INVESTIGATIONS AND MANAGEMENT OF NEW JERSEY'S FRESHWATER FISHERIES RESOURCES 2017

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 2017

Including
Sport Fish Restoration Grant F-48-R

Job Performance Reports Segment 28
(November 2, 2016 – December 31, 2017)

and

Final Reports

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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

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INTRODUCTION

Highlights for 2017

NJ Division of Fish and Wildlife's Bureau of Freshwater Fisheries (BFF) is responsible for the management of New Jersey's freshwater fisheries resources. BFF activities include many facets, including fish culture and managing wild and stocked fish populations, protecting and enhancing their habitats, and educating the public. In 2017 the BFF conducted a total of 199 fisheries surveys, at 118 waterbodies, to address a variety of recreational and resource management needs, including response to emerging fisheries issues. A total of 53 rivers and streams and 65 ponds and lakes were surveyed. Fisheries biologists captured, identified, and counted over 41,000 fish, represented by 72 species. Surveys were conducted to satisfy a wide variety of project and program needs, providing up-to-date data, so that the State's freshwater fisheries resources can be properly managed. Fisheries surveys were used to monitor populations, assess stocking programs, document populations of both rare native fishes and invasive species, among a variety of other functions. This report documents the ongoing fisheries management activities, performed by the Division of Fish and Wildlife (NJDFW) and the status of its fisheries resources in 2017. 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, which enables the Division of Fish and Wildlife to continue "Managing Your Fish and Wildlife since 1892."

New Jersey's Fish and Wildlife populations continue to benefit from the cooperative efforts of various conservation groups, state, and federal agencies. Dams along historic migratory fish pathways are being removed, allowing species such as the American Shad and Blueback Herring to return to rivers such as the Millstone and Musconetcong, and in the near future the Paulins Kill. Declining species such as Brook Trout and Bridle Shiners have more regulatory protections than ever. Largemouth Bass, Muskellunge, and Lake Trout of near-record proportions are being caught and often released for others to enjoy. Trout anglers enjoy up to 700,000 Rainbow Trout annually stocked into public waters. A record-setting 5 million warm and coolwater fishes were raised at the Division operated Charles O. Hayford Hatchery in 2017. These are only a few examples of the many successful programs and outcomes delivered by NJ Division of Fish and Wildlife's Bureau of Freshwater Fisheries.

In 2014 the Bureau initiated a multi-year project to assess the *Wild Trout Stream* regulation. The goals were to determine if the recreational fishing opportunities afforded by this regulation were appropriate and if the conservation needs of wild trout were adequately addressed. A total of 94 electrofishing surveys were conducted on 57 streams in 2014 and 2015 to obtain current fish population data. In addition, an online survey for anglers who fish for wild trout in New Jersey was conducted and scientific literature pertaining to hooking mortality was reviewed. This information was compiled, analyzed, and used to develop a suite of fishing regulations that not only highlight the variety of recreational fishing opportunities for wild trout, but also protect them. Recommended changes were submitted to the Fish and Game Council for their review in February 2017 and unveiled at the annual public trout meeting held later that month. Staff also attended meetings of ten Trout Unlimited chapters during the spring to present the potential changes and further solicit angler feedback. Following a formal sixty-day public comment period, the proposed amendments were approved by the Fish and Game Council and went into effect February 10, 2018.

The centerpiece of these new wild trout fishing regulations is the conservation of wild Brook Trout. The number of wild Brook Trout populations has significantly declined in our state, due to impacts from urbanization, the building of dams and roadways, and the stocking of non-native trout species. Due to growing concern over the plight of Brook Trout, a *Brook Trout Conservation Zone* has been established for northwestern New Jersey, where wild Brook Trout are most abundant. Any Brook Trout caught within this zone must be immediately released unharmed.

Within the *Wild Trout Stream* regulation, three designations highlight the variety of wild trout fishing opportunities available and better align individual streams with management strategies specific to the wild trout species present. Many streams previously designated as a *Wild Trout Stream* were retained, but some were dropped and others added. All three designations continue to allow anglers to use fly and spin fishing gear, but limits tactics to the use of artificial flies and lures only (no bait or bait scent). The harvest season commences in April (coinciding with the Opening Day of the trout season) and continues through September 15. A new requirement will limit lures to a maximum of three hook points, all of which must be barbless (previously nine, barbed hook points were allowed). For more information on the three designations, please see the section on Wild Trout Streams found in the Trout Waters with Special Regulations section of this report.

In addition to the sweeping regulatory changes described above, a new regulation was implemented in 2018 on streams having abundant wild Brown Trout, that Fish and Wildlife also stocks with Rainbow Trout. The *Trout Stocked Waters – Wild Brown Trout Managed* regulation is intended to enhance the existing wild Brown Trout fishery in five streams, while minimizing impacts to those anglers who primarily fish these waters for stocked trout. Unlike the regulation pertaining to designated *Wild Trout Streams*, anglers fishing these waters will continue to be allowed to use bait and up to nine hook points. However, because wild Brown Trout may reach impressive size in these five streams, a 12-inch minimum size applies for this species (compared to 9-inch limit for Brook and Rainbow Trout) and the daily creel of trout may include no more than two Brown Trout.

The Division of Fish and Wildlife initiated two exciting projects in 2017. The first was aimed to better understand stocked trout movement and the second was to restore wild Brook Trout. Staff implemented a stocked trout movement study using radio telemetry in the Flat Brook's *Catch and Release* area. The Flat Brook is considered one of New Jersey's most popular trout streams, however Division biologists have been surprised by the low numbers of trout found in many electrofishing surveys conducted in recent years. In order to better understand where stocked trout are going, a total of 40 radio telemetry transmitters were surgically implanted into 40 Rainbow Trout from the Pequest Trout Hatchery. These tagged trout were stocked in the spring and followed daily for the first two weeks, then every other day for the remainder of the study. Preliminary results indicate fish are not moving very far, but are succumbing to predation at very high rates.

The second exciting project attempts to restore Brook Trout in Rinehart Brook, a tributary to the Black River within Hacklebarney State Park. Non-native Brown Trout have become the dominant trout species and the native Brook Trout reside there in limited numbers. The objectives of this study were: to determine if multiple depletion electrofishing could be an

efficient technique to remove Brown Trout, to monitor potential rebound effects of the Brook and Brown Trout populations, and to determine if natural boulder waterfalls prevent Brown Trout from recolonization. Capture and removal of Brown Trout was accomplished via multiple electrofishing passes. During the initial pass, 725 Brown Trout and only 58 Brook Trout (7.4% Brook Trout) were captured in Rinehart Brook. All Brown Trout were removed, adipose fin clipped, and released into various sections of the Black River and the lower reaches of Rinehart Brook. All other species were returned where they were captured. This was repeated, until the 7th pass, when only 9 Brown Trout (all YOY) and 60 Brook Trout were encountered (87.0% Brook Trout). Additional surveys will resume in 2018, with intentions of continuing to remove Brown Trout that were not captured during the 2017 efforts. The existing Brook Trout population will be monitored for the next year or two, to determine if they rebound in response to a reduced/eliminated Brown Trout population. An insufficient Brook Trout rebound may result in the translocation of individuals from the neighboring Trout Brook.

Exceptionally low flows continued to plague New Jersey's waterways from the time an official Drought Watch was issued for much of the state on July 25, 2016. The Drought Watch was elevated, with the declaration of a Drought Warning on October 21, 2016 for 14 counties within the North, Central, and Coastal North Water Supply Regions (Administrative Order 2016-10). The Drought Warning remained in effect until April 12, 2017, when it was lifted for 12 of 14 counties. The Drought Watch for four counties in the southwestern part of the state was also lifted. Hunterdon and Somerset Counties, remained under a Drought Warning for an additional four months and was finally lifted August 18, 2017. A Drought Warning results in established minimum passing flow requirements to be reviewed to conserve levels in water supply reservoirs and often reduced within affected areas. Drought conditions during the summer months are typically far more detrimental, than cooler seasons, due to increased water temperatures, inadequate oxygen, etc. However, due to the existing exceptionally low stream conditions the newly proposed passing flows were well beyond any flows that the State has experienced in some cases in over 60 years. As a result, impacts to aquatic biota under these extreme conditions are difficult to predict.

The Division of Fish and Wildlife has several programs aimed to monitor and better understand how fish are impacted by changes in habitat and water quality. One project critical to understanding the relationship between fish and their habitat was initiated by establishing an ambient stream temperature monitoring network in 2013. This program has expanded to 39 thermographs (instruments that continuously monitor temperature). Data were recorded on 17 recreationally important trout streams and 14 small streams having reproducing trout populations. 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. Both water and air temperatures were recorded in wild Brook Trout streams as part of an Eastern Brook Trout Joint Venture initiative to assess climate change. On many of these streams, three years of year-round stream temperature monitoring and electrofishing surveys have been conducted, resulting in some interesting initial observations. The ultimate goals of the study are multi-faceted: (1) to develop a year-to-year analysis of stream temperature influence on wild trout populations, (2) submit data to the Department to determine if any streams are impaired as part of 303(d) listing, and (3) to develop metrics based on several factors such as Growing Degree Days, fry emergence times, critical summer time temperatures,

and aerobic scope curves that can guide us in determining what streams are the best candidates for possible translocations.

A second project based on the relationship of fish and their environment aims to identify and classify our streams based on water quality and critical habitat using bioindicators such as the ability of trout to naturally reproduce. Standardized stream electrofishing surveys contribute valuable data used for 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. Data from 53 electrofishing surveys conducted in 2017 were used to assess the current classifications. A total of 53 stream surveys provided valuable information in confirming existing classification as well as identifying potential upgrades. Streams recommended for upgrade to *Trout Production* include two unnamed tributaries to the South Branch of the Raritan River (Raritan River S/Br (trib.)(Drakestown) and Raritan River S/Br (trib.)(SW of Budd Lake). Two streams recommended for upgrade to *Trout Maintenance* include Bear Brook (Park Ridge) and Cresskill Brook (Demarest). In addition to recommending changes to existing surface water classifications, 2017 data confirmed the classifications of 22 stream segments (28 surveys), therefore no action was required.

As part of an ongoing monitoring program, naturally reproducing trout populations are surveyed at least once every 20 years, with those inhabited by wild Brook Trout every 10 years, and those regulated as *Wild Trout Streams* every 5 years. The data are evaluated to determine if changes have occurred and are used in the development management strategies and fishing regulations to protect this fragile resource. In 2017, surveys were conducted on eight *Trout Production* streams (Brook Trout) at locations previously surveyed. Unfortunately, Brook Trout were absent in four of them in 2017. Additional surveys should be conducted at these locations to determine if Brook Trout have been extirpated. Brown Trout appear to have displaced Brook Trout in one stream where they previously co-occurred. 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.

