory pathways and identification of new runs. (Federal Grant F-48-R, Project I)

2016 activities include:

The **Millstone River Restoration Project** aims to restore connectivity of the Millstone River by removing dams. The Weston Causeway Dam is located just downstream of the Wilhousky Street bridge in Manville and is the first impediment to fish passage on the Millstone River. This dam is 133 feet long and 5 feet high. The Weston Causeway dam was originally a mill dam at the Weston Mill, a site includes a gristmill, sawmill, dam, and associated waterpower features. The dam was repaired with concrete in the early 20th century, but appears to retain earlier masonry elements underneath. The dam has no current purpose; the mill buildings were claimed by arson in July 1983. In recent years, the dam has partially failed and is planned to be removed in 2017 as part of a NJDEP mitigation project due to previous environmental damages by a third party. Migratory fish including American Shad, Gizzard Shad, river herring, Striped Bass, and American Eel, in addition to resident warmwater species have been documented passing the Island Farm Weir fish ladder near the confluence of the Millstone River and the Raritan River approximately 1.5 miles downstream of the Weston Causeway Dam. This system supports a diverse recreational fishery composed of over forty-four species. (Crouse)

24-inch walleye captured while boat electrofishing below the Weston Causeway Dam and Wilhousky Streeet bridge (both seen in background)

In anticipation of the removal of the Weston Causeway Dam on the Millstone River, five electrofishing surveys and a seining survey were conducted above and below the dam at the Wilhousky Street Bridge (Manville / Weston Causeway) as part of a study to determine potential fish assemblage changes as a result of the dam removal (see table below). Surveys will be conducted each of the next 3 spring and fall seasons (one fall and one spring pre-dam removal to establish a baseline and 2 fall and spring cycles post-dam removal). Surveys were led by NJDFW and assisted by partners from USFWS and Stony Brook-Millstone Watershed Association. (Hunter and Angler Fund)

Forty-five fish species collected at 6 locations along the Millstone River above and below the Weston Causeway Dam.

Fish Species	near confluence with Raritan River (e-fish)	below Weston Causeway Dam (e-fish)	below Weston Causeway Dam (seine)	above Weston Causeway Dam	below Blackwells Mills Dam (e-fish)	below Griggstown Causeway (e-fish)
Largemouth Bass	8	17	2	24	1	2
Smallmouth Bass	2	9	1	4	4	
Rock Bass		1			1	
Striped Bass		1		4	2	
Bluegill		16	11	25	43	42
Pumpkinseed		8	1	3	9	1
Redbreast Sunfish	9	43	10	37	113	48
Green Sunfish			1	1	6	4
Bluespotted Sunfish		1	10			
Black Crappie				2	1	
White Perch		3	3	2		
Shield Darter					3	7
Tessellated Darter					130	46
Channel Catfish	4	5				
White Catfish	1				2	
Yellow Bullhead		3		3	13	8
Brown Bullhead		1				
Margined Madtom					2	
Tadpole Madtom					2	2
Yellow Perch	4	22	3	11	3	
Walleye		3				
Muskellunge		1				
Chain Pickerel		9	3	11	5	2
Redfin Pickerel					1	
American Shad		15				
Gizzard Shad				2		
Common Carp	12	48		33		
Grass Carp				1		
Blacknose Dace						2
Longnose Dace					1	6
Creek Chub				2		
Fallfish					6	2
Comely Shiner		2		2	2	1
Common Shiner					8	1
Golden Shiner		6		75		
Satinfin Shiner		1		1	7	46
Spottail Shiner		1		34	76	21
Swallowtail Shiner						4
Banded Killifish					1	22
White Sucker		10		5	9	1
Creek Chubsucker		20	2		1	
Sea Lamprey					1	
American Eel	9	25		54	274	257
Mosquitofish sp.			18		2	1
Oriental Weatherfish					2	

Millstone River (near Raritan River confluence) - The first boat electrofishing survey was conducted downstream of Weston Causeway Dam near Raritan River confluence on September 27, 2016. All fish were collected for one hour (Common Carp and American Eel abundance was estimated) for a distance of approximately 700 m. An assortment of eight species were encountered including Largemouth and Smallmouth Bass, Yellow Perch, Channel Catfish, White Catfish, Common Carp, American Eel, and a variety of sunfishes (see table above). The habitat in this section of the Millstone River looked excellent to support a warmwater fish assemblage, consisting of downed trees, woody debris, and a variety of submerged and emergent aquatic vegetation. Biologists noted that they were surprised to capture so few fish, given the apparent excellent habitat. In fact, it was speculated that the electrofishing boat may not have been functioning properly, although there were no apparent problems. A survey later that morning, just upstream from this location, produced many more individual fishes and a greater species diversity, although habitat and water quality were assumed to be very similar. It will be interesting to see if numbers and species counts continue to be relatively low at this location.

Millstone River (immediately below Weston Causeway Dam) - The second boat electrofishing survey was conducted just downstream of Weston Causeway Dam on September 27, 2016. Once again, all fishes were collected for one hour over a stretch of approximately 700 m. The upper survey boundary was at the base of the Weston Causeway dam and might explain a greater abundance of fish as compared to the survey near the confluence with the Raritan River, as the failing dam resulted in a form of attraction water that served as the only "riffle" in this section of river. In fact, the only American Shad found during the first six surveys were found at the base of the dam. Nine of the fifteen young-of-the-year (YOY) American Shad were retained for laboratory identification and had a range of 103 – 131 mm (4.0 – 5.2 in). This is the first documentation of YOY American Shad in the Raritan River drainage since adult pre-spawn Delaware River American Shad were introduced in to the Raritan River in the early 1980's. A total of 25 species were documented at within this location (see table above). In order to supplement the boat electrofishing surveys downstream of the Weston Causeway Dam, a total of eight seine pulls were conducted within approximately 100 m of the dam, using both 100 ft. and 20 ft. seines. Twelve species were collected including, however only two additional species were collected (Green Sunfish and Mosquitofish sp.). In 2013 one invasive Flathead Catfish was found below the dam as well.

First Flathead Catfish documented by Biologists in Millstone River during 2013 electrofishing survey.

10-inch Striped Bass from Millstone River

Millstone River (immediately above Weston Causeway Dam) - The third boat electrofishing survey was conducted on just downstream of Weston Causeway Dam on October 13, 2016. Once again, all fishes were collected for one hour over a stretch of approximately 700 m. Although juvenile American Shad were found below the dam during a previous survey, none were encountered upstream, indicating it may be an impediment to American Shad. Four juvenile Striped Bass (see photo) were found both upstream and downstream of the Weston Causeway Dam indicating it does not prevent their passage. Largemouth Bass outnumbered Smallmouth Bass 24 to 4. An abundance of large Common Carp was observed and one Grass Carp was netted that measured 41 inches and an estimated 30-35 lbs. The fish assemblage appears to be relatively similar above and below the dam (see table above), however predatory species found below the dam include, Walleye, Muskellunge, and Channel Catfish (in addition to the Flathead Catfish encountered in 2013).

Millstone River (below Blackwells Mills Dam) - An electrofishing survey was conducted with a Smith Root electrofishing barge approximately five miles upstream of the Weston Causeway Dam on the Millstone River at the base of the Blackwells Mills Dam. The fish assemblage was very diverse at this location, with 31 species documented (see table above). 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 designated 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.

Millstone River (below Griggstown Causeway) - An additional electrofishing survey was conducted with a Smith Root electrofishing barge approximately nine miles upstream at the Griggstown Causeway. This site was selected to obtain baseline fish assemblage information, as the Blackwells Mills Dam is also being considered for removal. The fish assemblage was diverse at this location, with 22 species documented, 18 of which are native to NJ (see table above). 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 designated 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).

The **Musconetcong River Restoration Partnership** is a multi-disciplinary team of agencies, organizations, and individuals working to improve and restore the Musconetcong River. Partners include the Musconetcong Watershed Association, USDA Natural Resources Conservation Service, National Oceanographic and Atmospheric Administration (NOAA), US Fish & Wildlife Service, National Park Service, Army Corps of Engineers, NJDEP (various agencies including NJDFW), American Rivers, North Jersey Resource Conservation and Development, Trout Unlimited, private landowners, and others. The Partnership works with willing dam owners to secure funding from conservation-minded organizations and government programs to remove antiquated dams and restore river health. The Musconetcong River drains 158 square miles of rural New Jersey and is a major tributary of the Delaware River, the longest undammed river east of the Mississippi River. According to state record, there are 34 regulated dams located along the length of the Musconetcong, portions of which are designated in the National Wild & Scenic Rivers program. From 2008 – 2015 the Partnership, led by the Musconetcong Watershed Association, orchestrated the removal of four dams on the river's mainstem (Finesville Dam and Riegelsville Dam on the lower Musconetcong River, and two dams near Hackettstown, the Gruendyke Mill Dam and Sebers Dam). During this time period the remnants of the Riegelsville Dam, the lowermost dam on the river (situated on a Wildlife Management Area) were also demolished. (Federal Grant F-48-R, Project II) (Hamilton)

In 2016, the Hughesville Dam located approximately four miles upstream from the river's confluence with the Delaware River was successfully removed. This project entailed removal of accumulated sediment behind the dam, breaching the dam and removing the dam material, restoring the stream channel above and below the dam to a natural condition (pools and riffles established), and stabilizing/revegetating the river banks and riparian zone. Although the construction activities associated with the dam removal only took four months, the planning process leading up to the removal took four years. The dam site was periodically inspected by NJDEP staff (Dam Safety and NJDFW) to ensure that the construction activity was proceeding as outlined and to observe conditions of the river (turbidity and sediment deposition) downstream of the project site. Migratory fishes can now move freely from the Delaware River upstream to the next barrier, the Warren Glen Dam. This 37-foot high dam is significantly larger than the Hughesville Dam and Partnership efforts to remove this dam are proceeding slowly, in part because of the magnitude of the project. The Army Corps of Engineers has taken the lead in removing the Bloomsbury Dam, located upstream.

The three photographs above represent various stages of removal of the Hughesville Dam.
(left: pre-removal, middle: after initial breach, right: complete dam removal)

Letters supporting proposals for funding were provided to the following organizations in 2016:

- Musconetcong Watershed Association – Proposal for restoration activities in the Musconetcong River, submitted to the National Fish and Wildlife Foundation (NFWF) and Eastern Brook Trout Joint Venture.
- NJ Audubon Society – Proposal for riparian restoration activities in the Upper Delaware Watershed, submitted to the National Fish and Wildlife Foundation (NFWF).

The **Paulins Kill River Restoration Project** is a multi-faceted partnership led by the Nature Conservancy, with goals of restoring connectivity to NJ's third largest tributary to the Delaware River and improving both riparian and in-stream habitat. One major aspect of the project is the removal of the Columbia Lake Dam, which was built by the Jersey Central Power and Light Company (JCP&L) in 1909. This 18-foot high, 330-foot long dam is located on the Paulins Kill less than ¼ mile upstream from its confluence with the Delaware River. The dam impounds a 32-acre reservoir that stretches more than 1.5 miles upstream of the dam. The State of New Jersey owns both the dam (sold by JCP&L in 1955) and 1,098 of the surrounding acres, and manages it as the Columbia Wildlife Management Area. Hydropower ceased being produced at the site in the spring of 2016 as the license to generate the hydropower was surrendered as part of the possible dam removal process. The impacts that this dam has on the Paulins Kill are significant; cutting off access to historic spawning grounds by American Shad, impeding passage of other migratory fish like American Eel and Sea Lamprey, disrupting the river's natural hydrology and sediment transport, and warming the water impounded behind the dam, among other effects. The ultimate desired ecologic outcome for the removal of the Columbia Lake Dam is to improve the overall health of this section of the Paulins Kill and maximize conservation and recreational benefits for nearby communities and businesses.

Columbia Lake Dam

Paulins Kill Smallmouth Bass

Beginning in the spring of 2015, the Bureau of Freshwater Fisheries began a multiyear sampling plan of the Paulins Kill to document and measure current fish assemblages prior to the proposed removal of the dam. The following is a summary of the NJDFW's 2015 and 2016 sampling efforts. Additional sampling is planned for the spring of 2017 and will continue into future years to document pre and post dam removal fish assemblages. (Federal Grant F-48-R, Project II) (Shramko)

Ten sampling locations, in 17 field days, for a total of 499 man hours have been used in 2015 and 2016 to collect data for this study. Seven sampling techniques were utilized; stream electrofishing, boat electrofishing, gill nets, trap nets, seines, cast nets and a dissolved oxygen / temperature probe with varying levels of success. The Paulins Kill being a large, wide and deep river complicates sampling which is why so many different sampling techniques have been utilized. Below average water levels during the spring of 2015 aided sampling efforts, however 2016 water levels were closer to average making sampling more difficult.

Overall, 2,313 individual fish representing 41 different species were collected, inspected and released. Anadromous fish species such as American Shad (33) and Blueback Herring (1) were documented below the Columbia Lake Dam, but not found above the Dam indicating that the Dam is a barrier to fish passage of these anadromous species. 461 American Eels (365 smaller than 200mm) were found in 2 locations below the Columbia Lake Dam. This compares to only 87 American Eels (8 smaller than 200mm) found in 8 locations above the Dam. These data illustrate that the Columbia Lake Dam is restricting the passage of this catadromous species as well. For more information, see page 68 and Appendix A (pages A14-A16) Additional sampling locations below the dam will continue in the spring of 2017.

American Shad caught electrofishing below the Columbia Lake Dam

Protection and Restoration of Inland Fisheries and Aquatic Habitats: Anadromous

In order to protect New Jersey's critical aquatic resources, fisheries biologists participate in or provide input on a number projects each year. Bureau staff provides technical assistance related to conservation, stream restoration, dam removal projects, and Land Use projects.
Land Use projects are coordinated through the Division's Office of Environmental Review. This input is directed towards minimizing land use change impacts to the state's fisheries resources. This is typically accomplished through the use of timing restrictions during critical fish spawning periods, protection of riparian buffers, and project modification, assuring best use practices are implemented at all times. However, at times a more in depth review and comments are necessary on specific projects.

In 2016 staff provided technical assistance to the following project related to our anadromous fisheries resources:

Monitoring the Passage of American Shad on the Raritan River - The Island Farm Weir Fish Ladder on Raritan River has been monitored by the NJ Bureau of Freshwater Fisheries from 1996 through 2003, and 2005, 2011, and 2012. The final report for JOB I-5: American Shad Restoration in the Raritan River, was submitted in January 2013. Beginning in the spring of 2013, the Department of Marine and Coastal Sciences at Rutgers University conducted the monitoring under the direction of Dr. Olaf Jensen, assisted by graduate student, Orion Weldon. Bureau staff assisted Rutgers staff with the clean out of the ladder in the spring of 2016. (Hunter and Angler Fund) (Boriek)

Monitoring the Outmigration of American Shad on the Delaware River - Bureau personnel assisted the Pennsylvania Fish Commission with the seining (300' seine) of young-of-the-year (YOY) Delaware River American Shad (AMS) at the Delaware Water Gap site on October 13, 2016. The Bureau conducted the annual seining (four seine hauls / site / month) during the months of August September and October at five sites on the Delaware River from 1979 - 2010. The Pennsylvania Fish Commission took over the survey in 2011. The survey is conducted to satisfy a requirement of the Atlantic States Marine Fisheries Commission. The October 13, 2016 Delaware Water Gap YOY American Shad total catch was 112. No river herring or Striped Bass were collected. (Boriek)

NATIVE SPECIES

New Jersey is home to nearly 60 Native Fishes, which form a significant component of the state's aquatic biological diversity and natural resource heritage. A list of fish species found in New Jersey can be found in Appendix D. While many native fish species are common, abundant, and widely distributed, such as Pumpkinseed, Blacknose Dace, and White Sucker, there also some that are of conservation concern and have limiting habitat and water quality requirements such as the Brook Trout, Bridle Shiner, Blackbanded Sunfish, and Slimy Sculpin. Many factors including land use changes, habitat loss, decline in water quality, and presence of invasive species threaten the survival of all aquatic biota, primarily those most sensitive.

Slimy Sculpin (soon to be listed Threatened)

The loss of any of these unique fish species through human impact is an undesirable outcome. In addition, natural factors such as climatic variations and watershed succession may dictate the future decline or expansion of fishes that are on the periphery of their established ranges. Further study is required to determine the current abundance and distribution of these nongame fishes throughout the state, including additional fisheries surveys, gathering additional fisheries data from other agencies, mapping, and determination of status for each species, all of which will result in the formation specific management objectives.