New Jersey has over 400 impoundments open to the 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 electrofishing surveys on lakes and ponds to assess the status of popular game species, primarily Largemouth Bass. A total of 35 surveys were completed at 24 locations in 2017. Assunpink Lake had the highest Catch Per Unit Effort for Largemouth Bass, at 60 bass/hr during daytime electrofishing. The largest bass encountered while electrofishing this year was from Perrineville Lake and weighed 6.99 lbs., followed by a bass weighing 6.72 lbs. collected at Union Lake.

Seining is an effective sampling method used to assess the status of warmwater fish reproduction, which aids in the management of their fisheries and helps assess stocking success or need. Seines also provide a means to sample fish populations in waters that are not easily accessible or conducive to standard electrofishing methods, such as waters with extremely low conductivity. The data gathered from seining surveys are also beneficial in documenting the presence of rare native species, as well as invasive species, that can often be missed when

sampling with other gear types. A total of 43 lakes and ponds were seined in 2017 during the months of June through early-October.

Over the last few years, the Bureau of Freshwater Fisheries has participated in revising 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 has recently updated the New Jersey's Wildlife Action Plan as required by Congress to continue to receive federal wildlife grants. More importantly, this plan will serve as a blueprint for conserving our wildlife heritage. The plan identifies priority actions addressing known threats that face 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 vital to raise fish, conduct fisheries surveys statewide, and perform countless tasks that help maintain and enhance New Jersey's freshwater fisheries resources. The Bureau's work is made possible 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. On January 1, 2017 the Fish Culture Unit was reunited with the Fish Culture Unit, once again providing a coordinated approach to the management of the State's freshwater fisheries resource.

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 – Senior 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

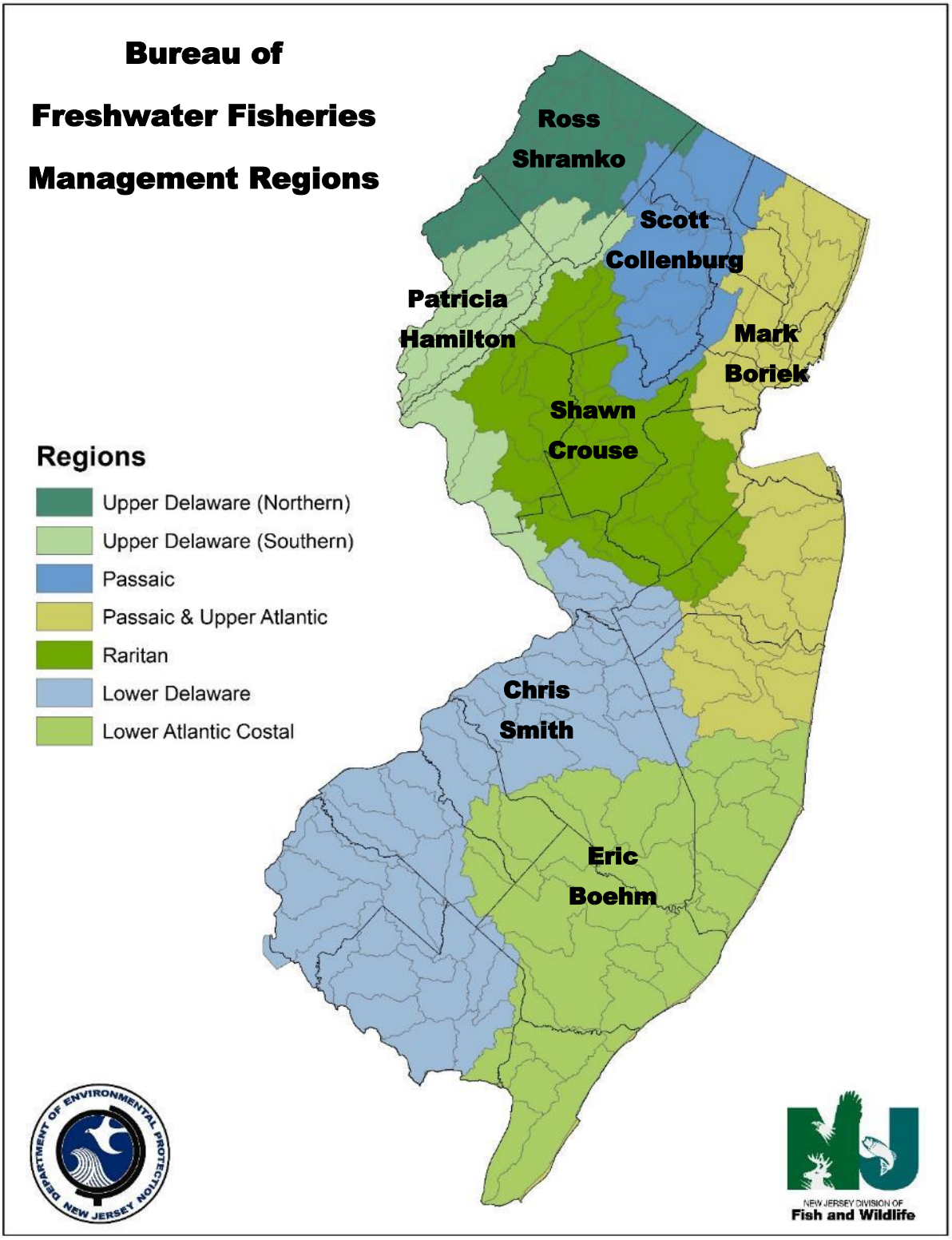
Shawn Crouse – Principal Fisheries Biologist
Fisheries Management in the Raritan Region (Raritan River Watershed), Native Fishes Management, State Wildlife Action Plan, and Annual Report Coordinator

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 – 2017 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, and $2.5 million is allocated to hatchery operations.

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 Bureau of Freshwater Fisheries annually receives $1 million in funding from the USFWS through the SFRP for fish culture and research and management activities. Research and management activities are conducted under Grant F-48-R, *Investigations and Management of New Jersey's Freshwater Fisheries Resources*. The grant cycle for Segment 28 began on November 2, 2016 and ended on December 31, 2017. A grant segment typically spans a one-year period, however, in 2017 this period was extended two months to better align this (and future) segments with the field season, report preparation period, and purchase of equipment/supplies. For Segment 28 the USFWS approved a total award of $256,668, of which 75% ($192,501) is federally funded and matched 25% ($64,167) with Hunter and Angler funds. An application to renew the five-year grant agreement for the period January 1, 2018 – December 31, 2022 was prepared and submitted.

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 projects, project objectives, and activities conducted under each project during 2017 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
12. Flat Brook Stocked Trout Movement Study

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 and 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

The Bureau of Freshwater Fisheries conducted 221 surveys throughout the state in 2017. The map below demonstrates the survey quantity, geographic distribution, and type (Figure 2). 199 surveys were conducted at 118 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 22 locations were water quality surveys only. A complete list of field locations surveyed in 2017 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 2017 by NJDFW, Bureau of Freshwater Fisheries.

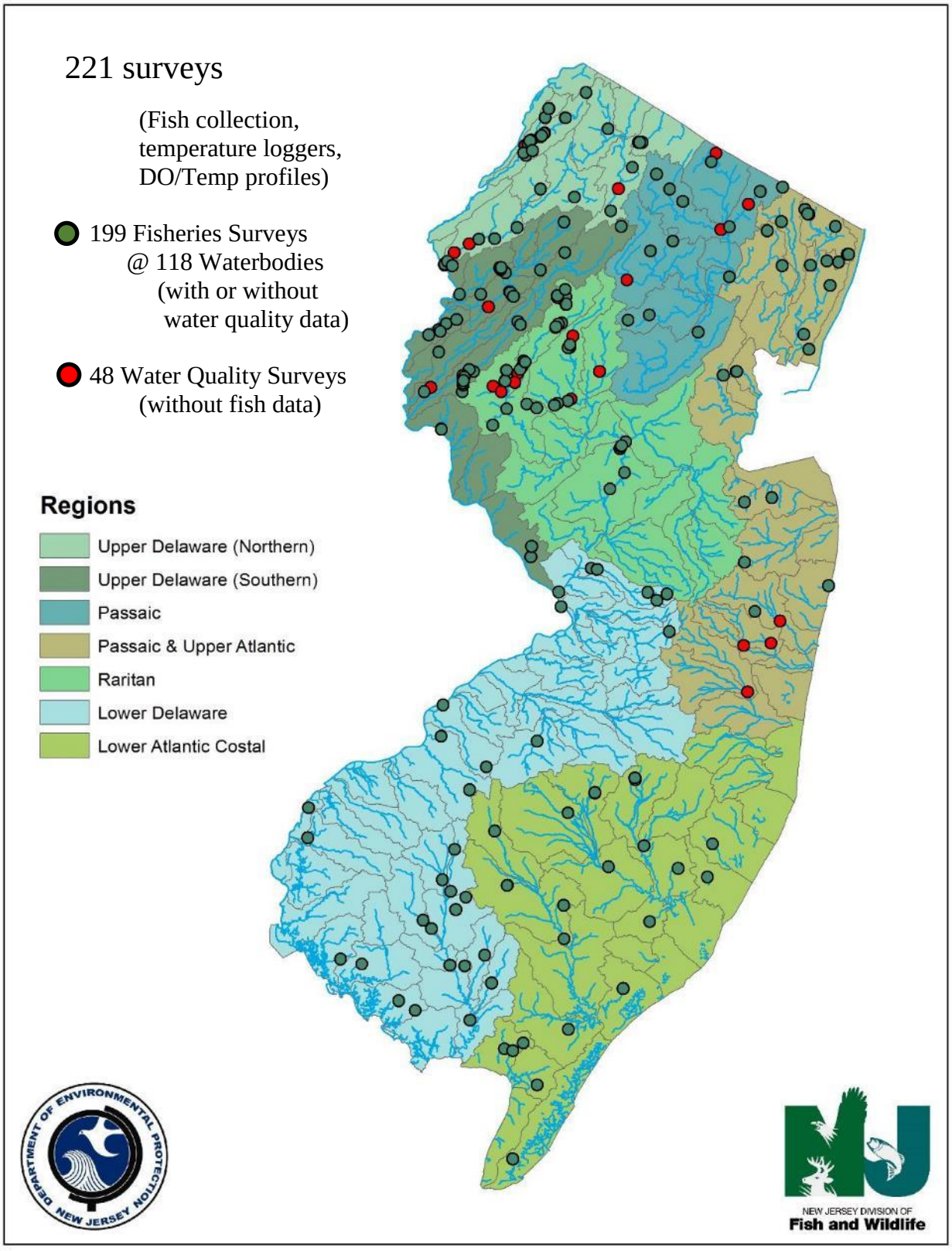


TABLE 1. 2017 field sampling locations

Bureau of Freshwater Fisheries

2017 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)	Brook Trout Assess. (I)	Temperature Study (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Trout Prod. Reinventory(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	▲	▲	●	■										▲		✓	32, 48, 139, A1
Big Flat Brook – old police barracks b/w Route 206 & Route 560	▲	▲		■	●									▲		✓	29, 32, 39, 48, 141, 149, A2
Big Flat Brook – 1200 m study area					●												41
Big Flat Brook – Route 560, downstream off unnamed dirt road	▲	▲			●									▲		✓	29, 39, 48, 141, 149, A3
Big Flat Brook – Blewitt Tract	▲	▲		■	●									▲		✓	29, 32, 39, 48, 141, 149, A4
Big Flat Brook (trib) (Lake Wapalanne)	▲	●												▲		✓	48, 137, 138, A5
Big Flat Brook (trib) (W of Lake Ashroe)	▲	▲				●								▲		✓	23, 48, 137, 138, A6
Blair Lake (Sussex)													●	▲		NA	86, 116
Flat Brook – Three Bridges	▲	▲			●									▲		✓	29, 39, 48, 140, 149, A7
Flat Brook – Roy Bridge				■												NA	29, 32, 149
Forked Brook	▲	▲	●	■										▲		✓	32, 49, 141, A8
Frelinghuysen Forest Preserve Pond #1 (Warren)													●	▲		NA	90
Little Flat Brook – Deckertown Turnpike	▲	●												▲		✓	49, 141, A9
Little Flat Brook (trib)(Flat Brook Office)	▲	●												▲		✓	49, 137, 138, A10
Paulins Kill – Sipley Road				■												NA	32, 38, 111
Paulins Kill – Viaduct				■												NA	32, 38, 111
Paulins Kill – Below Columbia Lake				■												NA	32, 38, 111

TABLE 1. 2017 field sampling locations (continued)

Bureau of Freshwater Fisheries

2017 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)	Brook Trout Assess. (I)	Temperature Study (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Trout Prod. Reinventory(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) (continued)																	
Sparta Glen Brook – Sparta Glen Park outside of restoration area	▲	▲								●				▲		✓	56, 49, 141, A11
Sparta Glen Brook – Sparta Glen Park restoration area	▲	▲								●				▲		✓	56, 49, 141, A12
Stony Brook (Stokes State Forest)	▲	●												▲		✓	49, A13
Tuttles Corner Brook (trib)(Camp Olympia) – above small pond		●												▲		✓	49, A14
Tuttles Corner Brook (trib)(Camp Olympia) – below small pond		●												▲		✓	49, A15
Wallkill River – Above Franklin Pond				■												NA	32
White Lake (Warren)													●	▲		NA	100

TABLE 1. 2017 field sampling locations (continued)

Bureau of Freshwater Fisheries

2017 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)	Brook Trout Assess. (I)	Temperature Study (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Trout Prod. Reinventory(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)																	
Merrill Creek Reservoir (Warren)										●						NA	27, 151
Musconetcong River – Point Mountain TCA				■												NA	32, 149
Musconetcong River – Valley Station Road – upper site		▲												▲	●		49, 51, A16
Musconetcong River – Valley Station Road – lower site		▲												▲	●		49, 51, A17
Musconetcong River – Warren Glen									●							NA	109
Pequest River – Alphano Road – upper site	▲	▲												▲	●	✓	49, 51, 139, A18
Pequest River – Alphano Road – lower site	▲	▲												▲	●	✓	49, 51, 139, A19
Pequest River – STCA				■												NA	32
Pohatcong Creek – Ravine Road				■												NA	32
Stephensburg Brook	▲	▲	●	■										▲		✓	32, 49, 138, A20
West Portal Creek – Asbury-West Portal Road – upper site	▲	▲								●				▲		✓	49, 60, 139, A21
West Portal Creek – Asbury-West Portal Road – lower site	▲	▲								●				▲		✓	49, 60, 139, A22
West Portal Creek – Asbury-West Portal Road – 8 other sites		▲								●				▲		NA	49, 60

TABLE 1. 2017 field sampling locations (continued)

Bureau of Freshwater Fisheries

2017 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)	Brook Trout Assess. (I)	Temperature Study (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Trout Prod. Reinventory(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)																	
Greenwood Lake (Passaic)											▲	●				NA	62, 65, 73
Pequannock River – Hamburg Turnpike- Waterfall Village	▲	▲			●									▲		✓	43, 49, 139, 149, A23
Pequannock River – Hamburg Turnpike - Appelt	▲	▲			●									▲		✓	43, 49, 139, 149, A24
Pequannock River – Hamburg Turnpike - STCA	▲	▲		■	●									▲		✓	32, 43, 49, 139, 149, A25
Pequannock River – Hamburg Turnpike - upstream	▲	▲			●									▲		✓	43, 49, 139, 149, A26
Pequannock River (trib.) (Irish Brook)		●												▲		✓	49, A27
Pequannock River (trib.) (Van Dam)		●												▲		✓	49, A28
Pequannock River (trib.) (W of Federal Hill)		●												▲		✓	49, A29
Ramapo River – Glen Gray Road				■												NA	32
Rockaway River – Rutgers Street				■												NA	32
Ryker Lake (Sussex)											●	▲				NA	78
Splitrock Reservoir (Morris)											▲	●				NA	80
Wanaque River – E. Shore Road				■												NA	32

TABLE 1. 2017 field sampling locations (continued)

Bureau of Freshwater Fisheries

2017 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)	Brook Trout Assess. (I)	Temperature Study (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Trout Prod. Reinventory(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)	●	▲												▲		✓	49, 137, 138, A30
Colts Neck Lower Municipal Pond (Monmouth)													●	▲		NA	87
Colts Neck Upper Municipal Pond (Monmouth)													●	▲		NA	87
Cresskill Brook – Church Street	▲	●												▲		✓	49, 142, A31
Cresskill Brook – Duck Pond Road	▲	●												▲		✓	49, 142, A32
Cresskill Brook – Deer Hill Road	▲	●												▲		✓	49, 137, 138, A33
Deal Lake (Monmouth)													▲	●		NA	64, 88, 116, 127
Forge Pond (Ocean)													▲	●		NA	89, 116
Manasquan River – Allaire State Park				■												NA	32
Metedeconk River N/Br – Ridge Avenue				■												NA	32
Metedeconk River S/Br – South Lake Drive				■												NA	32
Passaic River – Florham Park		▲								●						NA	49, 65, 66
Passaic River – Fairfield		▲								●						NA	49, 65, 66
Passaic River – Hawthorne		▲								●						NA	49, 65, 66
Peach Orchard Brook														▲	●		49, 154, A34
St. Gabriel Brook	●	▲												▲		✓	49, 120, 124, 137, 138, A35
Toms River - TCA				■												NA	32, 149
Warinanco Park Pond (Union)											▲			▲	●	NA	84, 154

TABLE 1. 2017 field sampling locations (continued)

Bureau of Freshwater Fisheries

2017 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)	Brook Trout Assess. (I)	Temperature Study (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Trout Prod. Reinventory(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)																	
Baldwin Lake (Mercer)													●	▲		NA	85
Beaver Brook – Old Allerton Road	▲	▲								●				▲		✓	49, 139, A36
Beaver Brook – Old Highway 22, upstream of Leigh Street	▲	▲								●				▲		✓	49, 139, A37
Black Brook	▲	▲	●	■										▲		✓	32, 49, 142, A38
Crystal Springs Preserve Ponds (Hunterdon)													▲	●		NA	88, 116
Drakes Brook (trib)(Mt. Olive)	▲	▲				●								▲		✓	23, 50, 142, A39
Electric Brook	▲	●												▲		✓	50, 140, A40
Etra Lake (Mercer)												●				NA	71, 125, 126
Farrington Lake (Middlesex)											▲				●	NA	71, 129
Grover's Mill Pond (Mercer)													●	▲		NA	91
Hickory Run – Hickory Run Road	▲	▲	●	■										▲		✓	32, 50, 140, A41
Lamington (Black) River – below Kay's Pond				■												NA	32
Lamington (Black) River - Hacklebarney State Park				■												NA	32
Lamington (Black) River - River Road				■												NA	32
Lamington (Black) River (trib)(Ironia)	▲	▲				●								▲		✓	23, 50, 142, A42
Metlars Pond (Somerset)													●	▲			95
Millstone River – Griggstown Causeway														▲	●	NA	103, A43, A44
Millstone River – Blackwells Mills Dam														▲	●	NA	103, A45, A46

TABLE 1. 2017 field sampling locations

Bureau of Freshwater Fisheries

2017 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)	Brook Trout Assess. (I)	Temperature Study (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Trout Prod. Reinventory(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)																	
Millstone River – above Weston Causeway Dam														▲	●	NA	103, 120
Millstone River – below Weston Causeway Dam														▲	●	NA	103
Millstone River – near Raritan confluence														▲	●	NA	103, 120
Mine Brook (trib)(E of Mine Mtn.)	▲	▲				●								▲		✓	23, 50, 142, A47
Mine Brook (trib)(S of Mine Mtn.)	▲	▲				●								▲		✓	23, 50, 142, A48
Oakdale Brook	▲	▲				●								▲		✓	23, 50, 137, 140, A49
Perrineville Lake (Monmouth)											●	▲				NA	76
Raritan River, N/Br – off Peapack Road				■												NA	32
Raritan River, S/Br – River Road		▲								●				▲			47, 50, 132, A50
Raritan River, S/Br – Claremont				■												NA	32, 149
Raritan River, S/Br – Ken Lockwood Gorge				■												NA	32, 39, 149
Raritan River, S/Br – below Lake Solitude				■												NA	32
Raritan River, S/Br (trib)(Drakestown)	▲	▲	●	■										▲		✓	32, 50, 137, 138, A51
Raritan River, S/Br (trib)(S of Hoffmans)	▲	▲				●								▲		✓	23, 50, 140, A52
Raritan River, S/Br (trib)(S of Schoolys Mtn)	▲	▲				●								▲		✓	23, 50, 140, A53
Raritan River, S/Br (trib)(SW of Budd Lake)	▲	▲	●	■										▲		✓	32, 50, 137, 138, A54
Rinehart Brook – Hacklebarney SP - Main Trail bridge	▲	▲	●	■						●				▲		✓	32, 50, 52, 140, A55, A56
Rinehart Brook – 4 other sites		▲								●				▲			50, 52