Shield Darter (soon to be designated Special Concern)

<u>Status Evaluation of Native Freshwater Fishes</u>

A formal review process led by the NJDFW's Endangered and Nongame Species Program was conducted in 2014 and 2015 to determine the status of our native freshwater fishes, known as the **Delphi Technique**. It is a systematic method for reaching consensus among experts in which absolute, quantitative answers are either unknown or unattainable. It is an iterative process characterized by anonymity among the participating experts, controlled feedback via the principal investigator and a statistical estimator of group opinion. By structuring the group communication process, the Delphi Technique helps the group reach a consensus of opinion by incorporating all available data and disseminating those data among all participants. The Delphi will assist the NJDFW's efforts towards updating New Jersey's State Wildlife Action Plan. To assist the Delphi efforts, the NJDFW created species distribution maps using GIS, based on data collected from 2000 through 2012. (Hunter and Angler Fund) (Crouse)

Brook Trout
(soon to be designated Special Concern)

Delphi Results
Sixty-five species were evaluated by an expert panel during round one, in which status selections, confidence levels, and comments were submitted by reviewers and compiled by ENSP staff. The Bureau of Freshwater Fisheries made recommendations on five non-consensus species (as indicated by a *). Results are listed below.

Endangered: Bridle Shiner*, Ironcolor Shiner, Shortnose Sturgeon

Threatened: Slimy Sculpin

Special Concern: American Brook Lamprey*, Blackbanded Sunfish*, Brook Trout, Comely Shiner, Mud Sunfish*, Northern Hogsucker, and Shield Darter

Secure/Stable: (32 species) American Eel, Banded Killifish, Banded Sunfish, Blacknose Dace, Bluespotted Sunfish, Brown Bullhead, Chain Pickerel, Common Shiner, Creek Chub, Creek Chubsucker, Cutlip Minnow, Eastern Mudminnow, Eastern Silvery Minnow, Fallfish, Gizzard Shad, Golden Shiner, Margined Madtom, Mummichog, Pirate Perch, Pumpkinseed, Quillback, Redbreast Sunfish, Redfin Pickerel, Satinfin Shiner, Sea Lamprey, Spotfin Shiner, Spottail Shiner, Swallowtail Shiner, Swamp Darter, Tadpole Madtom, Tessellated Darter, White Catfish, White Perch, White Sucker, Yellow Perch, Yellow Bullhead

Not Applicable: Black Bullhead, Bluntnose Minnow, Bowfin*, Longnose Gar, Pearl Dace

No Opinion (therefore removed): Alewife, American Shad, Blueback Herring, Fourspine Stickleback, Gizzard Shad, Hickory Shad, Hogchoker, Ninespine Stickleback, Rainbow Smelt, Rainwater Killifish, Spotfin Killifish, Threespine Stickleback

Unknown: Eastern Mosquitofish* (consensus of only 2 panelists)

A formal report on the status review was completed NJDFW's Endangered and Nongame Species Program and the findings were presented to the Endangered and Nongame Species Advisory Committee (ENSAC) during one of their regular meetings on March 16, 2016. During this time, committee members voted to accept the results, including Bureau of Freshwater Fisheries' recommendations for non-consensus species, and supported future listing and designations. The next step will be assigning official status via the state rulemaking process.

American Brook Lamprey
(soon to be designated Special Concern)

State Wildlife Action Plan

During 2015 and 2016 the Bureau of Freshwater Fisheries participated in the ten-year revision of the State Wildlife Action Plan (SWAP). The SWAP is a strategic and cost-effective mechanism to preserve the state's wildlife resources for the future. Recovery of species that have reached threatened or endangered status is typically more-costly than preventative actions that keep species populations from reaching such declines. Proactive management actions identified in the SWAP are intended to keep species from becoming federally (and state) threatened and endangered. NJDFW is currently updating the 2005 Wildlife Action Plan as required by Congress to continue to receive federal State Wildlife Grants. More importantly, New Jersey's update will serve as a blueprint for conserving our wildlife heritage. The plan will identify priority actions addressing known threats facing our targeted species and habitats that we, as a conservation community, can implement in the next ten years. (Hunter and Angler Fund) (Crouse)

Blackbanded Sunfish
(soon to be designated Special Concern)

A variety of tasks were required, including the prioritization of approximately 60 native fish species to determine those Species of Greatest Conservation Need. For these species, additional information was compiled to demonstrate species distribution, habitat information, state and range-wide status, etc. Species of Greatest Conservation Need were evaluated using several processes that resulted in the selection of eight Focal Species which were grouped into the following categories: Brook Trout, Pinelands Fishes (Banded Sunfish, Blackbanded Sunfish, Mud Sunfish, and Swamp Darter), and Vulnerable Minnows (Bridle Shiner, Comely Shiner, and Ironcolor Shiner).

Mud Sunfish (soon to be designated Special Concern)

A Threat Assessment was conducted for each species, aimed at identifying a standard list of threats that act as stressors to negatively impact each species. Threats are organized in a hierarchy in which broader (Level 1) threats are subdivided into more specific threats (Levels 2 and 3). Examples of Level 1 threats include development, agriculture, invasive species, pollution, etc., while Level 3 threats are much more specific. A scoring system was created to evaluate priority watersbodies (both lentic and lotic), using a multitude of data including fish presence/absence, diversity indices, landcover/landuse layers, etc. in an attempt to prioritize the states waters that are in the greatest need of conservation. Finally, the Bureau participated in two stakeholder meetings, aimed to address threats to the top 107 species of greatest conservation need to be identified in upcoming revisions to the SWAP.

Native Species Data Collection Efforts

During 2016, 34 waterbodies were surveyed, specifically targeting native fishes. The highest priority sites were those in which the Bridle or Ironcolor Shiners (soon to be listed state Endangered) were previously documented. Secondary priorities were sites that had species soon to be listed state Threatened or soon to be designated state Special Concern. This year the majority of those sites were located in the Lower Delaware River Drainage or Lower Atlantic Drainage to inventory for the presence of the four acid tolerant sunfish species (Blackbanded, Banded, Bluespotted, and Mud Sunfish). Additional sites were surveyed for a variety of other reasons. Sites and significant species accounts are in table below.

List of sites surveyed in 2016 searching for less common freshwater fish species.

Stream	Survey Date	Significance	Page #
Upper Delaware North & Wallkill Region (Shimmers Brook to Paulins Kill and Wallkill River watersheds)			
Hyper Humus Ponds (Sussex)	7/26/16	Paulins Kill Restoration Project with unknown fish assemblage. Bluespotted Sunfish in 2016.	84
Little Flatbrook (Sussex)	8/9/16	Bridle Shiner found 2003. Bridle Shiner found approx. 4 miles upstream in 2016.	NA
Sawmill Pond (Sussex)	6/30/16	Historic Bridle Shiner 1952. None in 1971, 2008, or 2016. Likely extirpated.	91
Raritan Region (Raritan River watershed)			
Rockaway Creek (Hunterdon)	7/12/16	Historic Bridle Shiner 1969. None in 2016. Shield Darter found in 2016.	A58
Rockaway Creek S/Br (Hunterdon)	8/3/16	Historic Bridle Shiner 1977. None in 2016. Shield Darter in2016.	A59
Rockaway Creek S/Br (Hunterdon)	8/3/16	Historic Bridle Shiner nearby 1977. None in 2016. Shield Darter in 2016.	A60
Lower Delaware Region (Assunpink Creek to Maurice River watersheds)			
Assunpink Creek (Mercer)	6/20/16	Historic Ironcolor Shiner in 1917. None in 2015.	A69
Burnt Mills Branch (Gloucester)	8/16/16	Historic Ironcolor Shiner in 1973. None found in 2015. Mud Sunfish in 2016.	A70
Iona Lake (Gloucester)	8/9/16	Historic Ironcolor Shiner, Blackbanded, Banded, & Mud Sunfish in 1955. No Ironcolor Shiner in 2016. Blackbanded, Bluespotted Sunfish & unknown *Enneacanthus* sp. in 2016.	85
Menantico Sand Pond (Cumberland)	8/22/16	Blackbanded, Banded, & Bluespotted Sunfish in 2016.	87
Rancocas Creek SW/Br (Burlington)	8/31/16	Historic Ironcolor Shiner in Rancocas tribs. near Browns Mills in 1905. None in 2015.	A72
Scotland Run (Gloucester)	8/24/16	Ironcolor Shiner and Bluespotted & Blackbanded Sunfish in 2002. Ironcolor Shiner & Bluespotted & Mud Sunfish in 2016	A73
Shaws Mill Pond (Cumberland)	7/28/16	Mud and Blackbanded Sunfish in 1957. Banded Sunfish in 1969. Banded Sunfish in 2016.	91
Wilson Lake	8/10/16	Blackbanded, Banded, Bluespotted, & Mud Sunfish in 1952. Blackbanded & Bluespotted Sunfish & unknown *Enneacanthus* sp. in 2016.	93

List of sites surveyed in 2016 searching for less common freshwater fish species (continued).

		Lower Atlantic Coastal (Sloop Creek to Dennis Creek watersheds)	
Atsion Lake (Burlington)	8/12/16	Blackbanded, Banded, Bluespotted, & Mud Sunfish in 1955. Blackbanded & Bluespotted Sunfish in 2016.	81
Cedar Lake (WMA) (Atlantic)	7/14/16	Blackbanded & unknown *Enneacanthus* sp. found in 2016.	81
Chatsworth Lake (Burlington)	6/21/16	Blackbanded, Banded, & Bluespotted Sunfish in 2016.	81
Clint Mill Pond (Cape May)	8/15/16	Banded & Mud Sunfish in 1972. None in 2016.	82
Cumberland Pond (Cumberland)	7/20 & 8/2/16	Blackbanded, Banded, Bluespotted, & Mud Sunfish found 2016.	82
East Creek Pond (Cape May)	8/4/16	Blackbanded, Banded, Bluespotted, & Mud Sunfish 1952. Blackbanded & Bluespotted Sunfish & unknown *Enneacanthus* sp. 2016.	83
Harrisonville Lake (Burlington)	7/8/16	Blackbanded & Bluespotted Sunfish 1969. Mud Sunfish 1994. Blackbanded & Bluespotted Sunfish 2016.	84
Lake Absegami (Burlington)	7/8/16	Banded Sunfish 2016.	85
Lake Lenape (Atlantic)	7/21 & 7/26/16	Ironcolor Shiner, Blackbanded, Banded, Bluespotted, & Mud Sunfish 1951. Blackbanded, Banded, & Bluespotted Sunfish 2016.	85
Lake Nummy (Cape May)	8/23/16	Blackbanded, Banded, & Mud Sunfish 1953. Bluespotted 1955. Blackbanded & Banded Sunfish 2016	86
Makepeace Lake (Atlantic)	8/3/16	Blackbanded & Banded Sunfish 2016.	87
Marsh Lake Branch (Atlantic)	7/20/16	No rare natives found 2016.	A74
Mill Pond (Atlantic)	7/6/16	Blackbanded & Bluespotted Sunfish 2016.	88
Morses Mill Stream (Atlantic)	7/7/16	No rare natives found 2016.	A75
New Brooklyn Lake (Camden)	6/23/16	Ironcolor Shiner 1964. Blackbanded, Banded, Bluespotted, & Mud Sunfish 1952. Blackbanded, Banded, Bluespotted, & Mud Sunfish & no Ironcolor Shiner 2016.	88
Pickle Factory Pond (Cape May)	8/15/16	Blackbanded, Banded, & Bluespotted Sunfish 2016	89
Pohatcong Lake (Ocean)	8/8/16	Bluespotted Sunfish 1969. Banded & Mud Sunfish 1982. Banded & Bluespotted Sunfish 2016.	89
Skit Branch (Burlington)	6/22/16	Blackbanded Sunfish 2016.	A76
Stafford Forge Impoundment #1 (Ocean)	8/8/16	Banded & Mud Sunfish 1967. Banded Sunfish 2016.	91
Tuckahoe Lake (Cape May)	8/3/16	Mud Sunfish 1950. Banded & Bluespotted Sunfish 1999. Banded Sunfish 2016.	92
Wading River W/Br	6/21/16	Blackbanded Sunfish 1953. Banded Sunfish 1977. Blackbanded, Banded, & Bluespotted Sunfish 2016.	A77

In addition to the sites that were surveyed specifically for rare native species, all 237 fisheries surveys conducted by the Bureau contribute valuable information to the status and distribution of fishes, including some of New Jersey's less common native fishes. The table below lists species soon to be listed as state Endangered, Threatened, or Special Concern. The number of sites in which each species was found during 2016, along with the number of sites that mark the first time each species was documented at that location are also found in the table below.

List of soon to be listed as state Endangered, Threatened, or Special Concern, including number of locations in which each species was encountered during 2016.

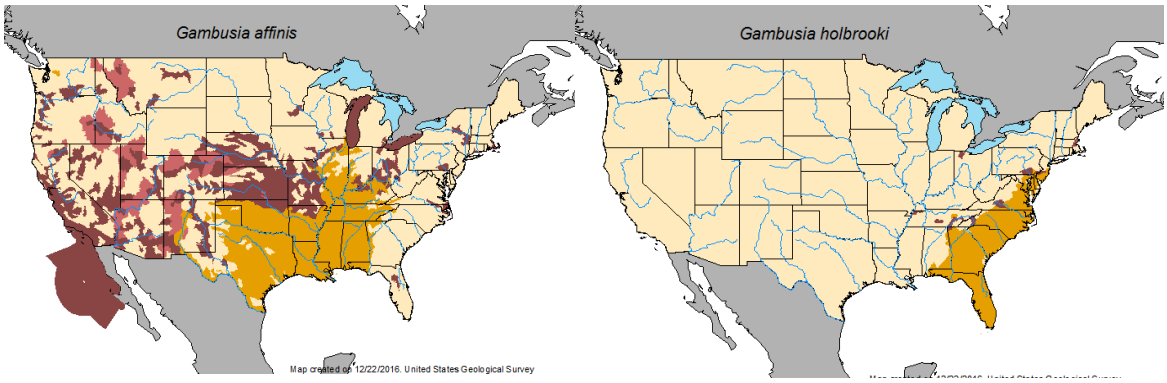
Species	Proposed status after Delphi and ENSAC review	Number of sites	New sites in FishTrack Database
Bridle Shiner	Endangered	1	Approx. 4 miles upstream from a 2003 location
Ironcolor Shiner	Endangered	1	0
Slimy Sculpin	Threatened	17 (8 from 3 streams)	2
American Brook Lamprey	Special Concern	4 (2 from 1 river)	1
Brook Trout (see Wild Brook Trout Assessment page 48)	Special Concern	48 (28 from 6 streams or rivers)	4
Blackbanded Sunfish	Special Concern	17	5
Comely Shiner	Special Concern	4 (4 from 1 river)	0
Northern Hog Sucker	Special Concern	3	1
Mud Sunfish	Special Concern	4	2
Shield Darter	Special Concern	12 (7 from 3 rivers)	4 (2 from 1 river) all near known populations

Bridle Shiner (soon to be listed Endangered)

Ironcolor Shiner (soon to be listed Endangered)

Mosquitofish

The Eastern Mosquitofish (*Gambusia holbrooki*) is native to the southeastern United States, its range possibly extending into the southern portion of New Jersey. The Western Mosquitofish (*Gambusia affinis*) is native to the south-central United States (see figures below). The non-native Western Mosquitofish has been widely introduced as a mosquito-control agent and are currently raised at the Hackettstown State Fish Hatchery (up to 2.5 million/year) and supplied to the county Mosquito Control Commissions. Discerning Eastern and Western Mosquitofish is difficult, as their physical characteristics are very similar and in fact hybridization and hatchery rearing processes can further confound the differences. The recent status evaluation of native fishes did not result in a status assessment for Eastern Mosquitofish. Contributing factors for their "undetermined" status pertained primarily to difficulty in proper identification and uncertainty of native range in NJ.



Range maps of Western Mosquitofish (G. affinis) (left) and Eastern Mosquitofish (G holbrooki) (right) from USGS NonIndigenous Aquatic Species website https://nas.er.usgs.gov/

The NJDFW has documented mosquitofish in an increasing number of locations in the wild in recent years. They were captured from 25 sites statewide in 2016. Many of them were retained for future laboratory identification and are temporarily referenced generally as Mosquitofish sp. Their increased distribution is believed to be a result of mosquito control related stockings. If the Eastern Mosquitofish are truly native and found very infrequently, they may warrant a protective measure to secure their future. Conversely, the non-native Western Mosquitofish may be acting as an invasive species and their establishment throughout the state may warrant management actions to minimize their spread.