TABLE 1. 2017 field sampling locations

Bureau of Freshwater Fisheries

2017 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)	Brook Trout Assess. (I)	Temperature Study (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Trout Prod. Reinventory(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)																	
Rinehart Brook (trib)(Fairmount)		▲								●				▲			50, 52
Rockaway Creek S/Br – Kullman Industries Campus Drive	▲	▲								●				▲		✓	50, 140, A57
Rockaway Creek S/Br (trib)(Lebanon Boro) – Mainstream	▲	▲								●				▲		✓	50, 137, 138, A58
Rocky Run	▲	▲	●	■										▲		✓	32, 50, A59
Selover's Mill Pond (Middlesex)											▲				●	NA	80, 129
Spruce Run Creek – Main Street	▲	▲												▲	●	✓	50, 57, 133, 140, A60
Spruce Run Creek – Route 31	▲	▲												▲	●	✓	50, 57, 133, 140, A61
Stony Brook (Morris-Washington)	▲	▲	●	■										▲		✓	32, 50, 140, A62
Sun Valley Brook – Wolfe Road	▲	▲	●	■										▲		✓	32, 50, 142, A63
Teetertown Brook	▲	●												▲		✓	50, 140, A64
Trout Brook (Hacklebarney)	▲	▲	●	■										▲		✓	32, 50, 140, A65
Turkey Brook	▲	▲	●	■										▲		✓	32, 50, 140, A66
Willhoughby Brook	▲	▲	●	■										▲		✓	32, 50, 140, A67

TABLE 1. 2017 field sampling locations

Bureau of Freshwater Fisheries

2017 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)	Brook Trout Assess. (I)	Temperature Study (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Trout Prod. Reinventory(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 Lake (Monmouth)												●				NA	68, 156
Clarks Pond (Cumberland)													●	▲		NA	87
Cooper River Park Lake (Camden)							▲					●				NA	69, 120, 122
Country Lakes (Burlington)													▲	●		NA	88, 116
Delaware River (Bordentown)							▲				▲	●				NA	50, 69, 120, 122
Delaware River (Burlington)							▲				▲	●				NA	50, 69, 120, 122
Delaware River (Trenton)							▲				▲	●				NA	50, 69, 120, 122
DOD Lake (Salem)							▲				▲	●				NA	64, 70, 120, 122, 156
Franklinville Lake (Gloucester)													▲	●		NA	90, 116
Game Creek (Salem)							▲					●				NA	50, 72, 120, 123
Iona Lake (Gloucester)													▲	●		NA	92, 116
Lake Audrey (Cumberland)													●	▲		NA	92
Lebanon Lake (Burlington)													▲	●		NA	93, 116
Little Pine Lake (Burlington)													●	▲		NA	93
Maskell's Mill Pond (Cumberland)											●	▲	●	▲		NA	75, 94, 156
Menantico Sand Ponds (Cumberland)													▲	●		NA	94, 116
Mirror Lake (Burlington)													▲	●		NA	95, 116
Newton Lake (Camden)							▲					●				NA	75, 120, 123

TABLE 1. 2017 field sampling locations (continued)

Bureau of Freshwater Fisheries

2017 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)	Brook Trout Assess. (I)	Temperature Study (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Trout Prod. Reinventory(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)																	
Parvin Lake (Salem)													●	▲		NA	96
Pemberton Lake (Burlington)												●	●	▲		NA	76, 96, 127
Presidential Lake (Burlington)													▲	●		NA	97, 117
Prospertown Lake (Ocean)											▲	●	●	▲		NA	77, 97
Rainbow Lake (Salem)													●	▲		NA	97
Rising Sun Lake (Monmouth)												●				NA	77
Salem Canal (Salem)							▲					●				NA	79, 120, 156
Scotland Run	▲													●		✓	50, 117, 123, 140, A68
Sheppard's Mill Pond (Cumberland)											●	▲	●	▲		NA	79, 98
Silver Lake (Camden)							●									NA	120, 121
Sunset Lake (Cumberland)												●				NA	81, 127
Union Lake (Cumberland)												●	●	▲		NA	82, 99, 156
Wilson Lake (Gloucester)													●	▲		NA	100

TABLE 1. 2017 field sampling locations (continued)

Bureau of Freshwater Fisheries

2017 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)	Brook Trout Assess. (I)	Temperature Study (I)	Temp. / DO Monitor. (I)	Special Reg. Trout As. (I)	Trout Prod. Reinventory(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)																	
Batsto Lake (Mercer)													●	▲		NA	85
Cedar Lake (Atlantic)													▲	●		NA	86, 117
Citta Boy Scout Camp Pond (Ocean)													●	▲		NA	87
Corbin City Impoundments (Atlantic)													●	▲		NA	87
East Creek Lake (Cape May)													▲	●		NA	89, 117
Egg Harbor Township Reserve Pond (Atlantic)	●										▲	●	●	▲		NA	71, 89, 143
Hammonton Lake (Atlantic)													▲	●		NA	91, 117
Lake Lenape (Atlantic)												●				NA	74
Lake Nummy (Cape May)													▲	●		NA	92, 117
Lower Lake (Ocean)													●	▲		NA	93
Makepeace Lake (Atlantic)													▲	●		NA	94, 117
Pickle Factory Pond (aka West Creek Mill Pond) (Cape May)													▲	●		NA	96, 117
Stephens Lake (Atlantic)											▲	●	▲	●		NA	81, 98, 117
Tuckahoe Impoundments (Cape May)													▲	●		NA	98, 117
Tuckahoe Lake (Cape May)													▲	●		NA	99, 117
Turnmill Pond (Ocean)													▲	●		NA	99, 117

** 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

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.

Well-fed Brook Trout YOY from a tributary to the South Branch of the Raritan River south of Schooley's Mtn.

Trout Production streams are monitored periodically to assess the status of their naturally reproducing trout populations (every 5 years if regulated as a *Wild Trout Stream*, every 10 years if wild Brook Trout were historically documented, or generally once every 20 years). 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 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 2017, surveys were conducted on eight *Trout Production* streams at (or near) locations that had been surveyed in the past (see table below). Results of these surveys are summarized as follows:

- All 8 streams had wild Brook Trout when previously surveyed (11+ years ago) populations (3 of these also had wild Brown Trout).
- Only 5 of 8 streams surveyed in 2017 had wild trout – 2 had only Brook Trout, 1 had only Brown Trout, and 2 had both Brook and Brown Trout.
- 4 streams did not have wild Brook Trout when surveyed in 2017 compared to data from previous surveys – Lamington (Black) River (trib.)(Ironia), Mine Brook (trib.)(S. of Mine Mtn.), Drakes Brook (trib.)(Mt. Olive), and Raritan River S/B (trib.)(S. of Hoffmans).
- Brown Trout appear to have displaced Brook Trout in 1 stream – Raritan River S/B (trib.)(S. of Hoffmans) – where previously they co-occurred.
- Additional surveys will be conducted on the 4 streams where Brook Trout were not found to determine if this species has been extirpated.

Results of electrofishing surveys conducted in 2017 on eight streams in New Jersey, as part of a monitoring program for streams classified *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.

Stream (County) and location	2017 Survey date	2017 Reproducing trout species	2017 Results page #	Prior to 2017 Survey date	Prior to 2017 Reproducing trout species
Upper Delaware (North) & Wallkill Region *(Shimers Brook to Paulins Kill and Wallkill River watersheds)*					
Big Flat Brook (trib.) (W. of Lake Ashroe) (Sussex) Brook Road	8/1/17	Brook Brown	A6	7/26/06	Brook Brown
Raritan River Region (N/B watershed)					
Lamington (Black) River (trib.)(Ironia) (Sussex) Pleasant Hill Road	7/26/17	none	A42	9/15/95	Brook
Mine Brook (trib.)(E. of Mine Mtn.) (Somerset) Rippling Brook Way	7/27/17	Brook*	A47	9/15/95	Brook
Mine Brook (trib.)(S. of Mine Mtn.) (Somerset) Douglass Avenue	7/27/17	none	A48	9/15/95	Brook
Oakdale Creek (Morris) Mountain Road bridge	7/26/17	Brook	A49	1970	Brook
Raritan River Region (S/B watershed)					
Drakes Brook (trib.)(Mt. Olive) (Morris) Flanders-Bartley Road	7/26/17	none	A39	8/16/94	Brook
Raritan River S/B (trib.)(S. of Hoffmans) (Hunterdon) Raritan River Road	7/19/17	Brown	A52	7/18/96	Brook Brown
Raritan River S/B (trib.)(S. of Schooleys Mtn) (Morris) Columbia Trail	7/31/17	Brook Brown	A53	7/17/95	Brook Brown

Perched box culvert (limiting fish passage) and one of several stormwater outfall pipes (impacting water quality) on this Lamington River tributary in Ironia. Brook Trout were found in 1995, however it was fishless when surveyed in 2017.

Severe erosion on this Mine Brook tributary East of Mine Mountain. Only five Brook Trout were found in 2017, which included no young-of-the-year. When last surveyed in 1995, 36 Brook Trout were captured, 35 of which were YOY.

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 New Jersey.

Round Valley Reservoir- Lake Trout reared at the Hackettstown State Fish Hatchery were stocked in this deep reservoir (maximum depth 160 feet) from 1977 until 1995. The Lake Trout population in Round Valley Reservoir has been closely monitored by NJDFW to evaluate the status of this trophy trout fishery. 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, as mature Lake Trout seek out suitable spawning habitat along the boulders lining the reservoir's dams, thus stocking was discontinued.

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

Gill net surveys have been conducted annually in the fall, however the monitoring schedule was modified to switch from annual to biennial (every two years) monitoring (as indicated below). As a result, no surveys were conducted in 2017, however a Lake Inventory was conducted in 2016 and a Fisheries Management Plan was completed in early 2017. This report appears as an appendix in the Bureau's 2016 annual report entitled, "Investigations and Management of New Jersey's Freshwater Fisheries Resources."

The lake inventory was conducted using various sampling techniques. Smith-Root electrofishing boats were used to capture fish. A total of four electrofishing surveys were completed during the 2016 sampling period. A total of 80 locations were sampled by shoreline seining on July 6. Experimental gillnets were not utilized due to associated risk of mortality. Length and weight measurements were taken on all game and panfish species collected. Scales were removed from a sub-sample of all gamefish species and aged. Back-calculation was used to obtain information on the growth history of Largemouth Bass, Smallmouth Bass, Bluegill, Pumpkinseed and Yellow Perch. Species including Chain Pickerel and Black Crappie were not collected in enough abundance for age growth analysis. Water quality parameters were measured in the lake at various locations. Dissolved oxygen, conductivity, pH, and temperature were measured in the field using hand held Yellow Springs Instrument (YSI) meter (Professional Plus model). Three dissolved oxygen temperature profiles were created on July 27, August 29 and October 5, 2016.