Protection and Restoration of Inland Fisheries and Aquatic Habitats: Native Species

In order to protect New Jersey's critical aquatic resources, fisheries biologists participate in or provide input on a number projects each year. Bureau staff provides technical assistance related to conservation, stream restoration, dam removal projects, and Land Use projects.

Land Use projects are coordinated through the Division's Office of Environmental Review. This input is directed towards minimizing land use change impacts to the state's fisheries resources. This is typically accomplished through the use of timing restrictions during critical fish spawning periods, protection of riparian buffers, and project modification, assuring best use practices are implemented at all times. However, at times a more in depth review and comments are necessary on specific projects.

INVASIVE SPECIES

Aquatic Invasive Fishes Management

New Jersey is host to over 85 freshwater fish species and of these nearly 60 are native. Native fishes contribute to the biological integrity of aquatic communities and may also be economically, recreationally, and culturally important. Introductions of invasive, non-native fish and aquatic plants are a growing concern of natural resource managers in New Jersey and elsewhere because of their potential to dominate and destroy aquatic ecosystems causing irreversible economic and cultural damage. (Federal Grant F-48-R, Project I) (Smith)

In New Jersey ten species of fish have been identified having the potential to become a significant threat to indigenous animals, the environment, or public safety hazard. Collectively they are referred to and regulated as "potential dangerous fish," which include: Asian Swamp Eel, *Monopterus albus*, Bighead Carp, *Hypophthalmichthys nobolis*, Brook Stickleback, *Culaea inconstans*, Flathead Catfish, *Pylodictis olivaris*, Grass Carp (diploid), *Ctenopharyngodon idella*, Green Sunfish, *Lepomis cyanellus*, Oriental Weatherfish, *Misgurnus anguillicaudatus*, snakeheads, *Channa spp*., Silver Carp, *Hypophthalmichthys molitrix,* and Warmouth, *Lepomis gulosus.* To date, all but the Silver Carp have been documented in New Jersey waters. Possession and/or release of live potentially dangerous fish species is prohibited and when these species are encountered while angling they must be destroyed.

Locations surveyed by NJDFW in 2016 for invasive fish species are listed and described in detail in table below. Green Sunfish were excluded from this table, as they are now fairly widespread, found at 21 locations in 2016, 12 of which are new documentations. Green Sunfish are now found in 15 of 21 counties.

Nineteen Locations sampled by NJDFW for invasive species (excluding Green Sunfish) in 2016

Location	Drainage	Date	Species Targeted	Sampling Gear	Run Time (Hours)	Number of Fish
Delaware River (Trenton)*	Delaware River	8/4/16	Flathead Catfish	Electrofishing	1.5	1
DOD Lake*	Delaware River	6/28/16	Northern Snakehead	Electrofishing	1.6	8
Game Creek	Salem River	7/22/16	Northern Snakehead	Electrofishing	1.0	2
Millstone River	Millstone River	9/28/16	Oriental Weatherfish	Electrofishing	0.88	2
Mullica River	Mullica River	8/5/16	Northern Snakehead	Electrofishing	1.0	0
Newton Lake	Newton Creek	7/19/16	Northern Snakehead	Electrofishing	1.0	6
Silver Lake	Cooper River	6/23/16	Asian Swamp Eel	Electrofishing	1.0	47
Silver Lake	Cooper River	7/14/16	Asian Swamp Eel	Electrofishing	1.06	38
Whites Pond	Saddle River	8/24/16	Oriental Weatherfish	Seining	NA	7

* Sampled as part of other field activities

Asian Swamp Eel

Monitoring and control of the Asian Swamp eel has been limited to backpack electrofishing removal methods. The complexity of the habitat and physiological adaptability of the Asian Swamp Eel significantly hinders chances of successful eradication.

Asian Swamp Eel

Silver Lake (Camden) – Backpack electrofishing surveys have been conducted annually at Silver Lake to monitor the Asian Swamp Eel population since 2008, when they were first discovered there. In 2016 two backpack electrofishing surveys were completed at Silver Lake (10 acres) on June 2 and July 14, 2016 to monitor the invasive Asian Swamp Eel population. A total of 47 Swamp Eels were removed during 1.0 hours of electrofishing on June 23 and 38 were removed during 1.06 hours of electrofishing on July 14. Increased monitoring and removal efforts will continue in 2017. The catch-per-unit-effort (CPUE) of 42 fish/hr.) was slightly lower than 2015 but still higher than the mean CPUE (34/hour) since sampling began in 2008. (See table and figure below). (Smith)

History of Asian Swamp Eel collection at Silver Lake, Camden County.

Year	Number of Asian Swamp Eels Collected	Total Run Time (hrs)	Catch per unit effort (CPUE)
2008	355	7.73	46
2009	189	11.68	16
2010	224	7.68	29
2011	159	4.09	39
2012	119	2.85	42
2013	305	5.9	51
2014	123	4.36	29
2015	78	1.31	59
2016	85	2.06	42
Total	1637	47.66	34

CPUE (fish/hour) of Asian Swamp Eels collected from Silver Lake 2008 – 2016.

Northern Snakehead

DOD Lake (Salem) – The DOD Lake WMA is a 120-acre borrow pit located in Penn Grove. A lake inventory and management plan was completed in 2002. The Largemouth Bass population has fluctuated since acquisition by NJDFW in 1999. Boat electrofishing surveys to monitor the Largemouth Bass population were completed in 2010, 2011, 2014, 2015 and 2016. DOD Lake has been stocked with Musky, Tiger Musky, Smallmouth Bass, Channel Catfish, White Crappie, Largemouth Bass, and Striped Bass since the lake was acquired. DOD Lake has received surplus stockings of Smallmouth Bass, Channel Catfish, Tiger Musky, and Musky since 2013. These stockings are not part of the annual stocking schedule. None of these species were encountered during sampling in 2016. The stocking of these species should continue in order increase diversity of the fish population and give anglers additional fishing opportunities.

Seasonal Technician Kyle Civalier holding a Northern Snakehead from Cooper River Lake 2015

In 2016 a boat electrofishing survey was completed on June 28, 2016 to evaluate the Largemouth Bass and Northern Snakehead population. A total of 45 Largemouth Bass were collected in 1.5 hours of daytime electrofishing. There were 35 bass greater than the 200 mm (8 in.) stock size indicating a CPUE of 23 bass/hour. The PSD was 89 and PSD-P was 11 indicating the population is slightly unbalanced. Northern Snakeheads were first reported in 2014 and the presence confirmed by NJDFW in 2015. Eight Northern Snakeheads were collected in 2016, measuring 225 - 530 mm (8.9 – 20.9 in). In comparison, two Northern Snakeheads were collected in 2015. The snakehead population appears to be growing and will continue to be monitored to determine the impact on the Largemouth Bass population. (Smith)

Newton Lake (Camden) – Newton Lake is a 40-acre impoundment of Newton Creek bordered by Collingswood, Oaklyn and Haddon Township. Much of the lake is maintained by the Camden County Parks System. Newton Lake has a small paved boat ramp, ample trailer parking, and good shoreline access for anglers. The lake is family friendly with a playground and temporary restrooms nearby. A fish ladder to increase spawning habitat for Alewife and Blueback Herring was installed in the early 2000's and subsequently deemed a pathway for the invasive Northern Snakehead.

A boat electrofishing survey was completed on July 19, 2016 at Newton Lake to evaluate the Largemouth Bass and Northern Snakehead populations. A total of 42 Largemouth Bass were collected, of which 39 were greater than the 200 mm (8 in) stock size. The CPUE was 39 bass/hour based on one hour of daytime electrofishing. The largest bass measured 480 mm (18.90 in) and weighed 1.695 kg (3.74 lbs.). A PSD of 56 and PSD-P of 36 indicate a slightly unbalanced population. A total of six Northern Snakeheads were collected ranging in size from 320-675 mm (12.6 - 26.6 in) and weighed .260-3.140 kg (.57 - 6.92 lbs.). Submerged aquatic vegetation is rather abundant in Newton Lake and provides excellent habitat for both Largemouth Bass and Northern Snakeheads. The lake will continue to be monitored for the presence of Northern Snakeheads and any impact on the Largemouth Bass population. (Smith)

Oriental Weatherfish

The Oriental Weatherfish (*Misgurnus anguillicaudatus*), one of ten fish species regulated as an invasive species in NJ, was recently confirmed in 2015 in a small tributary to the Neshanic River in Flemington, Hunterdon County. This marks the second watershed in which this common aquarium fish has been documented in NJ. The first documentation was in the Saddle River in 2001. NJDFW staff responded to an angler that reported catching three in a minnow trap.

Live Oriental Weatherfish (above)
Sexual dimorphism male on left and female on right (below)

Upon further field investigation in 2015, 73 Oriental Weatherfish were documented and removed by NJDFW staff at several locations, including adjacent tributaries, downstream in the Neshanic River, and approximately 11 miles downstream from the original encounter South Branch of the Raritan River at Studdiford Drive in Hillsborough Twp. In 2016, two Oriental Weatherfish were found in the Millstone River below the Blackwells Mills Dam. The Millstone River is within the Raritan Watershed and is approximately 26 river-miles from the initial location found in 2015. This lack of containment within a pond or small tributary makes the success of any eradication plan highly unlikely. Further field sampling is necessary to determine the extent of their distribution within the watershed. (Crouse)

Miscellaneous Non-native Species

Several species that are non-native to New Jersey waters were reported and confirmed in 2016 by NJDFW personnel (see table below). Although the species listed below are not legally regulated as potential dangerous fish species, they have potential to cause ecological and economic harm in New Jersey.

A Bigmouth Buffalo (*Ictiobus cyprinellus*) was collected at Mercer Lake during a daytime boat electrofishing survey on October 18, 2016. Typically found in the Mississippi River drainage and lower Great Lakes, the origin of this fish is unknown. A 14-lb. Redtail Catfish (*Phractocephalus hemioliopterus*) was caught by an angler on August 30, 2016 at Duck Pond in Secaucus and reported to NJDFW (see photo on right). Redtail Catfish are native to South America, and are common in the aquarium trade. However, they can quickly outgrow their captive holdings leading to illegal releases it into nearby waters. A freshwater Angelfish (*Pterophyllum* sp.), native to the Amazon River basin of South America, was observed on the Passaic River near Elmwood Park during a daytime Northern Pike boat electrofishing survey on October 12, 2016. Angelfish are

14-lb. Redtail Catfish

extremely popular within the aquarium pet trade and are commonly kept by aquarists. Eleven Tilapia (*Oreochromis* sp.) were collected via dipnet from Carnegie Lake on April 20, 2016 by the NJDFW (see photo below). Tilapia are native to the African continent, and are a popular food fish raised in the aquaculture market. Up to six additional Tilapia were observed but not collected. The source of this angelfish is mostly likely the result of an illegal release of a pet fish. Releasing or stocking any fish in the state of New Jersey is illegal without a permit issued by the NJDFW. All the above mentioned fish are considered non-native within the state of New Jersey. Fish collected by NJDFW personnel were removed and disposed of.

Location	Drainage	Date	Species	Number	Gear
Mercer Lake	Assunpink Creek	10/18/2016	Bigmouth Buffalo	1	Electrofishing Boat
Carnegie Lake	Millstone River	4/20/2016	Tilapia sp.	11	Dipnet
Passaic River	Passaic River	10/12/2016	Angelfish	1	Visual Observation
Duck Pond	Hackensack River	8/30/2016	Redtail Catfish	1	Angler Catch

11 Tilapia averaging 12 inches from Carnegie Lake

Aquatic Invasive Plant Management

Water chestnut, a non-native aquatic plant species that can rapidly colonize a waterbody once it is established, is becoming increasingly prevalent in New Jersey's waters. Early detection is the key to Water Chestnut control, since smaller populations are easier to eliminate than larger ones. It also costs less to control a small infestation because plants can be individually hand-pulled. A large population requires the use of mechanical harvesters or application of aquatic herbicides to achieve control. It can be difficult and costly to eradicate water chestnut given this plant's hardiness (seed pods remain viable for 10+ years) and abundance. Water chestnut is now found in approximately 24 waterbodies in 10 counties. Most new sightings are brought to our attention by anglers, who typically mention that they were made aware of the problem via recent invasive species articles in NJDFW's Freshwater Fisheries Digest. (Federal Grant F-48-R, Project I) (Smith)

Water chestnut seed pods: immature (left) and mature (right).

Newly Identified Locations in 2016

Water Chestnut was only found in one new location in 2016. An isolated Water Chestnut plant was found in Round Valley Reservoir on June 6, during a reproduction check. This plant was removed from the reservoir.

Solitary Water Chestnut plant found in Round Valley Reservoir on June 6, 2016.

FISH HEALTH

Cyanobacteria

Cyanobacteria, unlike more typical green algae, can produce toxins which can cause rashes on humans and pose a risk to animals drinking or swimming in affected areas of a waterway. A cyanobacterial Harmful Algal Bloom (HAB) is the name given to the excessive growth, or "bloom", of cyanobacteria, some of which can produce one or more types of potentially harmful toxins. These "blooms" often result in a thick coating or "mat" on the surface of a waterbody, often in late- summer or early fall. It is important to note that some blooms are due to common green algae and not cyanobacteria and, when present, cyanobacteria do not always produce cyanotoxins (HAB's Fact Sheet, NJDEP)

A cyanobacteria bloom was documented by NJDEP's Bureau of Freshwater and Biological Monitoring (BFWBM) at Assunpink Lake on Monday, October 3, 2016. A sample was collected and the cyanobacteria (blue green algae) anabaena sp. was identified. An initial screening test indicated toxin levels of microcystins > 10µg/l. Freshwater Fisheries staff prepared signs advising users of the lake of the harmful bacteria and potential effects if they or their pets were to come into contact in areas where the bloom was occurring. As a precautionary measure anglers were advised not to eat any fish caught from the lake while the bloom was present.

Further testing on October 4 and 5 confirmed the presence of high concentration of toxins in samples of the bloom. Additional lab analysis indicated Microcystins > 20 µg/l. This is in the WHO guidance as high recreational risk BFWBM recommended keeping the advisory in place. A dog trial scheduled in the vicinity of the lake was cancelled due to concerns of dogs entering the lake in the vicinity of the bloom. On October 11, 2016 no further evidence of the cyano bloom or toxins were detected at Assunpink and the advisory was removed.

A cyanobacteria bloom was also documented at Shepherd Lake located within Ringwood State Park in Passaic County on October 7, 2016. Although cyanobacteria were documented, unlike Assunpink Lake, little to no toxin was detected. The lake was posted with an advisory as a precautionary measure. (Barno)

Drought Watch/Warning

Exceptionally low flows plagued New Jersey's waterways for most of 2016. Impacts of extended dry weather patterns were further intensified by consecutive days of extreme temperatures during the summer. Stream temperatures in the Musconetcong River, in a Trout-Maintenance classified section, were documented in excess of lethal limits for trout. The combined low flows and high temperatures took a considerable toll on the state's aquatic resource. Fortunately, some coldwater, groundwater fed headwater streams no doubt were spared the full brunt of these impacts. On July 25, 2016, an official Drought Watch was issued for most of northern New Jersey. Persisting dry weather patterns resulted in a Drought Warning being declared on October 21, 2016 for 14 counties within the North (east and west), Central and Coastal North Water Supply Regions (Administrative Order 2016-10). Northern reservoir levels, especially Spruce Run and Round Valley Reservoirs were particularly low. Monksville Reservoir was also lowered for the first time in ten years.

A Drought Warning results in established minimum passing flow requirements to be reviewed and often reduced within affected areas. Drought conditions during the summer months are typically far more detrimental, than cooler seasons, due to reduced water temperatures, adequate oxygen, etc. However, due to the existing exceptionally low stream conditions the newly proposed passing flows are well beyond any flows that we have experienced in some cases in over 60 years. As a result, impacts to aquatic biota under these extreme conditions are difficult to predict.

Fish Health Rules

Expanded Fish Health testing requirements for private fish culture facilities, proposed in 2015, took effect in March 2016. The changes include testing for major salmonid pathogens for trout regardless of the type of waterbodies being stocked, and requiring fish health testing for warmwater species. In an effort to reduce the risk of potential disease transfer into NJDFW's Pequest Trout Hatchery, the Pequest Trout Hatchery is now the only source of trout for the Pequest River Drainage beginning in 2016. The use of trout as bait, which are often purchased from private fish culture facilities, was also prohibited within the drainage. The Pequest Trout Hatchery and the Hackettstown State Fish Hatchery were already established as the only sources of fish for the Pequest Wildlife Management Area and Trout Brook (Hackettstown), since Fish Health Regulations were incorporated into the Fish Code in 2008. (Barno)

Only one organization stocks a privately owned stream stretch with trout within the drainage. The organization was provided surplus trout from the Pequest Trout Hatchery, at fair market value, to maintain recreational opportunities for stocked trout within this private stretch.