The following recommendations were made Round Valley Reservoir Fisheries Management Plan:

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.

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 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.
   (Federal Grant F-48-R, Project I) (Crouse)

Heaviest Largemouth Bass (8.85 lbs.) captured by BFF staff during a 2016 (left) electrofishing Round Valley Reservoir. (right).

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.

In 2017, the Bureau of Freshwater Fisheries deployed four experimental gill nets in Merrill Creek Reservoir overnight, 11/8/17 – 11/9/17, to survey the juvenile Lake Trout population and supplement fisheries data collected the prior week by the owners' fisheries consultant. A total of 41 fish were captured during the survey, representing 9 species: Lake Trout (18), Smallmouth Bass (10), Rock Bass (3), Alewife (3), Yellow Perch (2), Rainbow Trout (2), Brown Bullhead (1), Yellow Bullhead (1), and Common Carp (1).

The number of Lake Trout captured during surveys conducted by the Bureau was consistent with the three previous years (same gear and effort); 18 (2016), 20 (2015), and 27 (2014). The Lake Trout captured in the 2017 survey ranged in size from 195 – 650 mm (7.7 – 25.5 in.) and the heaviest fish weighed 2.8 kg (6.2 lbs.). Four Lake Trout, ranging in size from 520 - 625 mm (20.5 – 24.6 in.) were fin clipped which indicated they were stocked (hatchery origin) rather than wild-born in the reservoir. The remaining 14 lakers captured were not fin-clipped and are considered to be the product of natural reproduction. (Federal Grant F-48-R, Project I) (Hamilton)

Jane Bullis, Merrill Creek Reservoir staff, holding an 8 lb. Lake Trout (28.5") captured in gill nets set by their consultant at the reservoir in 2017.

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. Landlocked Salmon, not native to New Jersey, were stocked in several 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, the DFW began stocking Landlocked Salmon into two north Jersey lakes, Lake Aeroflex and Lake Wawayanda (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 a portion of the salmon for 4-11 months and growing them to a much larger size (300-500 mm / 12-20 inches) before stocking. In 2014 Tilcon Lake (Morris) was added to the salmon stocking program. Stocking salmon at a larger size made a big difference in both angler interest and angling success.

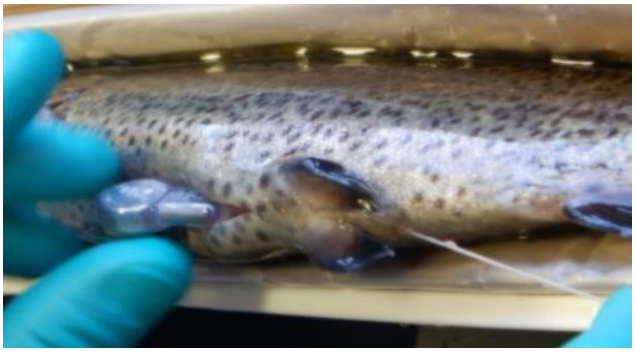
NJ angler with Landlocked Salmon (25 in. / 4 lbs.) from Lake Aeroflex.

Although no assessment activity for Landlocked Salmon occurred during 2017, a fishing regulation change was proposed that would establish harvest regulations for salmon in 2018 on Trophy Trout Lakes (Round Valley Reservoir and Merrill Creek Reservoir). The 15-inch minimum size and daily creel of 2 Landlocked Salmon (in combination with Brown and Rainbow Trout) would pave the way for Fish and Wildlife to expand the salmon stocking program into one or both reservoirs. Landlocked Salmon are closely related to Brown Trout and the stocking of salmon helps fill a void left when Fish and Wildlife discontinued stocking Brown Trout in 2014 (due to a disease at the Pequest Trout Hatchery). (Hunter and Angler Fund) (Hamilton)

Stocked Trout Movement Study in the Big Flat / Flat Brook Catch and Release Area

The Big Flat / Flat Brook is part of the Division's Spring and Fall Trout Stocking Programs. The river receives 34,000 trout each spring, the third highest allocation in a single waterbody besides the Musconetcong River and the South Branch of the Raritan River. The river is one of 14 stocked rivers closed to fishing until 5 pm on designated weekly stocking days following opening day. Although it is considered one of the state's most popular trout stocked waters, angler success in the Flat Brook is limited. Each year many anglers call the NJDFW to complain about the lack of fish found throughout the Flat Brook despite its generous allocation. Low numbers of trout in the Flat Brook was consistently documented in the numerous electrofishing surveys conducted by the Bureau over time. For more information on these surveys, see the *Trout Waters with Special Regulations* section of this report (pages 39 and Appendix A pages A2-A4 and A7). In 2014 *Catch and Release (C&R*) regulations were implemented on a 4.2-mile section of the Flat Brook, from Rt. 206 downstream to the Roy Bridge, to determine the influence of angler harvest on the low numbers of available trout and an effort to improve angler success. The Flat Brook is only one of two waters in the State designated as *Catch and Release Only* in the state.

To help answer these questions, NJDFW staff implemented a trout telemetry study in the *Catch and Release* area in the spring of 2017. Radio transmitters were surgically implanted into 40 Rainbow Trout from the Pequest Trout Hatchery (2 groups of 20). Half of the fish were stocked one week after opening day and the remaining were released about a month later. Scanning for tagged trout was performed daily for the first two weeks, then every other day for the remainder of the study. In addition, an un-manned station, operated 24 hours a day, 7 days a week, was deployed near the confluence with the Delaware River to record any tagged fish that were about to leave the Flat Brook system.



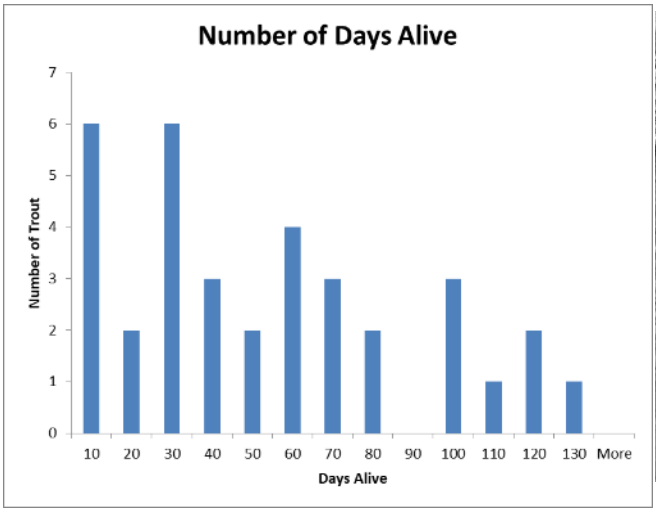
Radio transmitter surgically implanted into Rainbow Trout

When a transmitter could not be found near the last known location, staff searched the entire length of the Flat Brook, from Sawmill Pond to the confluence with the Delaware River, by scanning for the signal. The un-manned station was also checked each day to see if the fish entered the Delaware River. There were a few locations where the river could not be accessed by vehicle or by foot, staff used kayaks and floated these remote areas scanning for lost signals. If there still was no signal, staff would drive around the roads throughout the Flat Brook watershed scanning for lost signals, focusing on known Great Blue Heron rookeries.

The study lasted a total of 124 days. All 40 transmitters were either lost or found outside of a fish by September 11, 2017. This was far shorter than the 230 days of expected battery life. Seventy-six days were spent recording the location of at least one tagged fish. An average day lasted 5.5 hours and two staff personnel were assigned on most days. This resulted on over 800 man-hours spent on this project scanning and locating tagged trout or looking for

lost transmitters. Sixteen transmitters were never recovered by the end of the study and were assumed taken away from the stream beyond the distance of the receiving equipment. Other telemetry studies have shown reliability in the transmitters with a less than 1% failure rate. Therefore, all lost transmitters were believed to be a result of predation and not transmitter failure. These fish were most likely eaten by birds and flown away from the stream.

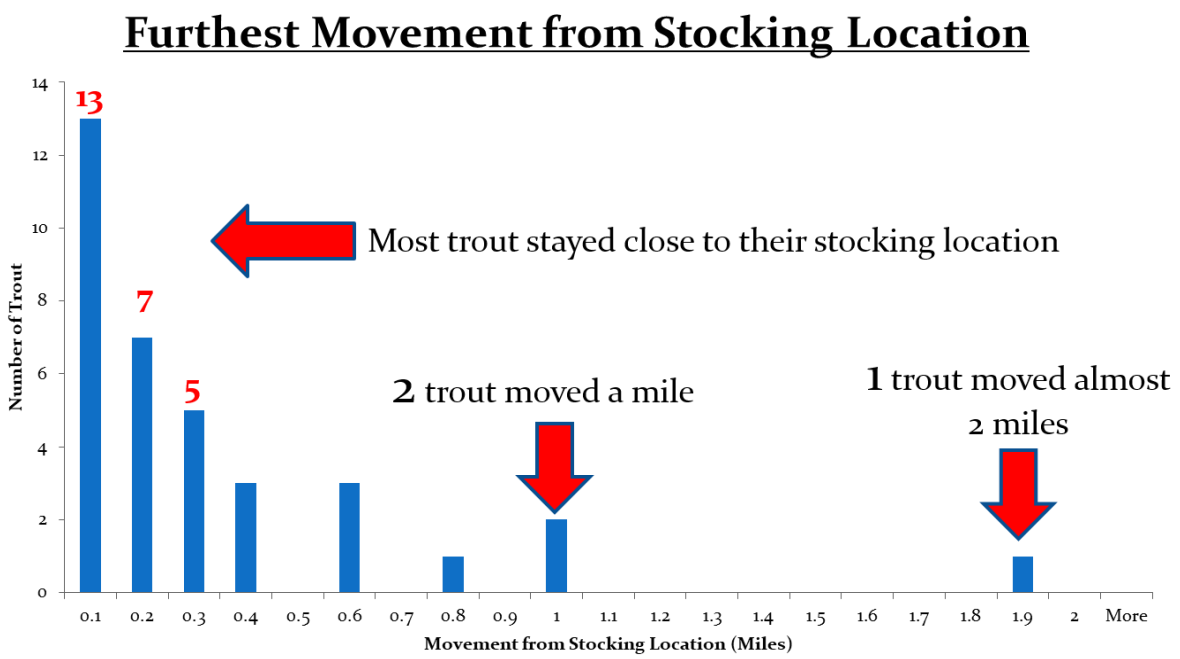
Twenty-four transmitters were found and recovered, some of which were found on land by the remains of trout, in scat piles, or found in mammal runs or den-like areas. Three transmitters were tracked to a Great Blue Heron rookery, but not recovered. Five transmitters were found after some time, at the exact location the trout was stocked. Since it could not be determined if these tags were "dropped" by the trout or the result of predation, these five transmitters were not used in any analysis, leaving a sample size of 35 of 40 transmitters. Overall, it was determined that 19 transmitters, including the 16 not recovered, were lost due to avian predation and 16 transmitters lost to mammalian predation, but other predation types were possible. Individual tagged trout were confirmed alive 3 days to 122 days after being stocked, with an average of 52 days (see figure below).