Fish Kill Investigations

Field investigations are conducted in response to reports of fish kills, distressed fish, unknown fish parasites, or to address potential pathogen issues in wild fish. These investigations are often a collaborative effort between the Bureau of Freshwater Fisheries staff (Federal Grant F-48-R, Project II) and the fish pathologist in the NJDFW's Office of Fish and Wildlife Health and Forensics (under Grant FW-69-R administered by that Office). In 2016, the Bureau of Freshwater Fisheries responded to fish kills at eleven waterbodies:

Assunpink Lake (Monmouth) – Spring fish kills have become a common occurrence at Assunpink Lake which is a popular fishing destination for bass and regulated as a *Lunker Bass Lake*. Bluegill is a species commonly affected. Division Fish Pathologist identified bacteria closely related to *Pseudomonas mandelii* as the cause of extensive fish kills at both Assunpink and Swartswood Lakes in the Spring 2015. This species has not been previously noted as a fish pathogen, though in fish kills at both lakes the bacterium caused systemic infection in the fish.

It is believed that the spring is a stressful season for the fish, causing immunosuppression and opportunistic infection with pathogens. In addition to bacterial agents, parasites may also cause mortality in fish populations. To better understand the parasites in the Bluegill populations in Assunpink Lake, Fish Pathologist, Dr. Jan Lovy had Bureau staff collect 40 Bluegills in March, and another 30 Bluegills in September to determine if parasite prevalence is greater in the spring than in the summer. Laboratory results are still pending.

Bargaintown Lake (Atlantic) – Bargaintown Lake is an impoundment of Patcong Creek located in the town of Bargaintown. A fish kill investigation was conducted on September 13, 2016 following a report of dead catfish received on September 9, 2016. Upon arrival no dead or dying fish were present. No foreign odors or chemicals were observed. Largemouth Bass, Bluegill and Mummichog were observed swimming along the bank. Water chemistry from the lake was recorded; dissolved oxygen measured 5.31mg/L, salinity 0.04ppt, and temperature 24.1 C (75 F). Present water chemistry conditions readily support aquatic life. No further action was warranted.

Bedminster Pond (Somerset) - A minor fish kill was reported to the Bureau in a small pond located off of Route 202/206 North in Bedminster Township. A Division Conservation Officer investigated and observed approximately 20 dead fish, identified as Gizzard Shad and Common Carp. No odor or sheen were observed, suggesting no dump or spill. Division fish pathologist, Dr. Jan Lovy, suspects this to be a typical spring mortality pattern, possibly due to an opportunistic bacteria or parasite due to warmer water temperatures with Gizzard Shad being very susceptible. It was determined that no further action is warranted at this time.

Budd Lake (Morris) - A fish kill was investigated at Budd Lake on June 1, 2016. It was estimated that the kill affected approximately 700 White Perch, 20 Black Crappie, 2 Bluegill, and 5 Bullhead Catfish. Majority of the dead fish were found near the public beach and the boat docks. Water temperatures ranged from 21°C to 27°C depending on depth. Dissolved oxygen was adequate (between 7-9 mg/L) throughout most of the water column, though lower at the bottom. Five White Perch and two Black Crappies were submitted to the Fish Pathology Laboratory for analysis.

Division Fish Pathologist, Dr. Jan Lovy, determined the cause of the kill was related to columnaris disease caused by *Flavobacterium columanare*, a bacterial infection in the gills and skin. This bacterium causes necrosis of skin and gill tissue. The bacterium is found throughout the aquatic environment and can cause disease in stressed fish populations. With Budd Lake being a relatively shallow lake and sudden increase to above average temperatures, it was likely that the predisposing stressor was the quick warming of water temperatures that occurred just prior to the kill that led to the columnaris outbreak.

Carnegie Lake (Mercer) – This 237-acre lake was sampled for Muskellunge by Bureau staff using trap nets between April 19 – 20, 2016 as part of the Coolwater Fisheries Stocking Assessment Project. Unfortunately, a significant die-off of Gizzard Shad coincided with the netting effort on the lake. Dr. Jan Lovy, the Division's fish pathologist, identified samples collected by Bureau staff to have a gill disease caused by the protozoan parasite, *Ichthyophthirius multifiliis*. This is a common outbreak that can occur in the spring, but do to the significant number of Gizzard Shad affected was alarming to local residents. Due to the extensive die-off trap netting efforts were discontinued after two days.

Cohansey River Tributary (Cumberland) - A fish kill in an impoundment on a tributary of the Cohansey River, Cumberland County was reported to the Bureau of Freshwater Fisheries on August 1, 2016. The impounded area is formed by a water control structure (floodgate) downstream of Bridgeton-Greenwich Rd. Three small tributaries, including Mounces Creek, Mill Creek and Wheaton Run drain into the impoundment upstream of the water control structure. The floodgate was replaced approximately two to three months ago. The previous structure failed many years ago and was no longer operating as designed, resulting in a much larger impoundment area than desired. The new structure, now operating properly, has reduced the amount of impounded water.

On August 2, 2016, approximately 500-1000 postmortem adult Common Carp, ranging from 10-15 lbs., were observed throughout the impoundment. Common Carp are an invasive species that are found commonly throughout the state. In addition, a few postmortem Channel Catfish, Brown Bullhead and White Perch were observed. Live Mummichogs were observed feeding on the decomposing fish. The Cohansey River appeared to be close to high tide, downstream of the floodgate, at the time of the inspection. Water chemistry was collected from the bridge on Bridgeton-Greenwich Rd. Dissolved oxygen, temperature and salinity were all adequate to support a fish population.

Water Chemistry
Dissolved Oxygen 7.14 mg/l
Salinity 0.31 ppt
Temperature 28.7 C
Salinity Downstream of Floodgate 7.56 ppt

The fish kill appears to be the result of the recent heat wave with numerous days in excess of 90 degrees. The combination of a very shallow impoundment, super heating of the water and a high concentration of large fish in a small area resulted in the significant fish kill.

Deer Path Park Pond (Hunterdon) - As a result of a significant rain event on Sunday July 31, there was a complete failure of the dam at Deer Path Park Pond, owned by Hunterdon County Parks. Fisheries Biologist arrived on site to evaluate on Monday morning. The 2-acre pond was reduced to a stream channel, cutting through decades of accumulated silt, with very few fish left behind. It is assumed that the majority of the fish were swept downstream approximately one mile, into the South Branch of the Raritan River via an unnamed tributary. Staff waded downstream along the tributary and observed the impacts of the high flows including erosion, sediment deposition, and vegetation damage. Approximately 50 dead fish, consisting of Bluegills, Black Crappie, and Largemouth Bass were observed within the wooded floodplain once the water receded, however the total loss was difficult to document as they were very dispersed within the wide floodplain. No fish salvage is necessary. The Division will restock this pond with an assortment of warmwater fish if/when the dam is rebuilt.

Deer Path Park Pond reduced from 2 acres to a stream channel anda small shallow pool after its dam failed in 2016

Jacob's Creek (Mercer) - Two Green Sunfish and one Creek Cub collected during a Bureau electrofishing survey of Jacob's Creek were submitted to the Pequest Fish Health Lab. The stream had particularly low flow; water temperature was 15.3°C, dissolved oxygen was low (2.04 mg/L), and pH was neutral at 7.13. All three fish had visible lesions. The Creek Chub had a deeply ulcerating lesion that went through the skin and muscle. The fish was unlikely to survive this deeply penetrating wound. The State Fish Pathologist detected a small number of fungal hyphae (Saprolegnia sp.) and several cysts caused by a parasite (dermocystidium-like organism) within the lesion. Dermocystidium is a parasite that belongs to the class Mesomycetozoea, which are organisms at the boundary of the animal and fungal divergence. These parasites are known to cause skin infections in various fish species. Considering the advanced progression of the skin lesion in the Creek Chub it is uncertain if this parasite was the primary cause of the large skin/muscle ulceration. This skin infection was likely the result of endemic parasites/fungi combined with poor water conditions.

One Green Sunfish had a severe skin lesion that extended deep into the musculature. No bacteria or fungi appeared associated with the lesion. Inspection of the tissue showed severe dermatitis extending into the musculature with cell death occurring throughout the lesion suggesting a viral origin, though this could not be confirmed.

Lily Lake (Cape May) – Lily Lake is a small impoundment located in the town of Cape May Point. A fish kill investigation was conducted on August 11, 2016. Fish kills at this location have been reported in the past. Upon arrival, the lake appeared significantly lower than normal and 11 submerged aerators were operational. No foreign odors or chemicals were observed. Several hundred dead adult fish were reported by local public works employees consisting primarily of Largemouth Bass and Bluegill. The dead fish were removed prior to the on-site inspection by Bureau personnel. At the time of inspection, well water was being pumped directly into the lake by the township at a reported rate of 100,000 gallons a day in an effort to remedy the fish kill. High salinity levels were observed within the well water and the recommendation to stop pumping into the lake was given. Saltwater intrusion from past flood events and saline groundwater conditions were also noted. Low dissolved oxygen and high salinity levels were found within the lake. Water chemistry from the lake was recorded; dissolved oxygen measured 1.93mg/L, salinity 0.98ppt, and temperature 30.9 C (87.6 F). Low dissolved oxygen levels appear to be the primary cause of the fish kill. Water chemistry was also collected directly over an operating submerged aerator and 50 meters away from the aerator. Dissolved oxygen levels were similar at both locations and indicated that the aerators do not effectively increase dissolved oxygen levels within the lake.

Memorial Day Weekend Fish Kills - Fish kills were reported at four lakes over Memorial Day weekend. All kills reported involved relatively small numbers of fish and seem to last several days with diminishing mortality. A sudden increase in air temperature led to dramatic increases in water temperatures. Many warmwater species such as bass, sunfish and crappies are also spawning which puts added stress on the fish. Interestingly, all kills reported were for lakes located within the Northwest area of the state. No similar fish kills were reported for waterbodies located in the central or southern areas of the state which also experienced the same dramatic increases in water temperatures.

Greenwood Lake (Passaic) – A small number of Alewives, bass, and crappie were reported to have died starting just prior to the holiday weekend. Die off diminished over the course of the weekend. Due to the relatively small extent of the kill and that it was diminishing neither New York nor New Jersey biologists felt further investigation was warranted.

Lake Hopatcong (Morris/Sussex) – A local resident reported to NJ Parks and Forestry staff that a small fish kill (less than 100 sunfish) had occurred in a small cove near Halsey and Raccoon Island around Memorial Day. When contacted, the resident indicated that fish were no longer dying and the and that he (and the snapping turtles) had disposed of most of the fish carcasses. Unfortunately, the cause of death could not be determined from decomposing fish. The resident was advised to contact us in the event more fish begin to die, so we could collect fish (distressed/dying/freshly dead fish) and provide them to our fish pathologist for examination in the lab. No further reports of dead or dying fish were received and it is suspected that the fish were stressed by the recent hot weather and more prone to bacterial disease infections.

Paulins Kill Lake (Warren) - Approximately 15 dead catfish were reported. No other fish reported.

Upper Greenwood Lake (Passaic) – Approximately 250 dead pickerel, sunnies, bass, crappie, and catfish were reported to have died over the holiday weekend. Similar to the Greenwood Lake fish kill dead fish were seen over the course of three days but the number of dead fish diminished each day. No further investigation warranted.

Pitman Golf Course (Gloucester) - A fish kill was reported on August 2, 2016 at the Pitman Golf Course by the Gloucester County Health Department. Approximately 25 Common Carp, ranging in size from 12 to 16" were affected. Live mosquito fish were observed in the three ponds on the golf course. The ponds which were all less than one acre in size all had a noticeable odor and were discolored. The water appeared to have an unusual black color and sheen, which is characteristic of the discharge of sewage effluent. The dissolved oxygen levels in the ponds ranged from .03 mg/l to 0.16 mg/l and were too low to support fish. Inspection further upstream of Golf Club Rd. indicated that the anaerobic water originated from presumably a failed residential septic system which was leaching into the stream feeding the pond. The dissolved oxygen in the unnamed tributary of Chestnut Branch (stream) was also below levels to sustain fish at 1.7 mg/l. The findings were reported back to the Gloucester County Health Department. Golf Course staff were informed that the fish kill will continue until the source of sewage effluent is identified and corrected.

Raritan River S/Branch (Hunterdon) – Two Rainbow Trout, captured from the South Branch of the Raritan River, Ken Lockwood Gorge section on July 20, 2016, were submitted to the Fish Pathology Laboratory. The trout were captured by the Bureau of Freshwater Fisheries during routine sampling of the river (page A53). The Rainbow Trout had noticeable skin lesions on their sides. The trout appeared to be hatchery-stocked fish according to the condition of the pectoral, pelvic, and dorsal fins. One fish had signs of a systemic bacterial infection and the atypical strain of *Aeromonas salmonicida* was isolated from the kidney of this fish. The atypical strain is believed to be *A. salmonicida achromogenes* based on identification and growth characteristics. The clinical signs of infection in the Rainbow Trout were similar to other reports of salmonids and other species with atypical furunculosis.

An angler also reported catching an eleven-inch Rainbow Trout also within the Ken Lockwood Gorge Wildlife Management Area. The trout was reported to have a red, blister-like boil the size of a golf ball on its body. Unfortunately, the angler released the fish back into the river.

West Portal Creek Fish Kill - On May 5, 2016 a catastrophic fish kill occurred on West Portal Creek, a small *Trout Production* stream that flows into the Musconetcong River. A truck fire had occurred on Interstate 78 the previous evening and during the ensuing clean-up a large amount of detergent lethal to aquatic biota washed into West Portal Creek. Bureau of Freshwater Fisheries staff responded and determined that a 2.8-mile section of the creek, from the I-78 bridge to the Musconetcong River, was impacted by this spill. On May 5, 2016, NJDFW collected 1,109 dead fish (13 species) at four sites totaling a distance of 3/4 mile. Nearly 50% of the dead fish collected

Detergent in West Portal Creek, May 5

Same location, May 6

Representative aquatic organisms killed

were wild (not stocked) Brown and Brook Trout and all year classes of trout were affected. Salamanders, crayfish, and macroinvertebrates were also killed. The loss of wild Brook Trout, which are few in number in this stream, is of grave concern. Brook Trout is the only trout species native to New Jersey and it is estimated that today they survive in less than half their original range in our state. This species has recently been identified as a Species of Special Concern in New Jersey. West Portal Creek is among the most southern of New Jersey's *Trout Production* streams inhabited by wild Brook Trout. Another fish species impacted by the spill, the Slimy Sculpin (soon to be listed as state Threatened), rivals trout as an excellent indicator of cold, clean water, and a healthy ecosystem.

A short-term (5 day) bioassay study was later initiated on May 11, 2016 to assess if conditions in West Portal Creek remained toxic to fish. Test fish (fingerling rainbow trout from the Pequest Trout Hatchery) were placed in cages at six locations and checked daily. After the first two days of the study all test fish were alive. The Bureau then initiated a project to actively restore native fishes (Brook Trout and Slimy Sculpin) to the creek (described more fully in the Conservation and Restoration of Fish Habitat and Technical Assistance – Coldwater section on page 56)

Fish Salvages

Permitted fish salvages are necessary under a variety of circumstances, such as substantial water lowering events related to projects such as the dredging of a lake or the repair of a dam. These salvages are typically conducted by trained private aquatic consultants and are conducted under controlled circumstances, during the more favorable conditions encountered in the fall and can be a relatively simple exercise. On the other hand, every year, as the result of a catastrophic dam failure or merely a minor leak, compounded with increased water temperatures and diminished oxygen levels during the summer, countless fish are threatened with demise. During emergency situations on state owned property such as Wildlife Management Areas or those managed by the Division of Parks and Forestry, the Bureau of Freshwater Fisheries may mobilize to conduct fish salvages to rescue fish and relocate them to suitable waters. (Hunter and Angler Fund)

Clove Brook (Sussex) – Staff from the Bureaus of Freshwater Fisheries, Fish Production and Law Enforcement performed a fish salvage in Clove Brook, at the base of the Clove Lake dam. Fish from the lake slowly make it over the dam when water is spilling over the dam. Due to the lack of rainfall there was little overflow. Fish became trapped in a deep twelve-foot pool at the base of the dam. Fish were distressed (gulping at the surface) due to the lack of flow and subsequent low oxygen due to the large number of fish congregated in the pool area. Approximately 20 dead fish were observed. Division staff netted approximately 2,000 fish (bass and sunfish) from the pool area and returned them to the lake. (Barno)

SURFACE WATER CLASSIFICATION

Surface Water Classification Assessments

Trout are useful bioindicators of stream health as excellent water quality and habitat are necessary for their survival and successful reproduction. In 1968, the Bureau of Freshwater Fisheries initiated the process of identifying and classifying New Jersey waters according to their suitability to support trout. Five years later, a classification system for New Jersey waters was developed. The Bureau's classification system, although already in use by various programs within the Department, was formally recognized in 1981 under the state's newly adopted *Surface Water Quality Standards* (SWQS).

Today, waters of the state are classified according to their suitability to support trout. Lakes are classified on their ability to support trout year round, whereas streams are classified on the occurrence of natural reproduction and the presence or absence of trout and/or trout associated species (Hamilton and Barno 2006). Ultimately, the more suitable a waterway is to supporting trout the higher the classification and the more protection it will receive. The Department's Land Use Regulation Program, through Stream Encroachment, Freshwater Wetlands, and the more recently developed storm water rules acknowledge the fragile nature of these ecosystems and provide additional protective measures.

Although a vast amount of work has been accomplished in classifying New Jersey waters, waters continue to be classified and reclassified according to their trout supporting capabilities, when justified by additional field investigation data collected by NJDFW. These data are interpreted and recommendations for surface water classification changes are provided to DEP's Bureau of Water Monitoring and Standards, Environmental Analysis Restoration and Standards, who ultimately integrate changes to the SWQS through an established rule making process. (Federal Grant F-48-R, Project I) (Crouse)

Stream Assessments for Surface Water Classification

During the summer months, a 150-meter section of stream is electrofished (single-pass) using one or more backpack electrofishing unit or a generator positioned on land or in a barge, with 2-3 hand-held anodes (Appendix B). All fish are captured and enumerated by species (total length measurements taken on all salmonids). Physicochemical parameters measured include water temperature, dissolved oxygen, pH, alkalinity, conductivity, specific conductance, and stream width, depth, and substrate type. The EPA Rapid Bioassessment habitat assessment protocol is used to assess in-stream habitat and riparian conditions (Barbour et al. 1999) with regional modifications (Appendix C). (Federal Grant F-48-R, Project I)

Double backpack electrofishing crew

In 2016 six electrofishing surveys were conducted on four streams specifically for classification purposes by the Bureau under Grant F-48-R, Project I. All four streams were unnamed tributaries, however NJDFW recommends individually listing them with the names provided: Musconetcong

River (trib) (NW of Stephensburg), (Musconetcong River (trib) (S. of Asbury), Whippany River (trib) (W. of Watnong Brook), and Bear Brook (Park Ridge). Four of the six stream surveys resulted in recommendations to upgrades their current SWQS classifications (see Table 2) and two surveys resulted in confirming existing default classifications (see Table 4).

Data from 53 additional stream electrofishing surveys, also conducted in 2016 under a variety of other jobs and/or funding sources are valuable in confirming existing classification as well as identifying potential upgrades (Table 1). Twelve stream surveys conducted in 2016 support potential surface water classification changes, six of which are upgrades to *Trout Production* and two to *Trout Maintenance* (Table 2).

Table 3 consists of two stream segments in which apparent naming discrepancies occur in the Courtesy Copy of Title 7 of the New Jersey Administrative Code N. J. A. C. 7:9B Surface Water Quality Standards Statutory Authority: N.J.S.A. 58:10A-1 et seq., 58:11A-1 et seq., and 13:1D-1 et seq. Re-adopted: October 17, 2016 Last Amended - January 18, 2011 (43 N.J.R. 174(b)) http://www.nj.gov/dep/rules/rules/njac7_9b.pdf . Both stream segments are individually listed, however they should be listed as tributaries, not as they are currently listed.

In addition to recommending changes to existing surface water classifications, since 2006 NJDFW has reported surveys in which data confirm existing surface water classifications. The 2016 data confirmed the classifications of 28 stream segments, therefore no action is required (Table 4). At times, electrofishing surveys yield data that neither confirm an existing use (classification), nor warrant a change to the existing use (classification), as classifications are not downgraded unless proven the existing use can not be re-established. This was true for surveys at eighteen locations in 2016, therefore no action is required (Tables 5).

Table 2. Summary of recommended surface water classification changes supported by 12 surveys conducted in 2016 by NJDFW. Reproducing trout species determined by the presence of young-of-the-year trout. A current surface water classification enclosed by brackets indicates a default surface water classification (i.e. the waterbody is not specifically listed in NJ's Surface Water Quality Standards, N.J.A.C. 7:9B). I.O. = Incidence of Occurrence; NA = Not Applicable (due to presence of trout reproduction).

Waterbody	Waterbody section	Midpoint of survey		Current surface water classification	Recommended surface water classification	I.O. value	Reproducing trout species	Survey date	Page
		Lat. (N)	Long. (W)						
Upper Delaware (South) Region (Delawanna Creek to Lockatong Creek watersheds)									
*Buckhorn Creek (trib) (Roxburg)	Entire length, including all tributaries	40º46'41.3"	75º5'56.1"	[FW2-TP(C1)]	FW2-TP(C1)	NA	Brown	8/26/16	A28
*Buckhorn Creek (trib) (Summerfield)	Entire length, including all tributaries	40º48'12.2"	75º3'12.6"	[FW2-TP(C1)]	FW2-TP(C1) [d]	NA	Brook	8/16/16	A29
*Musconetcong River (trib) (NW of Stephensburg)	Entire length, including all tributaries	40º47'59.2"	74º52'47.3"	[FW2-TM(C1)]	FW2-TP(C1)	NA	Brook	7/22/16	A34
*Musconetcong River (trib) (S of Asbury)	Entire length, including all tributaries	40º46'30.8"	74º0'16.6"	[FW2-TM(C1)]	FW2-TP(C1)	NA	Brook & Brown [c]	8/5/16	A35
Upper Passaic Region (Pompton, Pequannock, Wanaque, Ramapo, Upper Passaic, Whippany, & Rockaway River watersheds)									
*Whipanny River (trib) (W of Watnong Brook)	Entire length	40º48'53.9"	74º30'21.6"	[FW2-NT]	FW2-NT	12.7	none	9/2/16	A40
Lower Passaic & Upper Atlantic Region (Lower Passaic, Saddle, Hackensack, Pascack & Elizabeth to Toms River watersheds)									
*Bear Brook (Park Ridge)	Source to Spring Valley Road, including all tributaries	41º2'28.6"	74º3'47.9"	[FW2-NT(C1)]	FW2-NT(C1)	9.3	none	8/17/16	A41
*Bear Brook (Park Ridge)	Spring Valley Road to Woodcliff Lake, including all tributaries	41º1'56.0"	74º3'20.6"	[FW2-NT(C1)]	FW2-TM(C1)	22.6	none	8/24/16	A42
*Bear Brook (Park Ridge)	Spring Valley Road to Woodcliff Lake, including all tributaries	41º1'53.3"	74º3'11.7"	[FW2-NT(C1)]	FW2-TM(C1)	50.1	Brown [e]	8/5/16	A43
Raritan Region (Raritan River watershed)									
Raritan River S/Br (Ken Lockwood Gorge)	River and tributaries within Ken Lockwood Gorge WMA [b]	40º42'7.5"	74º52'4.8"	FW2-TM(C1)	FW2-TP(C1)	NA	Brook [c] Brown & Rainbow	7/20/16	A53
Raritan River S/Br (Ken Lockwood Gorge)	River and tributaries within Ken Lockwood Gorge WMA [b]	40º41'47.2"	74º52'18.2"	FW2-TM(C1)	FW2-TP(C1)	NA	Brown	7/20/16	A54

Table 2 (continued)

Raritan Region (Raritan River watershed) (continued)									
*Raritan River S/Br (Trib.) (Drakestown)	Entire length	40º51'9.5"	74º46'01.4"	[FW2-NT]	FW2-TP(C1) [a]	NA	Brook	7/5/16	A55
*Raritan River S/Br (Trib.) (SW of Budd Lake)	Entire length	40º51'25.0"	74º46'00.1"	[FW2-NT]	FW2-TP(C1) [a]	NA	Brook	7/5/16	A56

[a] Potential change also supported by survey data collected in 2011 and previously submitted to NJDEP Water Monitoring and Standards Survey in Memo dated March 11, 2013, titled Recommended Changes to Individual Surface Water Quality Classifications.
[b] New boundaries suggested in Memo titled Recommended Changes to Individual Surface Water Quality Classifications (March, 11 2013).
[c] Young-of-the-year trout not present, however trout from older year classes present.
[d] Potential change also supported by data collected in 2006.
[e] Stocked trout
* Indicates unnamed tributary as recognized by SWQS. Name given is recommended by NJDFW.

Table 3. Stream segments in which apparent naming discrepancies occur in the Courtesy Copy of Title 7 of the New Jersey Administrative Code N. J. A. C. 7:9B Surface Water Quality Standards Statutory Authority: N.J.S.A. 58:10A-1 et seq., 58:11A-1 et seq., and 13:1D-1 et seq. Re-adopted: October 17, 2016 Last Amended - January 18, 2011 (43 N.J.R. 174(b)) http://www.nj.gov/dep/rules/rules/njac7_9b.pdf. Both stream segments are individually listed, however they should be listed as tributaries, not as they are currently listed.

Waterbody	Waterbody section	Midpoint of survey		Current surface water classification	Recommended surface water classification	I.O. value	Reproducing trout species	Survey date	Page
		Lat. (N)	Long. (W)						
Upper Delaware (South) Region (Delawanna Creek to Lockatong Creek watersheds)									
*Beaver Brook (trib) (E of Manunka Chunk) [a]	Entire length, including all tributaries	40º51'31.7"	74º2'40.8"	FW2-TM	FW2-TM	25.6	none	8/15/16	A25
*Big Flat Brook (trib) (Lake Ashroe) [b]	Entire length, including all tributaries	41º11'56.6"	74º48'54.8	[FW2-TP(C1)]	FW2-TP(C1)	NA	Brook	7/1/16	A5

[a] This stream segment is misnamed in N. J. A. C. 7:9B Surface Water Quality Standards as "Beaver Brook (Hope) (E of Manunka Chunk) - Entire length, including all tributaries." It is a tributary to Beaver Brook (Hope). The name proposed for individual listing is bases off of data collected in 2006 and 2016
[b] This stream segment is misnamed in N. J. A. C. 7:9B Surface Water Quality Standards as "Big Flat Brook (Tuttles Corner) - Outlet stream from Lake Ashroe to its confluence with Big Flat Brook." It is a tributary to Big Flat Brook. The name proposed for individual listing is bases off of data collected in 2005 and 2016

Table 4. Electrofishing surveys conducted in 2016 by NJ Division of Fish & Wildlife that *confirm existing surface water classifications* as indicted in New Jersey's Surface Water Quality Standards, N.J.A.C. 7:9B. No action is required. Reproducing trout species is determined by the presence of young-of-the-year trout. Data are found in report titled "2016 Investigation & Management of NJ's Freshwater Fisheries Resources."

Waterbody	Waterbody section	Midpoint of survey		Current surface water classification confirmed	I.O. value	Reproducing Trout Species	Date	Page
		Lat. (N)	Long. (W)					
Upper Delaware North & Wallkill Region (Shimmers Brook to Paulins Kill and Wallkill River watersheds)								
Beerskill Creek (Shaytown)	Boundary of High Point State Park to confluence with Little Flat Brook	41º15'34.9"	74º47'34.6"	FW2-TP(C1)	NA	Brook	8/4/16	A1
Forked Brook (Stokes State Forest)	Entire length	41º14'20.9"	74º44'42.3"	FW2-TP(C1)	NA	Brook	8/4/16	A10
Flat Brook (Walpack)	Flatbook-Roy Wildlife Management Area boundary to the Delaware River, except segments described below	41º11'05.9"	74º51'09.1"	FW2-TM(C1)	30.6	Brook [a] & Rainbow [c]	7/9/16	A9
Tillman Creek (Walpack)	Entire length	41º9'28.4"	74º51'27.7"	FW1-TP	NA	Brook	7/29/16	A20
Upper Delaware (South) Region (Delawanna Creek to Lockatong Creek watersheds)								
Barkers Mill Brook (Independence)	Entire length	40º51'17.4"	74º53'29.1"	FW2-TP(C1)	NA	Brook	7/27/16	A21
Barkers Mill Brook (Independence)	Entire length	40º51'27.5"	74º53'47.8"	FW2-TP(C1)	NA	Brook	7/27/16	A22
Barkers Mill Brook (Independence)	Entire length	40º51'43.9"	74º54'1.0"	FW2-TP(C1)	NA	Brook	7/28/16	A23
Barkers Mill Brook (Independence)	Entire length	40º51'50.0"	74º54'9.7"	FW2-TP(C1)	NA	Brook	7/28/16	A24
Buckhorn Creek (Hutchinson)	Entire length	40º47'41.0"	74º4'55.9"	FW2-TP(C1)	NA	Brook & Brown	8/23/16	A26
Buckhorn Creek (Hutchinson)	Entire length	41º46'56.7"	74º6'12.4"	FW2-TP(C1)	NA	Brown	8/23/16	A26
Hakihokake Creek (Milford)	Entire length, including headwaters known as Little York Creek	40º34'3.8"	75º05'40.8"	FW2-TP(C1)	NA	Brown	8/11/16	A30
Hakihokake Creek (Milford)	Entire length, including headwaters known as Little York Creek	40º34'0.4"	75º05'34.1"	FW2-TP(C1)	NA	Brown	8/11/16	A31
Stephensburg Brook (Stephensburg)	Entire length	40º47'34.7"	74º52'16.6"	FW2-TP(C1)	NA	Brook & Brown	7/21/16	A37

Table 4. (continued)

Upper Passaic Region (Pompton, Pequannock, Wanaque, Ramapo, Upper Passaic, Whippany, & Rockaway River watersheds)								
Whippany River (trib) (Brookside)	Entire length	40º48'14.6"	74º34'0.3"	FW2-TP(C1)	NA	Brown & Rainbow	9/2/16	A39
Lower Passaic & Upper Atlantic Region (Lower Passaic, Saddle, Hackensack, Pascack & Elizabeth to Toms River watersheds)								
Cresskill Brook (Demarest)	Duck Pond Rd. bridge to Tenakill Brook	40º56'41.7"	73º56'36.5"	FW2-NT(C1)	17.0	none	7/18/16	A45
Raritan Region (Raritan River watershed)								
Hickory Run (Califon)	Entire length	40º42'55.8"	74º51'45.5"	FW2-TP(C1)	NA	Brook	7/11/16	A47
Hickory Run (Califon)	Entire length	40º42'45.8"	74º51'27.2"	FW2-TP(C1)	NA	Brook & Brown	7/11/16	A48
Raritan River S/Br (Middle Valley)	Dam (located 390 ft upstream of Flanders-Drakestown Road) downstream to, but not including Lake Solitude, including all tributaries not individually listed [b]	40º47'42.2"	74º45'54.4"	FW2-TM(C1)	NA	Brook Brown & Rainbow	7/25/16	A51
Raritan River S/Br (Middle Valley)	Dam (located 390 ft upstream of Flanders-Drakestown Road) downstream to, but not including Lake Solitude, including all tributaries not individually listed [b]	40º47'21.5"	74º46'14.8"	FW2-TM(C1)	NA	Brook & Brown	7/25/16	A52
Rinehart Brook (Hacklebarney)	Entire length	40º44'40.0"	74º44'10.0"	FW2-TP(C1)	NA	Brown	7/26/16	A57
Rockaway Creek Mainstem (Whitehouse)	Confluence of North and South Branches to Lamington River	40º37'45.4"	74º44'8.5"	FW2-NT	9.6	none	7/12/16	A58
Rocky Run (Lebanon)	Entire length	40º41'41.0"	74º54'36.9"	FW2-TP(C1)	NA	Brook	7/26/16	A61
Round Valley Reservoir (Clinton)	Entire Waterbody	39º47'28.5"	75º0'29.6"	FW2-TP(C1)	NA	Lake	7/26/16	App I
Stony Brook (Washington)	Entire length	40º47'49.6"	74º45'17.3"	FW2-TP(C1)	NA	Brook [a] & Brown	8/2/16	A62
Trout Brook (Hacklebarney)	Entire length	40º45'05.0"	74º43'52.5"	FW2-TP(C1)	NA	Brook	7/14/16	A67
Turkey Brook (Mt. Olive)	Entire length	40º50'18.7"	74º44'29.7"	FW2-TP(C1)	NA	Brook & Brown	7/21/16	A68
Willhoughby Brook (Buffalo Hollow)	Entire length	40º40'18.5"	74º54'49.5"	FW2-TP(C1)	NA	Brook & Brown	7/1/16	A69

Table 4. (continued)

Lower Delaware Region (Assunpink Creek to Maurice River watersheds)								
Scotland Run	MAURICE RIVER MAIN STEM (Willow's Grove) Source to the boundary of Union Lake Wildlife Management Area	39º34'17.7"	75º03'33.3"	FW2-NT	3.4	none	8/24/16	A73

[a] Young-of-the-year trout not present, however trout from older year classes present.
[b] New boundaries suggested in Memo titled Recommended Changes to Individual Surface Water Quality Classifications (March, 11 2013).
[c] Stocked trout

Table 5. Electrofishing surveys conducted in 2016 by NJ Division of Fish & Wildlife that *neither confirm an existing use (classification), nor warrant a change to the existing use*, as classifications are not downgraded unless proven the existing use can not be re-established. Reproducing trout species is determined by the presence of young-of-the-year trout. Data are found in report titled "2016 Investigation & Management of NJ's Freshwater Fisheries Resources."