Number of days tagged trout survived.

Dropped radio transmitter found among fish scales and bones, an obvious sign of mammal predation.

Initial movement from each of the three stocking points was recorded. Nineteen trout initially moved downstream, 10 moved upstream, and 6 did not move from their stocking location, but were determined to still be alive at least a week after stocking. The number of days each trout spent at their stocking location before moving ranged from 0 to 56 days, with an average of 12 days before moving. There was no statistical difference between stocking locations, with regards to the number of days a fish stayed in its initial location before moving, number of days a fish remained alive, or the distance or direction a fish traveled. Furthest distance a tagged trout moved from its stocking location ranged from 0 to 1.85 miles, with an average of 0.28 miles. The total distance an individual trout moved ranged from 0 to 1.95 miles with an average of 0.45 miles (see figure below).



The data collected during this study confirmed that the trout are not leaving the Flat Brook watershed by moving downstream to the Delaware River. The un-manned recording station, positioned near the Delaware River confluence, did not record a single radio tagged trout. A second question this study was designed to answer was, "Are the stocked trout leaving the *Catch and Release* area, but still remaining in the Flat Brook System?" Ultimately the answer to this question is no. Thirty-four of the 35 radio tagged trout remained inside the *C&R* area. The third question was, "Are the fish remaining in the *C&R* area, but moving minor distances into areas that electrofishing equipment cannot sample effectively due to depth or flow?" Results from the study showed that some of the trout are moving into these deeper pools and high flow areas. What the study also showed is that not all of the radio tagged trout moved into these deeper pools. What is certain, is that all 40 radio tagged trout were lost before the end of the summer. It is fairly certain that 35 of the 40 radio tagged trout were lost due to some sort of predation, while the other 5 may have been lost due to predation or simply just dropped by the fish, possibly due to suture failures. This study showed that predation is definitely a key factor in limiting trout availability within the Flat Brook C&R area.

The stocked trout movement study answered many key questions on why the Flat Brook *C&R* area is not holding trout to expected levels, but it also more questions about movement and predation rates on stocked trout in the Flat Brook system. In an attempt to further understand what is happening to stocked trout in the Flat Brook system, the Division of Fish and Wildlife is partnering with the Montclair State University and its School of Conservation to continue and expand this study for a second year. A graduate student will follow and expand the design of this stocked trout movement study to gain further knowledge of stocked trout movements and predation rates in the Flat Brook system. The information garnered from the continuation of this study will be used to guide future management decisions about stocking rates on the Flat Brook and whether the *C&R* regulation is appropriate for this area. (Federal Grant F-48-R, Project I) (Shramko)

Stream Temperature Monitoring

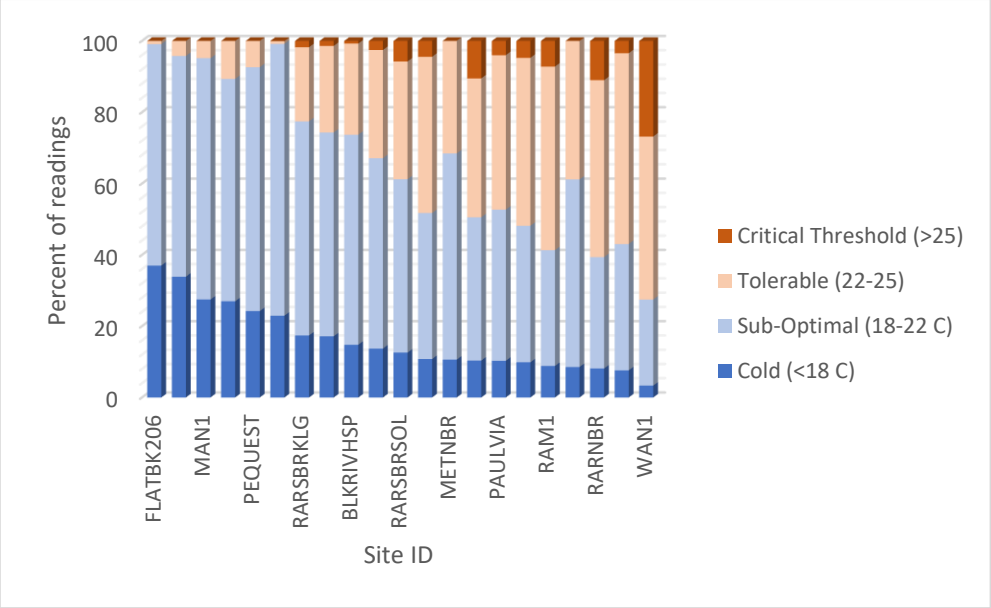
In 2013 the Bureau established an ambient stream temperature monitoring network on streams having trout fisheries that are recreationally important or of conservation interest. The temperature data is used to assess current temperature conditions, evaluate long term trends, determine if ambient water quality is consistent with NJDEP's Surface Water Quality Standards, and aid in the management of coldwater (trout) fisheries in these streams. In 2017 water temperature was monitored at 39 sites. Twenty-five of the sites were located on 17 recreationally important, major trout-stocked streams. (Federal Grant F-48-R, Project I) (Collenburg)

Trout Stocked Waters Stream Temperature Assessment

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

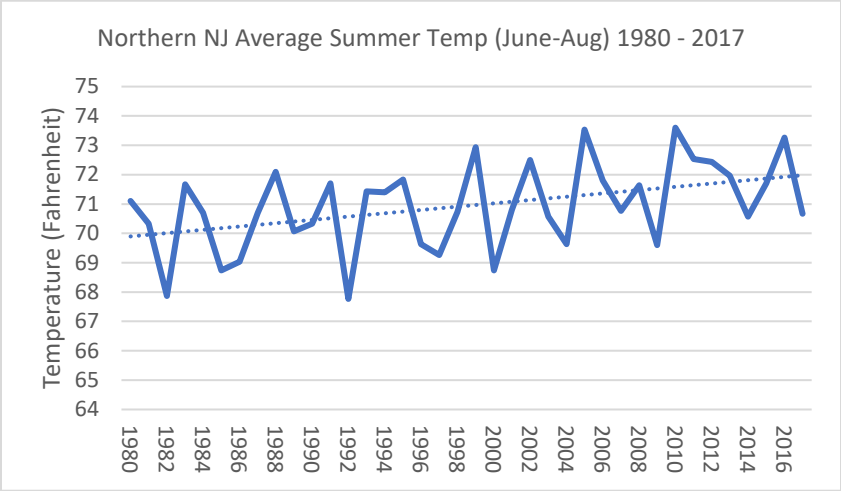
Sites on the Flat Brook/Big Flat Brook, the Claremont section of the South Branch of the Raritan River, Manasquan River, and Pequest River had the highest percentages of cold temperatures (below 18°C) throughout summer, while the sites on the Wanaque River and North Branch of the Raritan River had the highest percentage of readings exceeding 25°C (see figure below)

Proportion of 2017 summer stream temperatures that fit into each thermal regime category: cold, cool, and sub-optimal, and critical threshold.



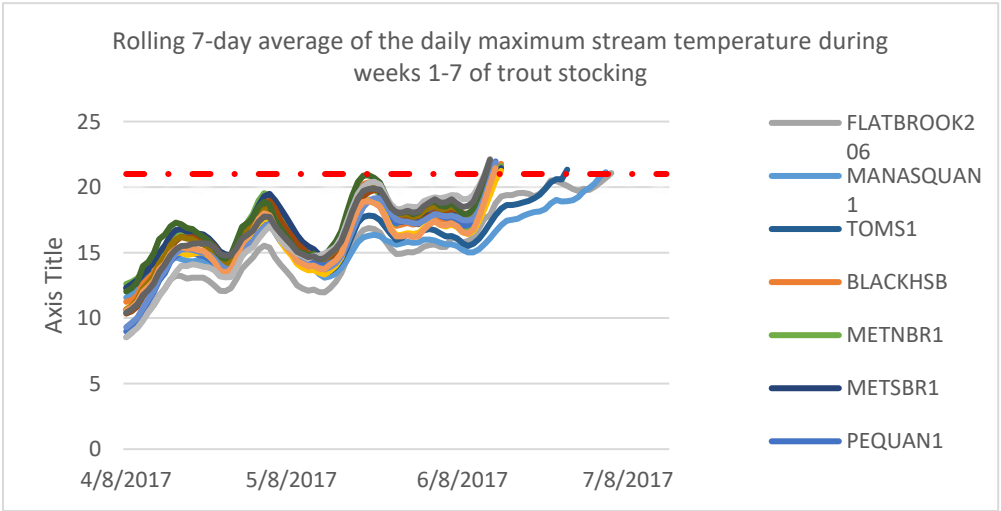
Summer temperatures are critical for trout survival and a continued warming trend may threaten the future of the NJDFW's trout stocking program and shorten the length of time trout can survive in any section. The summer of 2017 was comparatively cooler than the previous two years, which should have improved the trout holdover capacity in more marginal locations (see figure below).

Average summer (June 1 - August 31) air temperature in Northern New Jersey from 1980 to 2017.



Distribution of trout is strongly linked to optimal temperature thresholds for trout and by knowing the timing and for how long these thresholds are exceeded can help NJDFW make management decisions based on when and where trout should be stocked. This year on our major trout stocked streams, the rolling seven-day average of the daily maximum stream temperature was analyzed at each site from the opening day of trout season, through the first 7 weeks of trout season (in-season stocking period), to the eventual exceedance of each sites thermal threshold for trout (see figure below). The thermal threshold was defined as 21°C, as above this temperature trout become stressed, have other negative physiological effects, and may potentially die after chronic exposure.

The rolling seven-day average of the daily maximum stream temperature on important NJ trout stocked waters during the trout stocking period.



None of the streams exceeded the thermal threshold during the seven weeks of trout stocking (April 8th – May 26th), but the summer holdover capacity of many streams is limited as most

streams exceeded 21°C by mid-June. This is not always the case (yearly variation) and microhabitats exist within large systems providing areas of thermal refuge, but this is certainly a limitation to the density of trout in some of these streams. As temperatures continue to rise, adjustments can be made to stocking practices to help recreational anglers gain as much access to the popular sportfish. Some streams may warm more than others based upon their buffering capacities (defined often by geology, riparian zone, water usage, and other human impacts), and these streams should continue to be monitored to make those determinations. (Federal Grant F-48-R, Project I) (Collenburg)

Trout Production Stream Temperature Study

2015 marked the beginning of a study to collect year-round continuous stream temperature data on *Trout Production* streams and assess their naturally reproducing trout populations. Excessively cold fall and winter temperatures (approaching 0°C) can limit wild trout recruitment via late emergence and slow growth. Fourteen *Trout Production* streams were selected, based on location (i.e. watershed, proximity to our office) and on population structure (struggling or well-established trout populations) to investigate. Year-round stream temperature monitoring and electrofishing surveys were conducted over a three-year period. The 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 the Department to determine if any streams qualify for impairment designation as part of 303(d) listing, 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 to identify which streams are the best candidates for possible translocations of wild trout.

In the spring of 2015, fourteen *Trout Production* streams were selected and stream temperature monitoring devices were placed. The streams included: 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, Turkey Brook, Trout Brook (Hacklebarney), and Willhoughby Brook. Subsequently, backpack stream electrofishing surveys, following EPA bioassessment protocols were conducted during the summers of 2015-2017 to determine abundance and sizes of wild trout present.

Stream temperature background data (established in 2013) were compared to fisheries survey data resulted in the following observations:

- Streams experiencing the coldest temperatures during trout egg incubation 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)

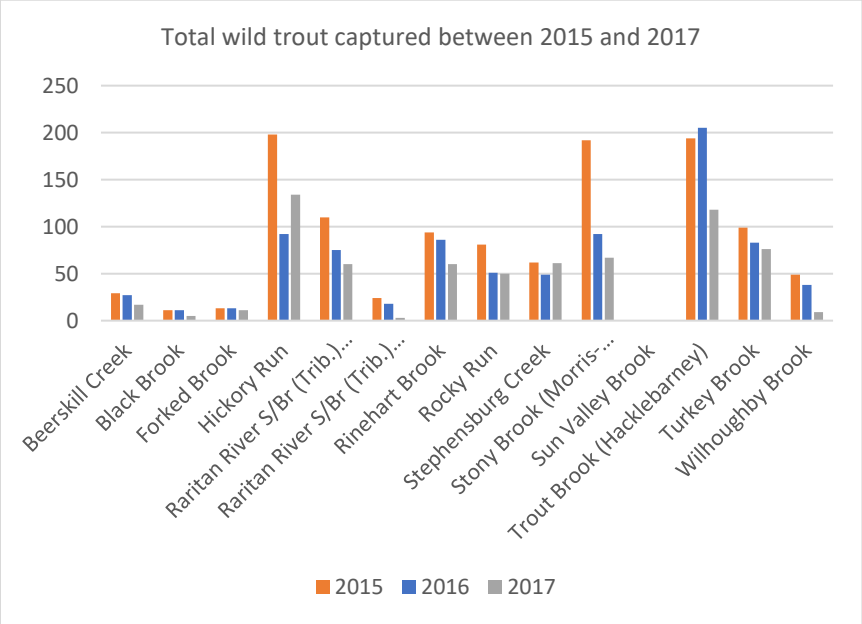
- Trout Production streams with higher Growing Degree Days (GDD) had better recruitment (streams with slightly warmer winter temperatures).

These observations identify the limiting factors of recruitment of trout in New Jersey and indicate metrics could be developed for use in the monitoring of stream temperatures and in

management of *Trout Production* streams. A full report will be provided after additional years of data are collected.

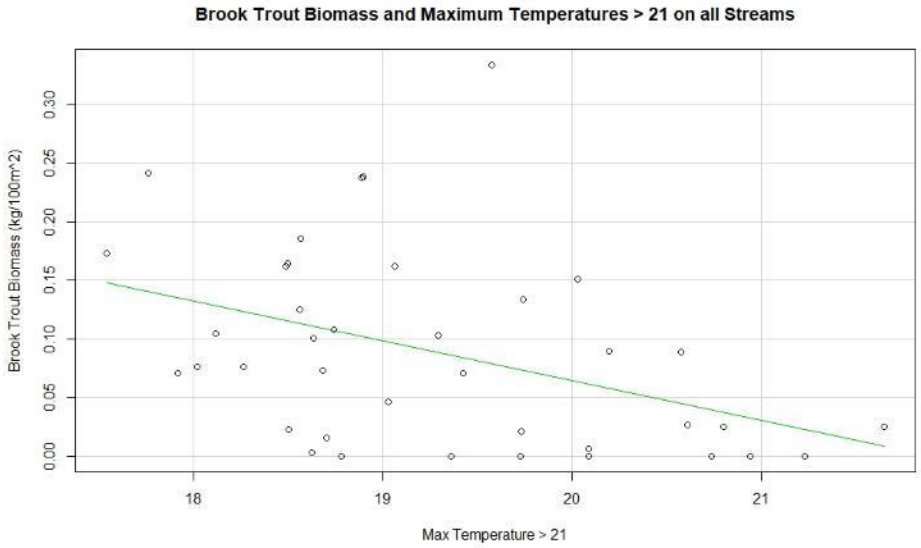
Summer air temperatures taken from Rutgers University state climatologist dataset (nClimDiv), established in 1895, depict 2017 as the sixth warmest year on record. This trend is expected to continue in the decades to come as greenhouse gas concentrations continue to increase. Warm temperatures tested the resilience of wild trout this summer. As 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 fall and winter of 2016 was marked by low flow and drought conditions. As less water is available to find suitable spawning habitat for trout, recruitment can be affected. Data collected on fourteen streams in 2015-2017 have shown that total population abundance has decreased in 10 of the 14 streams, 1 showed no change, and 2 others showed considerable variation (see figure below).

Total number of trout captured from stream temperature study sites between 2015 and 2017.



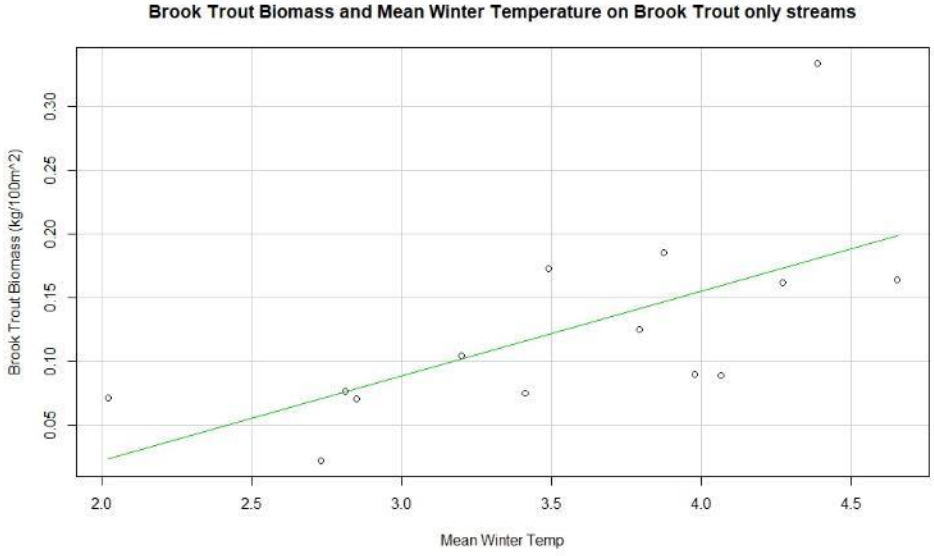
A cursory look into variables explaining this variation on wild trout streams exposed interesting correlations between existing Brook Trout biomass and stream temperature. Pearson correlation coefficients were determined between Brook Trout Biomass and a number of independent variables. A negative correlation of Brook Trout Biomass to increased stream temperatures (percent of all summer time stream temperatures exceeding 21°C) was determined when looking at all survey sites for the three-year period ($r = -0.3807$, $p = 0.016$; (see figure below). Although this correlation is not surprising to see, it may help in planning restoration efforts and affect other management implications.

Scatterplot of total Brook Trout Biomass and percent of all summer time stream temperatures exceeding 21℃. A significant (p=0.016), negative correlation (r=-0.3807) between the two variables was found.



Pearson correlation coefficients were determined between Brook Trout Biomass on streams containing only Brook Trout and mean winter stream temperature. A significant (p=0.012), positive correlation (r=0.6468) was determined between these variables (see figure below). Warmer temperatures in the winter are critical for development of eggs and the life cycle of trout to ensure proper development and emergence times. As stream temperatures decline in the winter time, so does the activity and metabolism of trout. These are harsh conditions and influence the growth and survivability of wild trout populations. These data support the necessity to collect year-round stream temperature data to properly guide management Brook Trout sampling and management activities. (Federal Grant F-48-R, Project I) (Collenburg)

Scatterplot of total Brook Trout Biomass on streams containing only Brook Trout and mean winter stream temperature. A significant (p=0.012), positive correlation (r=0.6468) between the two variables was found.



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.

Beginning in the spring of 2015 and continued through 2017, 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 at the Pequest Hatchery for at least the next couple of years.

There are no changes to the "Trout Formula" methodology used to determine 2017 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.

Dropped / Suspended for 2017:
None – No suspensions or dropped waterbodies to the program for 2017

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 adding or dropping of stocking locations, general stream mile database corrections occur due to continued communication with the Lands Management Staff and the use of GIS mapping to assess stream mileage of trout stocked sections.

Hakihohake Creek (Hunterdon) - The Hakihohake Creek trout stocking stream mileage was reduced from 4.3 miles to 3.3 miles, due to the loss of a four stocking locations and recalculation of the total stream mileage based upon the remaining stocking locations. This one mile reduction resulted in a decrease of 420 fish in 2017.

Pophandusing Creek (Warren) - The Pophandusing Creek trout stocking stream mileage was reduced from 1.5 miles to 1.3 miles, due to the loss of a stocking location and recalculation

of the total stream mileage based upon the remaining stocking locations. This 0.2 mile reduction resulted in a decrease of 90 fish in 2017.

Paulins Kill (Warren and Sussex) - The Paulins Kill stocking run was updated for 2017. Over the years, the Pequest Hatchery has been producing slightly larger fish than when the Paulins Kill run was designed. In some cases, stocking loads were beginning to get overcrowded due to this increase in fish size. On the Paulins Kill, stocking crews were worried that they would lose fish due to the overcrowding if they were to have any sort of problem or delay and a re-design of the run was necessary. This re-design found that the Paulins Kill culminated in a reduction of stream mileage on the river. No stocking points were lost, but through the use of new and more accurate technology (GIS mapping) it was determined that the Paulins Kill stream mileage is actually less than what the allocation program was using. This correction in stream mileage resulted in a 5% or 1,750 fish reduction in 2017. The Paulins Kill received about 30,500 total fish in 2017.