Waterbody	Waterbody section	Midpoint of survey		Current surface water classification	I.O. value	Reproducing Trout Species	Date	Page
		Lat. (N)	Long. (W)					
Upper Delaware (North) & Wallkill Region (Shimmers Brook to Paulins Kill and Wallkill River watersheds)								
Big Flat Brook (Sandyston)	Confluence with Parker Brook, through the Blewitt Tract, to the confluence with Flat Brook, except tributaries described under the listing for Flat Brook, below	41°12'23.5"	74°48'22.3"	FW2-TP(C1)	30.2	Brook [a] & Rainbow [b]	8/2/16	A2
Big Flat Brook (Sandyston)	Confluence with Parker Brook, through the Blewitt Tract, to the confluence with Flat Brook, except tributaries described under the listing for Flat Brook, below	41°11'54.9"	74°49'05.1"	FW2-TP(C1)	33.1	none	7/19/16	A3
Big Flat Brook (Sandyston)	Confluence with Parker Brook, through the Blewitt Tract, to the confluence with Flat Brook, except tributaries described under the listing for Flat Brook, below	41°11'30.6"	74°50'34.6"	FW2-TP(C1)	27.9	Brook [a]	8/2/16	A4
Black Creek (trib) (McAfee)	Entire length	41°11'14.7"	74°32'2.3"	FW2-TP(C1)	100	Brown [a]	8/22/16	A6
Black Creek (trib) (McAfee)	Entire length	41°11'14.9"	74°32'14.7"	FW2-TP(C1)	100	Brown [a]	8/25/16	A7
Little Flat Brook (Layton)	State park boundary to, but not including, tributary described below, to confluence with Big Flat Brook	41°14'24.3"	74°48'11.1"	FW2-TP(C1)	19.4	Brook [a]	8/9/16	A11
Little Flat Brook (Layton)	State park boundary to, but not including, tributary described below, to confluence with Big Flat Brook	41°11'24.1"	74°50'48.7"	FW2-TP(C1)	27.5	Rainbow [b]	8/9/16	A12
Shawanni Creek (Stokes State Forest)	Headwaters and tributaries downstream to, but not including, Shawanni Lake	41°10'8.3"	74°50'25.5"	FW1-TP	NA	No fish found	8/22/16	A17
Shawanni Creek (Stokes State Forest)	Outlet of Shawanni Lake downstream to confluence with Flat Brook	41°9'50.4"	74°51'52.9"	FW2-TP(C1)	48.7	Brown [a]	7/29/16	A18
Sparta Glen Brook (Sparta)	Entire length	41°2'19.2"	74°36'6.7"	FW2-TP(C1)	41.1	Brook [a]	7/15/16	A19

Table 5. (continued)

Lower Passaic & Upper Atlantic Region (Lower Passaic, Saddle, Hackensack, Pascack & Elizabeth to Toms River watersheds)								
Cresskill Brook (Alpine)	Source to Duck Pond Rd. bridge, Demarest	40º56'41.5"	73º56'27.3"	FW2-TP(C1)	31.5	none	7/18/16	A44
Raritan Region (Raritan River watershed)								
Black Brook (Polktown)	Entire length	40º39'39.0"	74º56'54.6"	FW2-TP(C1)	50.1	Brown [a]	7/1/16	A46
Rockaway Creek S/Br (Whitehouse)	Lake Cushetunk to its confluence with main stem Rockaway Creek	40º37'11.6"	74º46'28.3"	FW2-TM	7.6	none	8/3/16	A59
Rockaway Creek S/Br (Whitehouse)	Lake Cushetunk to its confluence with main stem Rockaway Creek	40º37'27.3"	74º45'58.0"	FW2-TM	9.4	none	8/3/16	A60
Sun Valley Brook (Mt. Olive)	Entire length	40º51'17.3"	74º44'34.1"	FW2-TP(C1)	45.5	Brook [a]	7/15/16	A63
Sun Valley Brook (Mt. Olive)	Entire length	40º51'6.5"	74º44'59.6"	FW2-TP(C1)	45.5	Brook [a]	7/14/16	A64
Sun Valley Brook (Mt. Olive)	Entire length	40º51'1.8"	74º45'24.0"	FW2-TP(C1)	26.6	none	7/14/16	A65
Lower Delaware Region (Assunpink Creek to Maurice River watersheds)								
*Masons Run (trib) (Pine Hill)	Source to Little Mill Road	39º47'28.5"	75º00'29.6"	[FW2-TP(C1)]	7.5	none	8/26/16	A71

[a] Young-of-the-year trout not present, however trout from older year classes present.

[b] Stocked trout

* Indicates unnamed tributary as recognized by SWQS. Name given is recommended by NJDFW.

Lake Assessments for Surface Water Classification

As part of the continued assessment of New Jersey waters dissolved oxygen and temperature profiles are performed to determine a lake's ability to support trout throughout the harsh summer months. During the summer, most New Jersey lakes deeper than 3 m (10 ft) thermally stratify. The epilimnion (surface waters) become 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. A water temperature and dissolved oxygen profile is conducted in the deepest part of a lake using a YSI 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. The criteria used to determine trout-supporting water is water temperature $\leq$ 21ºC (69.8ºF) and dissolved oxygen $\geq$ 4 mg/L (Appendix B). If criteria are met, Lakes and reservoirs are classified as *Trout Maintenance* and they are classified as *Non-Trout* if they are not met. The presence and amount of trout supporting water can vary from year to year, depending on air temperature and rainfall. Shallow lakes, particularly those less than 50 feet deep, often have little or no trout supporting water during the summer due to anoxic conditions in their colder bottom waters and warm surface waters. (Federal Grant F-48-R, Project I)

Twelve water temperature and dissolved oxygen profiles were conducted on eight waterbodies during 2016. Eleven of the surveys were conducted during the summer months and can be used to use for classification purposes in the Surface Water Quality Standards (Table 6). All surveys conducted confirm existing classifications, therefore no additional surveys are necessary for classification purposes at this time.

Table 6.— Summary of temperature & dissolved oxygen profiles conducted during the summer months on eight lakes in 2016. Results page number references in *2016 Investigations & Management of NJ's Freshwater Fisheries Resources Report.*

Waterbody (County)	Current surface water classification	Depth (ft) of water capable of supporting trout [a]	Recommended classification change	Date	Page
Upper Delaware (North) & Wallkill Region (Shimmers Brook to Paulins Kill and Wallkill River watersheds)					
Columbia Lake (Warren)	FW2-NT	none	confirmed (2 locations)	7/27/16	69
Upper Delaware (South) Region (Delawanna Creek to Lockatong Creek watersheds)					
Allamuchy Pond (Warren)	FW2-NT(C1)	none	confirmed	8/8/16	80
Delaware Lake (Warren)	FW2-NT	none	confirmed	8/10/16	83
Mountain Lake (Warren)	FW2-TM	17	confirmed	7/27/16	75 & 80
Saffin Pond (Morris)	FW2-NT	none	confirmed	8/23/16	90
Twin Lakes (Sussex)	FW2-NT(C1)	none	confirmed	8/11/16 [b] & 9/1/16	92
Raritan Region (Raritan River watershed)					
Spruce Run Reservoir (Hunterdon)	FW2-TM(C1)	none	not confirmed	8/16/16	NA
Round Valley Reservoir (Hunterdon)	FW2-TM(C1)	30 - 135	confirmed	7/27/16	App I
Round Valley Reservoir (Hunterdon)	FW2-TM(C1)	30 - 130	confirmed	8/29/16	App I
Round Valley Reservoir (Hunterdon)	FW2-TM(C1)	0 - 120	NA (too late in season)	10/5/16	App I

[a] Depth measured from the surface; criteria for trout supporting water: water temperature $\leq$ 21ºC and dissolved oxygen $\geq$ 4 mg/L.

[b] Although this profile met criteria for trout supporting water (water temperature $\leq$ 21ºC and dissolved oxygen $\geq$ 4 mg/L), it should not be upgraded to *Trout Maintenance* due to the data obtained on 9/1/16 in which no trout supporting water was found.

ANGLER USE ASSESSMENT

Angler Surveys

Opening Day Trout Angler Survey

NJDFW's trout stocking programs provide Garden State anglers with many opportunities to fish for trout throughout the year. Under Fish and Wildlife's spring stocking program, nearly 200 streams, ponds, and lakes throughout the state are stocked with 570,000 trout annually. The opening day of the trout season each April is greatly anticipated by anglers, who flock to these waters to fish for trout on this eventful day. To assess angler turnout and success on this important recreational day, angler counts, and interviews are conducted on various trout-stocked waters. Information on angler participation and satisfaction is used to assess trout stocking and to make program changes. (Federal Grant F-48-R, Project III) (Shramko)

Since 2004 the NJDFW's Wildlife Conservation Corps (WCC) volunteers have provided a valuable service by assisting with the collection of angler data on *Opening Day*. Each volunteer is assigned a trout-stocked water and provided with written instructions on how to conduct the survey, data forms, and information about their assigned waterbody. Volunteers are also asked to submit digital pictures of anglers fishing, catching fish, and holding up their catch for display, as well as a panoramic view that would be indicative of the angler turnout. Not only do the volunteers obtain much needed information regarding trout angler activity, but their visible presence has also reaped several unexpected benefits. For many anglers, this is often their first contact with a NJDFW representative. Anglers are generally willing to provide information about their fishing experience, and many are pleased to see Fish and Wildlife taking an active role in managing the waterbody they are fishing. The WCC volunteers that participate also had positive experiences, with several commenting that this was their first opportunity to assist the NJDFW and they had fun doing it. In 2013 NJDFW began funding this survey under the Sport Fish Restoration Program (Federal Grant F-48-R, Project III) and the volunteer hours are used as state matching funds.

The Opening Day of the 2016 trout season was Saturday, April 9, 2016. The weather was cold with overcast skies and snow showers in many locations. Some parts of the state received upwards of 3 inches of snow by 12:00 p.m. Of the 37 surveys conducted, 18 were on lakes and ponds. On the 18 lakes and ponds surveyed, 664 anglers were observed fishing (an average of ~37 anglers per waterbody). This number is down from last year's opening day when 2,109 anglers were observed on 33 lakes and ponds surveyed (an average of ~64 anglers per waterbody). It is important to note, that the waterbodies selected to survey are not random. This year a number of waterbodies were selected due to consistent poor angler turnout in previous years which would affect the overall number of anglers recorded. The lower angler turnout could also be contributed to the effect of less than desirable weather. Also, as noted above, the counts do not account for turnover over the course of the day. For

Anglers this year braved harsh conditions in search of their share of the 360 trout stocked in Grenloch Lake.
Photo Credit: Ronald Mares, 04/09/2016

example, a volunteer survey clerk at a waterbody may record 100 anglers on any given hour, then, they count 100 anglers the next hour; this second count does not take into account anglers that may have left or arrived within that time interval. By making counts using these methods (number of anglers counted every hour and using the highest number) there is a potential for underestimating the number of anglers that actually fished on a given waterbody.

Trout-stocked Lakes and Ponds

In some locations trout fishing was fantastic. Several anglers proclaimed this was the best opening day ever while many more said they are happy to see the trout stocking program back to where it was prior to the disease issues at the Pequest Trout Hatchery in 2014. Mac's Pond (Monmouth), Manny's Pond (Hunterdon), Nomahegan Park Pond (Union) had the highest catch rates per angler at 1.78 fish per angler, 1.74 fish per angler and 0.93 fish per angler respectively. In fact, anglers at Mac's Pond caught an astonishing 72% of the total trout stocked in the pond before 12:00pm!

Unfortunately, trout were not as cooperative in other lakes and ponds. The cold air temperatures (lower 30's) and cold water temperatures (mid-30's to mid-40's) appeared to keep the fish from biting, frustrating anglers and sending them home early in multiple locations. Many clerks reported the number of anglers at a waterbody was highest at 8 a.m. or sometimes 9 a.m. but dropped heavily by 10 a.m. and throughout the rest of the day because of the weather, especially on the waterbodies where snow fell.

Jonathan Paterno holds one of the coveted broodstock from South Vineland Park Pond. Photo Credit: Tito Gonzalez, 04/09/2016.

The following waterbodies had a total of five or fewer trout reportedly caught by all anglers. The number of anglers ranged from 106 to 19.

- Amwell Lake – 19 anglers caught 4 trout
- Colonial Lake – 50 anglers caught 0 trout
- Grenloch Lake – 21 anglers caught 5 trout
- Mt. Hope Pond – 58 anglers caught 0 trout
- Pohatcong Lake – 27 anglers caught 0 trout
- Sylvan Lake – 106 anglers caught 5 trout
- Tuckahoe Lake – 24 anglers caught 0 trout

The following waterbodies also reportedly caught five trout or less, but had considerable fewer anglers (2-7 anglers total):

- Clinton Reservoir – 6 anglers caught 0 trout, but it is unknown how many of these anglers were targeting trout
- Green Turtle Pond – 5 angler caught 0 trout
- Heritage Park Pond – 7 anglers caught 0 trout
- Mountain Lake – 2 anglers caught 4 trout

Angler success rate data has been collected and calculated per waterbody starting in 2008. Since then, the division has had the ability to compare one year's opening day's success to another year's opening day success. Even with the waterbodies mentioned above that had very poor results, the overall success rate per anglers surveyed in 2016 was right on the average compared with previous opening days. 2016 had a success rate per angler of 0.57 fish per angler or just over 1 fish for every 2 anglers. The most successful opening day was in 2008 when 0.73 trout were caught per angler, while 2011 and 2015 are tied for the least successful with 0.46 trout per angler. See table below for more detail.

Yearly comparison of angler success rate

		2008	2009	2010	2011	2012	2013	2014	2015	2016	AVERAGE
Total	Anglers	1115	853	1095	1462	1675	1918	1830	2100	**664**	**1412**
	# Trout	814	485	551	669	1107	1354	996	960	**380**	**813**
	Trout/Angler	0.73	0.57	0.50	0.46	0.66	0.71	0.54	0.46	**0.57**	**0.58**

Some waterbodies have consistently poor opening day success rates. The following waterbodies in the table below will continue to be monitored, but if their success doesn't change, they could in the future be dropped from the trout stocking program.

Waterbodies with consistent poor angler success.

County	Waterbody	Acres		2010	2011	2012	2013	2014	2015	2016	AVERAGE
Mercer	Colonial Lake	10	Anglers	58			50	22	28	50	**41.6**
			# Trout	4			8	0	2	0	**2.8**
			Trout/Angler	0.07			0.16	0	0.07	0	**0.07**
Atlantic	Heritage Park Pond	6	Anglers					14	25	7	**15**
			# Trout					1	3	0	**1**
			Trout/Angler					0.07	0.12	0	0.09

A complete list of the 2016 Opening Day angler success on the lakes and ponds can be found in the table below along with trout catch information.

2016 Opening Day Angler Survey – Lakes and Ponds.

Waterbody	County	BB[1]	Total # of Anglers	Total # of Trout Caught	Trout Caught/ Angler	Allocated Trout Species	Allocated # of Trout	Percent of Allocation Caught
Amwell Lake	Hunterdon		19	4	0.21	RBT	370	1.08
Clinton Reservoir	Passaic		6	0	0.00	RBT	370	0.00
Colonial Lake	Mercer	X	50	0	0.00	RBT	370	0.00
Englishtown Mill Pond	Monmouth		18	8	0.44	RBT	430	1.86
Green Turtle Pond	Passaic		5	0	0.00	RBT	480	0.00
Grenloch Lake*	Gloucester	X	21	5	0.24	RBT	360	1.39
Heritage Park Pond	Atlantic		7	0	0.00	RBT	430	0.00
Lake Ocquittunk	Sussex	X	81	52	0.64	RBT	360	14.44
Lower Echo Park Pond	Union		50	35	0.70	RBT	390	8.97
Mac's Pond	Monmouth	X	73	130	1.78	RBT	180	72.22
Manny's Pond	Hunterdon	X	39	68	1.74	RBT	280	24.29
Mountain Lake	Warren		2	4	2.00	RBT	600	0.67
Mt. Hope Pond	Morris	X	58	0	0.00	RBT	410	0.00
Nomahegan Park Pond	Union	X	60	56	0.93	RBT	390	14.36
Pohatcong Lake	Ocean		27	0	0.00	RBT	610	0.00
South Vineland Park Pond	Cumberland	X	18	13	0.72	RBT	450	2.89
Sylvan Lake	Burlington		106	5	0.05	RBT	420	1.19
Tuckahoe Lake	Cape May		24	0	0.00	RBT	540	0.00
Total			**664**	**380**	**0.57**		**7440**	**5.11**

Trout-stocked Streams and Rivers

Typically, Opening Day Trout Angler Survey may only have a few streams or rivers as part of the survey because angler counts and success on streams and rivers is difficult to assess. The distance that has to be covered and the movement in and out of fishing spots by anglers makes it difficult to get accurate quantitative data from the survey. This year, fisheries staff focused on streams that have both wild and stocked trout, so more surveys on streams and rivers were done this year than in previous years. As such, streams selected were generally smaller and narrower, with shorter trout stocked sections helping offset limitations typically encountered when conducting angler surveys on streams.

Two young anglers show off their catch at Hakihohake Creek. Photo Credit: Heather Aupperle, 4/09/2016

Angler surveys and counts were conducted on 19 streams or stream sections. A total of 302 anglers were surveyed and 607 trout were caught. The catch rate was 2.01 trout per angler. This data shows that of the streams and stream sections surveyed, anglers did very well. Anglers had the highest catch rates on the following streams:

- Big Flat Brook – 67 trout caught by 31 anglers (2.16 trout per angler)
- Capoolong Creek – 25 trout caught by 11 anglers (2.27 trout per angler)
- Franklin Pond Creek – 76 trout caught by 31 anglers (2.45 trout per angler)
- Lopatcong Creek – 43 trout caught by 11 anglers (3.91 trout per angler)
- Mulhockaway Creek – 42 trout caught by 21 anglers (2.00 trout per angler)
- Spruce Run Creek – 42 trout caught by 20 anglers (2.20 trout per angler)
- S/Br Raritan R. (Upper Section) – 160 trout caught by 37 anglers (4.32 trout per angler)

Angler William Gunderman proudly holds his first trout of the season, caught at Franklin Pond Creek.
Photo Credit: Lisa Kisch, 04/09/2016

A complete list of Opening Day angler counts on streams and rivers is found in the table below.

2016 Opening Day Angler Survey – Streams and Rivers

Streams/Rivers						
Waterbody	**County**	**BB[1]**	**Total # of Anglers**	**Total # of Trout Caught**	**Trout Caught/ Angler**	**Allocated Trout Species**
Big Flat Brook	Sussex		31	67	2.16	RBT
Beaver Bk	Hunterdon		5	11	2.20	RBT
Capoolong Ck	Hunterdon		11	25	2.27	RBT
Franklin Pond Creek	Sussex		31	76	2.45	RBT
Furnace Brook	Warren		2	5	2.50	RBT
Hakihokake Ck	Hunterdon		14	25	1.79	RBT
India Bk	Morris		14	6	0.43	RBT
Jacksonburg Creek*	Warren		3	unk		RBT
Lopatcong Creek	Warren		11	43	3.91	RBT
Mulhockaway Creek	Hunterdon		21	42	2.00	RBT
Paulins Kill*	Sussex/Warren		43	71	1.65	RBT
Pequannock River TCA	Passaic		15	2	0.13	RBT
Pequest*	Warren		10	6	0.60	RBT
Pond Brook*	Sussex		15	11	0.73	RBT
S/br Raritan River (Upper S	Morris		37	160	4.32	RBT
S/br Rockaway Ck	Hunterdon		6	7	1.17	RBT
Spruce Run Ck	Hunterdon		20	42	2.10	RBT
Trout Brook (Middleville)	Sussex		3	0	0.00	RBT
Whippany River	Morris		10	8	0.80	RBT
Total	***incomplete surveys**		**302**	**607**	**2.01**	**RBT**

Interestingly, only 12 out of the 607 trout caught in this year's survey were Brook or Brown Trout. These 12 trout were likely wild trout as the Division has stocked only Rainbow Trout in these waterbodies over the last two years with few private stockings occurring on the surveyed waterbodies. This shows that the wild Brook Trout and Brown Trout are harder to catch than stocked Rainbow Trout and suggests that angler harvest of wild trout on opening day may not be as impactful to the wild trout population as one would anticipate based on sheer numbers of anglers fishing on opening day. Although it is acknowledged that there are a few instances where private landowners or private clubs stock Brown Trout or Brook Trout and that the Brown Trout and Brook Trout caught were possibly misidentified as wild trout.

In Summary

Opening Day success in 2016 was varied. The cold weather and up to three inches of snow in areas definitely had a negative effect on the number of anglers and the success rate at many waterbodies. However, some waterbodies still showed a strong angler contingent, and many waterbodies produced a much higher than average angler success rate. Anglers fishing streams were far more successful than anglers fishing lakes and ponds. The average angler's catch rate on streams was 2.01 fish per angler compared to 0.57 fish per angler fishing ponds and lakes. Streams flows were lower than average for this time of year, but still had plenty of water for anglers to enjoy.

The overall number of opening day anglers counted in this year's survey was down from recent years. No doubt the cold weather and snowy forecast kept many anglers indoors, but numbers were also lower due to division biologists focusing more on lakes and ponds with historically poor turnout and success rates, and more on streams and rivers which can be difficult to assess good angler numbers. For those who braved the elements, Sylvan Lake had the largest showing of anglers with 107 individuals fishing. But the place to be was Mac's Pond in Monmouth County as nearly 75% of the trout stocked in the pond were caught in the first 4 hours of the season.

Despite the overall average to slow start to the spring trout fishing season on many waterbodies, anglers will be more successful as the season progresses, when warmer waters and mild days prevail.

Detailed results noted by volunteer survey clerks for each waterbody surveyed can be found in Appendix F of this report.

Warmwater/Coolwater Angler Survey

In the Fall 2015, the Bureau initiated an online angler survey to obtain anglers opinions and experiences concerning their warmwater and coolwater fishing experiences in New Jersey. The survey specifically focused on opinions concerning Muskellunge, Northern Pike, Walleye, Hybrid Striped Bass, Channel Catfish, and bass. The questions focused on angling success, waterbodies fished, and views on regulations pertaining to these fisheries. The survey was concluded on April 25, 2016 with 1,013 anglers participating. 95.4% of participating anglers were residents and 4.6% were non-residents. It should be noted that non-residents account for 8.4% of overall fishing license sales. Responding anglers represented all 21 counties, with Morris with the highest representation of 10% and Cape May the lowest of 1%. The majority of non-resident anglers were from Pennsylvania. More than half of the anglers participating (both resident and non-resident) ranged in age from 51 to 69 years of age.

60.3% of the anglers spend the majority of their time fishing waters open to the general public. When asked to rank their favorite species to target while fishing, bass, trout, pickerel and Striped Bass (in order of preference) were the top ranked. 37.4% of anglers (980) fished more for other types of fish than trout while 21.7% fished more for trout than other types of fish (see chart).

When freshwater fishing in New Jersey do you fish		
Answer Options	**Response Percent**	**Response Count**
ONLY for other types of fish - NO TROUT	15.7%	154
MORE FOR OTHER TYPES OF FISH than trout	37.4%	367
EQUALLY for other types of fish and trout	20.0%	196
MORE FOR TROUT than other types of fish	21.7%	213
ONLY for trout	4.4%	43
Not Sure	0.7%	7
	answered question	**980**

With the exception of bass, targeted by the vast majority of responding anglers (88%), anglers targeting the other species were almost equally represented in the survey, 24.7% to 29.5%. Although catch and release was prevalent with most species, Muskellunge had the highest percentage of anglers always practicing catch and release with 93%. Not surprisingly, anglers fishing for Channel Catfish and Walleye were less apt (56.4%) to practice strict catch and release.

When asked about current regulations, the majority of anglers were satisfied with current regulations governing these fisheries. However, regardless of species, a percentage of anglers did indicate that although they are catching larger and larger fish, they believe the minimum size should be increased to force others to release their catch more often.

The survey also includes angler opinions and success on specific waterbodies, regulations, opinions on bass tournaments, and how anglers obtain information about fishing in New Jersey. (Federal Grant F-48-R, Project III) (Barno and Smith)

Wild Trout Angler Survey – A survey of wild trout anglers was designed to obtain angler feedback concerning New Jersey's wild trout fishing opportunities. The Wild Trout Survey, which was released to the public on March 2, 2016, had a total of 291 anglers participate in the 25 question survey. Anglers were asked if they supported or opposed the current Wild Trout Stream Regulations and how they felt about several possible new Wild Trout Stream Regulations. The following bullets are highlights from the survey. For more information on the Wild Trout Stream Regulation Assessment see page 52. (Federal Grant F-48-R, Project III) (Barno and Shramko)

- 90% of participating anglers felt that the most important attribute to having a good day of fishing for wild trout is not based on the number of trout caught or even the size of the trout caught, but just seeing evidence of wild trout in their stream.
- 87% said catching just one wild trout is important to having a good day fishing.
- 95% of the anglers said that a scenic location without a lot of other anglers was important to having that good day of fishing.
- In contrast, 60% of participants stated that catching big fish was NOT important to them when it comes to having a good day on the water.
- 61% are not in support of the current *2 fish per day creel limit* while only 26% support it.
- 75% answered that they want a *Catch & Release* Regulation on all wild trout streams (only 14% opposed this).
- 74% would like *Catch & Release* Regulations on Brook Trout streams, while 60% answered that they would support *Catch & Release* Regulations on wild Brook Trout, but allow harvest on wild Brown Trout and wild Rainbow Trout (19% oppose this).
- 78% of anglers were not in support of the current hook point regulation that allows up to 3 treble hooks or 9 hook points (8% supported).
- Anglers were asked about all different hook point combinations, but the most unified responses were: 65% of anglers support *single hook only* (15% oppose this) and 69% want *barbless hooks only* (13% oppose).
- 70% of participating anglers stated that they support the current *Artificials Only (No bait or scents)* gear restriction while only 19% oppose the current regulation.

Trout Angler Logbook Program

NJDFW utilizes a logbook (diary) program to obtain current information regarding trout angler catch and effort on special regulation areas on trout streams. Initially launched as a pilot program in 2012 on three special regulation trout fishing areas, the program was expanded in 2013 to include all seven areas. Logbooks are distributed annually to experienced anglers who indicate they regularly fish one or more of the areas in the study. Anglers record information about fish harvested or released during each trip, as well as time spent fishing and gear used. At the end of the calendar year anglers return their logbooks to NJDFW and the data is then compiled and analyzed during the following calendar year. Compared to other survey methods, angler logbooks are one of the least expensive ways to collect information on a fishery. Data collected through angler logbooks supplement other data collected by NJDFW (such as Opening Day angler surveys, telephone and internet-based surveys, on-site angler creel surveys, fish population surveys using electrofishing gear, and water temperature monitoring). Collectively, this data aids in evaluating the fishery and guides managers and stakeholders in making informed decisions that benefit both the resource users and the resource. (Federal Grant F-48-R, Project III) (Sedor)

In 2015 seven special regulation areas were included in the logbook program and the logbooks results were compiled (see table below). A total of 85 anglers volunteered for the program, receiving a total of 110 logbooks (some anglers needed more than one logbook to record all their trips). Despite efforts to encourage logbook returns only 16 anglers (19%) returned their logbooks. Collectively the 16 logbook anglers logged 309 trips to 6 of the 7 special regulation trout fishing areas. The Big Flat Brook / Flat Brook *Catch and Release (C&R)* area was the most commonly visited site with 119 trips (38%), followed by the Musconetcong River *YTCA* (81 trips, 26%), and the Ken Lockwood Gorge *C&R* section of the South Branch Raritan River (71 trips, 23%). The remaining 38 trips (13% of total) were to the Pequest River *STCA* (29 trips, 9%), S/Br. Raritan River – Claremont Stretch *YTCA* (6 trips, 2%), and Pequannock River *STCA* (3 trip, <1%). No fishing trips were recorded for the Toms River *YTCA*. Anglers fished an average of 2.9 to 4.0 hours per trip; the highest average trip lengths were on the Ken Lockwood Gorge (4.0 hrs/trip), the Musconetcong River (4.0 hrs/trip), and Pequest River (3.9 hrs/trip). The logbook data includes trips that were taken to the *STCA*'s at times when the special regulations were not in effect. Interestingly, fly fishing gear was used by anglers for the majority of trips; only 11 trips (3%) used spin fishing gear, including trips where both techniques were used.

Logbook anglers recorded a total catch of 2,206 trout. Catch and release fishing was practiced all the time, or nearly so; anglers recorded 2,167 trout released (99%), no trout kept, and failed to indicate if 39 other trout were kept or released. The catch rate averaged 2.0 trout/hr, and ranged (by special regulation area) from 0.5 – 2.9 trout/hour. The average number of trout caught per trip was 7.1, and by special regulation area ranged from 1.3 – 8.0 trout/trip. These catch rates are very much in line with previous year's logbook reports (2013 – avg. 7.0/trip, 1.8/hr., 2014 – avg. 5.2/trip, 1.9/hr.), despite the effects of 2014's truncated stocking season and the subsequent shift to stocking only rainbow trout. The highest catch rates (per hour and per trip) occurred in the Flat Brook / Big Flat Brook *C&R* (2.9/hr, 8.0/trip). The lowest catch rate was on the Pequannock River *STCA* (0.5 trout/hr and 1.3 trout/trip). Most trip reports were reasonably close to these averages, though three trips to the Flat Brook / Big Flat Brook *C&R* logged over 50 trout per trip. Two of the three 50+ trips were on stocking days (Flat Brook remains open to fishing

year round, including stocking days), and the third was the day after stocking. This may contradict the conventional wisdom that fish are less likely to feed immediately after stocking.

Of the total trout caught, anglers recorded the species for 95% (2,088 trout). Overall Rainbow Trout were caught most frequently 96%), followed by Brown Trout (3%), and Brook Trout (1%). Two Tiger trout (Brook X Brown hybrid) were recorded in the Ken Lockwood Gorge; one of unrecorded size and the other 16 inches in length.

Anglers were also asked to note if the origin of each trout they caught was wild, stocked, or unknown. This assessment can be very subjective and difficult since a decision is based primarily upon fin wear and also influenced by fish coloration. Anglers reported catching 54 (2%) wild trout and 1,969 (89%) stocked trout. 183 (9%) trout were recorded as species origin unknown, indicating that most anglers were reasonably confident in their ability to distinguish wild from stocked fish, though less so than in previous years (5% in 2014).

The average size of trout caught (results not provided in the table) was 294 mm (11.6 in) and they ranged in size from 76 mm (3 in) (Pequannock River) to 711 mm (28 in) (in the Pequest River *STCA*). 72% (1,582) of trout recorded fell within the 9 to 11-inch range stocked by Pequest Trout Hatchery. 85% (1,857) were between 8 and 12 inches, a range which allows for some variation in length estimates (anglers are asked only to estimate trout length, not required to carry a measuring device) and slight differences in stocking length.

Summary of fishing trip and catch statistics for 24 logbooks returned by 16 anglers who participated in the 2015 Trout Angler Logbook Program which targeted 7 special regulation trout fishing areas.

Total number of trips	Hours Per Trip	Number of trout caught by species1				Total trout caught	Number of trout caught by origin			% wild caught	Number of trout caught per	
		BKT	BNT	RBT	UNK		Wild	Stocked	UNK1		Hour	Trip
Big Flat Brook / Flat Brook (Catch & Release)												
119	2.8	7	2	929	15	953	10	865	78	1%	2.9	8
Musconetcong River – Point Mtn. (Year Round Trout Conservation Area)												
81	4	1	3	534	56	594	5	531	58	<1%	1.8	7.3
S/Br. Raritan River – Ken Lockwood Gorge (Catch & Release)												
71	4	0	47	345	40*	432	13	379	40	3%	1.5	6
Pequest River (Seasonal Trout Conservation Area)												
29	3.9	1	4	194	9	208	10	190	8	4%	1.8	7.2
S/Br. Raritan River – Claremont Stretch (Year Round Trout Conservation Area)												
6	3.3	5	4	5	1	15	9	4	2	60%	0.8	2.5
Pequannock River (Seasonal Trout Conservation Area)												
3	2.9	0	3	1	0	4	4	0	0	100%	0.5	1.3
Toms River (Year Round Trout Conservation Area)												
0	0	0	0	0	0	0	0	0	0	0	0	0

[1] BKT = Brook Trout; BNT = Brown Trout; RBT = Rainbow Trout; UNK = unknown (trout species or origin). * = One angler reported two Tiger Trout, Brook X Brown Trout hybrids. These trout included in UNK Count.

In 2015, 97 logbooks were prepared and distributed to anglers who indicated they regularly fish the seven stream sections described above. The data from these logbooks (that are returned by anglers) will be compiled and the results summarized in the 2016 annual field report titled: Investigations and Management of New Jersey's Freshwater Fisheries Resources.

INFORMATION AND EDUCATION

In addition to a multitude of research and management activities, the Bureau of Freshwater Fisheries actively participates in a number of Information and Education activities each year. Several such as two annual Fisheries Forums, a Public Trout Meeting, and biennial Public Hearing are directly tied to research and management activities and promulgation of regulations governing the state's freshwater aquatic resources. In addition, Bureau staff actively participates in the preparation of the Freshwater Fishing Digest. For the 2017 edition, the first of two feature articles is titled, "Restoring Free-flowing Rivers, Bringing Down the Dams" and explains the benefits of removing on-stream dams to improve water quality and to restore natural river functions and historic fisheries. The second feature article is titled "The Truth about Hooks and Lures", which aims to clarify the debate among anglers as to the impacts that various hook and lure types have on fish. The Freshwater issue of the Digest is perhaps the most widely distributed publication throughout the Department.

Professional Meetings/Conferences

New Jersey participates in a number of regional initiatives geared towards the protection of the nation's freshwater fisheries resources. As such, state fisheries biologists participate in a number of regional panels and workshops to share information and experiences with biologists in other states on a variety of topics in the realm of fisheries management.

Eastern Brook Trout Joint Venture (EBTJV) Meeting - Bureau staff attended two EBTJV meetings in 2016 (2/19/16 and 12/5-12/7/16). At the first meeting the partners were updated on the catchment assessment results for wild Brook Trout and discussed how to incorporate these results into the EBTJV Brook Trout Conservation Strategy. At the second meeting EBTJV's mapping of Brook Trout occurrence at the catchment scale (using data supplied by state fisheries agencies) and its incorporation into a new patch designation was explained. These patches and catchments were discussed at the state level and summarized for the Eastern Brook Trout range. This approach will allow states to view Brook Trout catchment data as collected patches, not only to identify key strongholds, but also to help prioritize catchments for restoration to connect patches to create larger strongholds. Since its inception in 2005, the EBTJV has coordinated range wide Brook Trout conservation and habitat restoration efforts through a collaborative, multi-agency approach. EBTJV partners (17 states, federal agencies, and NGO's) periodically meet to work, both collectively and in workgroups, on strategies and on-the-ground actions to improve water quality and restore Brook Trout habitat and populations. (Federal Grant F-48-R, Project I and II)

Merrill Creek Reservoir - The annual fisheries management meeting with staff and their consultant held on March 4 to review and discuss the fisheries data collected in 2015 and future management of the recreational fisheries. The data collected on Lake Trout continues to indicate this species is reproducing successfully in the reservoir (stocking was discontinued in 2013). The results from the night electrofishing survey indicate the Smallmouth and Largemouth Bass population is thriving and may be a good candidate for Lunker Bass fishing regulations.

Public Presentations

Each year state fisheries biologists attend meetings of a variety of organizations which may include angling clubs, watershed groups, local planning boards, and sportsmen shows. (Hunter and Angler Fund)

In 2016, presentations on the fisheries resources within the state were presented to:

North Jersey Freshwater Fisheries Forum – Thirty-seven anglers attended the annual North Jersey Freshwater Fisheries Forum held on January 30. The purpose of the forum is to disseminate information pertaining to Bureau research and management activities and provide attendees the opportunity to comment on our fisheries programs and interact with Bureau staff. Highlights of 2015 field sampling efforts were presented by Principal Biologist Shawn Crouse, Coolwater Fisheries Assessment work was presented by Fisheries Biologist Scott Collenburg, and discussion on potential Wild Trout Stream Regulations was presented by Principal Biologist Pat Hamilton. All Bureau of Freshwater Fisheries staff attended the meeting and answered questions from anglers.

South Jersey Freshwater Fisheries Forum - Twenty-five anglers attended the annual South Jersey Fisheries Forum held on February 20, 2016 at the Batsto Visitor's Center. Principal Biologist, Christopher Smith presented highlights of warmwater lake electrofishing surveys, and Fisheries Biologist, Eric Boehm presented fisheries data collected from bass tournaments held on Wildlife Management Area Lakes. A question and answer period and open discussion followed the presentations.

Trout Meeting – Ninety-seven anglers attended the annual Trout Meeting held on February 27, 2016 at the Pequest Trout Hatchery. Jeff Matthews, Fish Production Chief, presented hatchery production numbers for the upcoming spring trout stocking. Senior Fisheries Biologist, Ross Shramko, presented information on allocation and waterbody changes for the spring stocking as well as presented a new allocation methodology for Fall and Winter Trout Stocking Programs. Principal Biologist, Pat Hamilton, presented information concerning the development of potential Wild Trout Regulations. An extensive question and answer period, and open discussion followed the presentations.

Outdoor Writer's Workshop – Fisheries Biologist Chris Smith prepared and presented a PowerPoint presentation on various Bureau of Freshwater Fisheries activities, including highlights from the Bureau's 2015 Field Sampling Season, including a fisheries inventory completed at Union Lake.

Round Valley Trout Association – Biologist Shawn Crouse prepared and presented a PowerPoint presentation at Round Valley Trout Association's meeting held on March 17, 2016. Information provided included important dates, upcoming NJDFW events, current research and management of Round Valley Reservoir, with a focus on Lake Trout research and management.

South Jersey Bass Club Association – Biologist Chris Smith gave an informal presentation to the South Jersey Bass Club Association in January, 2016.

Public Events

The **New Jersey WILD Outdoor Expo** is an annual event celebrating the state's bountiful natural resources and rich outdoor heritage. The event was held on September 10 and 11, 2016, from 10 a.m. to 5 p.m. daily at the Colliers Mills Wildlife Management Area in Jackson Township, Ocean County. The Expo is an annual event which is free of charge and takes place rain or shine. The WILD Outdoor Expo is hosted by the NJDEP Division of Fish and Wildlife, Division of Parks and Forestry, the Green Acres Program and the Conserve Wildlife Foundation of New Jersey. The event also has several sponsors, and exhibitors and vendors from the field of outdoor recreation were on site. The Expo helps people connect with the natural world by providing a unique blend of conservation information, education and hands-on opportunities to learn outdoor skills and activities. Numerous environmental and conservation exhibits, demonstrations and seminars are planned for the weekend. Visitors can learn about, and try, a wide array of activities including fishing, hiking, shooting sports, kayaking, camping skills, rock climbing, wildlife watching and much more. (Hunter and Angler Fund)

Every year NJDFW holds an annual **Open House at the Pequest Trout Hatchery and Natural Resource Education Center**, prior to the opening of trout season. The event was held on April 2 and 3, 2016, from 10 a.m. to 5 p.m. Each year thousands of people of all ages come to the hatchery to see the trout that are raised, and participate in many activities including kids fishing, shooting sports, fisherman's flea market, and much more. Staff assist in a number of facets including assisting at the Fishing Education Pond, providing demonstrations on the stripping an fertilization of eggs, providing fish for the kiddie pool, and answering questions from the general public. (Hunter and& Angler Fund)

Attended the **Pequest Teen Angler Event (13th Annual)** held on July 23, 2016 at the Pequest Fish Hatchery's Fishing Education Pond. There were 56 anglers, 12 – 20 years old, with 16 of them licensed anglers. There were also 28 adults accompanying them, with 18 of which had fishing licenses. Fishing was excellent with lots of fish caught, in fact there were too many to count. The action kept up right to the end. Every angler caught multiple fish, with one young angler claiming she caught 30 fish. 138 trout from 18-28 inches and 11 under 18 inches were kept. A few of the fish in the 18 to 28-inch range were over 8 lbs. The 14th Annual Pequest Teen Angler Event is scheduled for July 22, 2017. (Hunter and Angler Fund) (Boriek)

NJDEP's Youth Fishing Derby was held at Stacy Pond in Trenton on May 22, 2016. An estimated 80 youth participated in the fishing derby (the largest number of competitors, to date) and an estimated crowd of 160 participants and volunteers experienced the event. (Boriek)

Union County's BioBlitz-
The 2016 BioBlitz was held at Kawameeh Park, Black Brook Park, and Galloping Hills Golf Course on June 11, 2016. The fish team, led by New Jersey Department of Environmental Protection, Division of Fish and Wildlife, sampled the West Branch of the Elizabeth River, Shallcross Pond, and several ponds within NJ American Water property near Kawameeh Park. The team used a variety of sampling methods including electro-fishing (using mild electrical currents to temporarily stun the fish for easy capture and identification) and seining. Thirteen fish species were collected. Native species include Pumpkinseed, Brown Bullhead, Golden Shiner, Banded Killifish, Mummichog, and American Eel. Non-native species include Largemouth Bass, Bluegill, Green Sunfish, Black Crappie, Common Carp, Goldfish, and Western Mosquitofish. The fish assemblage in the West Branch of the Elizabeth River is typical for a degraded watershed, consisting almost exclusively of Green Sunfish, Mummichogs, and Western Mosquitofish. The warmwater fish assemblage encountered at Shallcross Pond provides recreational opportunities for anglers. The fish team also conducted one waterfront public presentation, consisting of a fish collection demonstration by means of the use of a 20-ft. seine. The presentation also touched upon the job of a fisheries biologist, a summary of fishes encountered, and field identification. (Hunter and Angler Fund) (Crouse)

Common Name	Comments	Elizabeth River	NJ American Water Ponds	Shallcross Pond
American Eel	native	x		
Common Carp	non-native	x	x	
Goldfish	non-native	x		
Golden Shiner	native			x
Western Mosquitofish	non-native	x	x	
Largemouth Bass	non-native			x
Black Crappie	non-native			x
Pumpkinseed	native	x	x	x
Bluegill	non-native			x
Green Sunfish	non-native	x	x	x
Brown Bullhead	native	x	x	x
Banded Killifish	native	x		
Mummichog	native	x		

OTHER FISHERIES RELATED ACTIVITIES

Permits

The Bureau of Freshwater Fisheries reviewed and issued 425 permits in 2016 to provide for the effective management and protection of the state's aquatic resources (see table below). These permits encompass 9 specific permits which include commercial harvest of aquatic species, water level management (for the protection of aquatic species), the introduction of aquatic species into waters of the state, as well as the collecting of aquatic species for scientific purposes, and special use permits. The review and approval of these permits not only include protection for freshwater fish, but also protection for other aquatic species such as frogs and turtles during critical spawning and hibernating periods. In addition to permits directly issued by the Bureau, the BFF also reviews Aquatic Use Permit Applications issued by the Department's Pesticide Control Program for the use of copper in waters known to be stocked or inhabited with trout. Trout are particularly sensitive to copper which is a basic agent for algal control treatments (copper sulfate) throughout the state. (Hunter and Angler Fund) (Barno)

Permits issued by the Bureau of Freshwater Fisheries in 2016

Permit Type	Number
Baitfish - Commercial	6
Fish Stocking	169
Trout in the Classroom	4 new
Fish Stocking	202 existing
Gill Net – Staked - Commercial	0
Gill Net – Drifting -	0
Haul Seine - Commercial	1
Miniature Fyke/pot	0
Scientific Collecting	60
Special Use Limited License	28
Water Lowering	157
Total	**425**

Wildlife Management Area Fishing Tournament Permits

The popularity of recreational and tournament bass fishing was elevated to a new level during the 1960's. In an effort to unite bass anglers nationwide Ray Scott created the Bass Anglers Sportsmen Society (B.A.S.S). The goal of BASS was to emphasize conservation, education, and sportsmanship. Since 1996 the Division of Fish and Wildlife has required a permit to hold fishing tournaments on Wildlife Management Area Lakes. Permits are necessary to regulate the number of tournaments held on WMA Lakes, due to an increasing demand on our public waterbodies. NJDFW collects valuable information from tournament reports to supplement existing fisheries data. (Hunter and Angler Fund) (Smith)

In 2016 there were 185 WMA Tournament Permits issued by the NJDFW. Anglers are required to submit a summary report within two weeks following the event. The return rate had been rather poor until 2015 when the South Jersey Bass Club Association diligently pursued members of the organization reminding them of the reporting requirement. Their campaign was successful resulting in 64% return rate in 2015. In comparison only 24% of reports were received in 2014. This year was another successful year with a return rate 67%. The four most popular waters in 2016 were Salem Canal (46 tournaments), Union Lake (32 tournaments), Lake Assunpink (25 tournaments) and DOD Lake (16 tournaments). The largest bass reported to date was a 6.74-poind Largemouth Bass from DOD followed closely by a 6.71-pound Largemouth Bass from Assunpink Lake. Assunpink Lake has shown a significant increase in the number of five-pound bass with 10 bass over five pounds caught. DOD was second in the five pounder category with four caught, of which three were caught in the same tournament.

The tournament report forms are a vital component of the tournament permit process. A summary of tournament results will be prepared and available later in 2017.

Database Management - FishTrack

FishTrack is an Access database which houses New Jersey's Bureau of Freshwater Fisheries stocking information and field survey data collected by NJDFW throughout the state, historically through present day. In 2016, the *FishTrack* database was updated in a few key areas.

The young-of-the-year category was updated for all historical and present trout data. A determination was made that any trout collected and measured 100mm or less that the trout was born the year that it was collected. The database was updated to represent this determination.

In addition to the young-of-the-year category update, a stocked trout or wild trout label was applied to all individual trout where it could be determined for all surveys where trout were found. These two updates will assist the NJDFW with its management of stocked and wild trout.

Also, all 2016 field survey data has been inputted and validated for accuracy. Maintaining an accurate and consistent database is critical as this gives staff biologists the ability to access accurate historical data to assist with appropriate management of the state's fisheries resources. (Federal Grant F-48-R, Project I) (Shramko)

LITERATURE CITED

Barbour, M. T., J. Gerritsen, B. D. Snyder and J. B. Stribling 1999. Rapid bioassessment protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates, and fish, 2nd edition. EPA 841-B-99-002. U. S. Environmental Protection Agency, Office of Water, Washington, D.C.

Broccoli, A.J., M.B. Kaplan, P.C. Loikith, and D.A. Robinson. 2013. State of the Climate: New Jersey. Rutgers University.

Creaser, C. W. 1930. Relative importance of hydrogen-ion concentration, temperature, dissolved oxygen, and carbon-dioxide tension, on habitat selection by brook trout. Ecology 11:246-262.

Duda, Mark. 2012. New Jersey Trout Anglers' Opinions on Stocking and Other Trout Regulations. Responsive Management Inc., Harrisonburg, VA 22801.

Hamilton, P. L. and L. M. Barno. 2006. New Jersey Coldwater Fisheries Management Plan. New Jersey Division of Fish and Wildlife, Trenton, New Jersey.

Power, G. 1980. The brook charr, Salvelinus fontinalis. Pages 141-203 in E.K. Balon, editor. Charrs: fishes of the genus Salvelinus. Dr. W. Junk Publishers, The Hague, Netherlands.

Raleigh, R. F. 1982. Habitat suitability index models: Brook trout. U.S. Dept. Int., Fish and Wildl. Serv. FWS/Obs-82/10.24. 42 pp