Other Trout Allocation Changes:
Culver's Creek (Sussex) - The trout allocation formula uses multiple waterbody attributes to determine the trout allocation and stocking schedule. One factor it uses for streams is known as the "recreational use potential" or RUP. The RUP is made up of 3 smaller categories; angler interest, parking availability, and amount of public land on the stream. The RUP for Culver's Creek was decreased from a value of 3 to a value of 2 after it was determined, through conversations with the stocking crews and the conservation officer assigned to that area, that angler interest on this stream should be switched from moderate to low. This change affects the number of times this stream is stocked throughout the spring season and also the total number of trout it receives as determined by the RUP value. This change resulted in 450 less trout stocked for the spring season and from 5 in-season stockings to 2 in-season stockings. The pre-season stocking was not affected.

A summary of trout stocked from NJDFW's Pequest Trout Hatchery during 2017, by season and species, is found in the table below. (Hunter and Angler Fund) (Shramko)

Spring 2017 Trout Stocking Summary				
Species	Type	Avg. Length	Lbs.	# Fish
Rainbow Trout	Production	11.2"	287,627	581,550
	Broodstock	15.7" & 21.5"	18,531	7,380
		Totals	**306,158**	**588,930**
Fall 2017 Trout Stocking Summary				
Species	Type	Avg. Length	Lbs.	# Fish
Rainbow Trout	Production	14.6"	28,168	20,540
	Broodstock	19.8"	2,965	770
		Totals	**31,133**	**21,310**
Winter 2017 Trout Stocked Lakes Program Summary				
Species	Type	Avg. Length	Lbs.	# Fish
Rainbow Trout	Production	14.6"	7,192	5,040
		Totals	**7,192**	**5,040**

Trout Waters with Special Regulations

Catch & Release Trout Regulation Assessment

Ken Lockwood Gorge

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 are routinely conducted on these streams to provide data for evaluating the effect of the regulation change on these trout fisheries.

South Branch of the Raritan River- Recognized 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* (*C&R*) (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 stocked privately. 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* 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. No surveys were conducted in the Ken Lockwood Gorge in 2017. (Federal Grant F-48-R, Project I) (Crouse)

Flat Brook/Big Flat Brook- Four sites per year on the Flat Brook/Big Flat Brook *Catch and Release (C&R)* section were electrofished annually since 2012 (see Appendix A pages A2-A4 and A7). For the purpose of this report, this section will be referred to as the Flat Brook C&R area. 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 2015, 2016, and 2017 (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* 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* area outright, or are subject to high predation rates.

Electrofishing locations along the Big Flat Brook and Flat Brook from 2012 – 2017.

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	3				2		1
2013	17.1°C	8	2			1		5
2014	17.6°C	3	3					
Big Flat (Old Police Barracks) (page A2)								
2015	18.6°C	6	3					3
2016	19.3°C	3	2					1**
2017	18.2°C	5						5
Big Flat (Station 2 – upstream from Blewitt Tract)								
2012	20.8°C	3	3					
2013	18.6°C	7	5			1		1
2014	17.6°C	8	5		3			
Big Flat (between Rt. 560 & "Warner's Hole") (page A3)								
2015	17.1°C	10						10
2016	20.4°C	8						8
2017	18.2°C	19						19
Big Flat (Station 1 – upstream from Blewitt Tract) (page A4)								
2012	19.1°C	8	7					1
2013		0						
2014	17.5°C	2			2			
2015	19.3°C	3	1					2
2016	19.5°C	2	1					1
2017	16.9°C	0						
Flat Brook (above Roy Bridge - just downstream of rifle range pool)*								
2012	18.8°C	6	1		1	2		2
2013	16.3°C	4	1		1			2
2014	17.3°C	2			1			1
Flat Brook (Three Bridges WMA) (page A7)								
2015	18.7°C	48	1					47
2016	18.6°C	8	1					7***
2017	16.6°C	44			2			42***

* 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 in 2016 & 2017 could not be sampled. This deeper location was able to be sampled in 2015 and accounts for the difference in trout captured from 2015 with 2016. In 2017 an additional 35-50 stocked rainbow trout were seen for a total of 77 to 92 total stocked Rainbow Trout.

To help biologists understand if and when trout may be migrating out of the areas conducive to sampling, six additional surveys were conducted in 2016 and one in 2017. These seven additional surveys were very different than the typical standardized 150-m surveys conducted previously. To sample a larger area, these surveys covered a total of 1,200 nearly contiguous meters, with only a few pools throughout the 1,200 m 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 1,200-m survey section encompassed 3 of the 150-m standardize surveys previously sampled. These 150-m surveys conducted in July / August each year from 2012 through 2015 were very consistent and found on average 11 stocked trout per 100 m. The consistency of this data suggests that 11 trout/100 m is an average summertime density for these locations (see table below).

The C*atch and Release* regulation area on the Big Flat Brook / Flat Brook receives a preseason stocking and seven successive weekly stockings during the spring trout program. The 1,200 m survey section of the *C&R* regulation area receives about 2,500 trout per season (approximately 312 trout/week). The 1,200 m survey conducted in 2017 occurred on 6/15/17, 20 days after the last spring stocking. The following table shows a breakdown of the data collected of the six 1,200 m surveys from 2016, the one 1,200 m survey from 2017, and other relevant survey data collected in the area. Additional information is compiled in Appendix A (pages A2-A4 and A7). The large increase in trout/100 m found during the 2017 survey is likely due to improved stream conditions in 2017 over 2016. Spring time stream flows in 2017 were above average and remained that way into the early summer months. The higher than average stream flows aid in water temperatures staying cooler longer and gives trout more and deeper water to evade capture from predators. If all of the trout remained in this study area, the area would be holding about 208 trout/100 m at the time of this survey. The survey conducted in 2017 on this section found 36 trout/100 m, far less than the possible 208 trout/100 m. A single pass backpack electrofishing survey is not anticipated to capture all of the fish in an area, nor are all stocked trout expected to remain in the *C&R* section since stocking began in the middle of March, but the 36 trout/100 m survey results are far lower than what should be expected. In fact, the 36 trout /100 m are closer to what you should expect to find if the area was stocked 1.5 times (312 trout per stocking) instead of 8 times. It is possible that the trout still remain within the *Catch and Release* area in deep pools outside of the 1,200-m study area, but it is also a possibility that the trout are swimming even greater distances and leaving the *C&R* area outright leaving the Flat Brook system entirely. It is also possible that these trout are not migrating out from where they were stocked, but being lost to bird or mammal predation. Finally, it is also possible (but less likely) that the backpack electrofishing equipment is less efficient in the Big Flat Brook system, due to low conductivity and deep pools.

To answer these questions, Division staff implemented stocked trout movement study in the C*atch and Release* area on the Flat Brook in the spring of 2017. A summary of this study can be found in the section titled, Stocked Trout Movement Study in the Flat Brook C&R Area: Preliminary Findings (page 29) and in Appendix G. (Federal Grant F-48-R, Project I) (Shramko)

Big Flat Brook Catch & Release Regulation Area Surveys 2012 – 2017.

	Survey loc 1 (fish/100m)	End of loc 1 to Rt 560 (fish/100m)	Rt 560 to beginning survey loc 2	Survey loc 2 (fish/100m)	Old Police Barracks loc (fish/100m)	Total area (fish/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**
6/15/17 20 days after last stocking	45	20	41	22	23	**36**

Seasonal Trout Conservation Area Assessment

Pequannock River - The trout stocked section of the Pequannock River is a popular location to fish and is known to hold populations of wild Brown Trout. Much work has been done to improve water temperatures downstream of the reservoirs on the Pequannock River and a resurgence of the wild trout populations have been documented. The current extent includes the upper most boundary of the Route 23 (Paterson-Hamburg Turnpike) bridge in Kinnelon downstream to the Paterson-Hamburg Turnpike bridge in Pompton Lakes. This section includes the seasonal Trout Conservation Area downstream from Appelt Park. It was suggested by several anglers to regulate this section of the Pequannock River, or part of it, under the new *Wild Trout Stream* regulations to provide more protection to the wild Brown Trout population that is known to occupy this section. Currently, there is a *Wild Brown Trout Enhancement* section above Charlottesburg Reservoir.

Four surveys were conducted in the trout stocked section to assess the wild population of Brown Trout (see Appendix A pages A23-A26). A total of 53 wild Brown Trout, including 12 young-of-the-year (YOY) and 24 stocked Rainbow Trout, were captured during the four surveys. The abundance of wild Brown Trout is low but there is heavy fishing pressure in this section especially at Appelt Park where the lowest number of trout were captured from all surveys (also the most heavily fished section). An angler creel survey was conducted in this section on the opening day of trout season in 2017 and found that anglers were harvesting wild Brown Trout, as well as stocked Rainbow Trout. Some anglers commented that they practiced catch and release for the wild Brown Trout, but other anglers were indiscriminate and would keep a wild Brown Trout as readily as a stocked Rainbow Trout. More angler and electrofishing surveys may be necessary to collect enough data to determine if a change is warranted. (Federal Grant F-48-R, Project I) (Collenburg)

Wild Trout Stream Regulation Assessment and Development

NJDFW has documented reproducing trout populations in nearly 200 streams (or stream segments) statewide. Most of these streams are tributaries to larger, trout-stocked streams in northern New Jersey. The primary means of regulating fishing for wild Brook, Brown, and Rainbow Trout has been through the *Wild Trout Stream* (*WTS*) regulation, which is more stringent (restrictions on fishing gear and harvest) compared to the statewide general regulation for trout. Designated *WTS's* are not stocked with hatchery trout, but rather rely upon naturally reproducing wild trout populations to provide a recreational trout fishery. This regulation, and the number of designated streams (29 initially, 36 in 2017), have changed little since it was adopted in 1990.

In 2014 the Bureau initiated a multi-year project to assess the *Wild Trout Stream* regulation and determine if the recreational fishing opportunities afforded by this regulation were appropriate and adequately addressed the conservation needs of wild trout. Ninety-four electrofishing surveys were conducted on 57 streams in 2014 and 2015 to obtain current fish population data. In addition, an online survey for anglers who fish for wild trout in New Jersey was conducted and scientific literature pertaining to hooking mortality was reviewed.

This information was compiled, analyzed, and used to develop a suite of fishing regulations that not only highlight the variety of recreational fishing opportunities for wild trout (in streams), but also protect them. Recommended changes were submitted to the Fish and Game Council for their review in February 2017 and unveiled at the annual public trout meeting held later that month. Staff also attended meetings of ten Trout Unlimited chapters during the spring to present the potential changes and further solicit angler feedback. Following a formal sixty-day public comment period, the proposed amendments were approved by the Fish and Game Council and became effective February 10, 2018.

The centerpiece of these new wild trout fishing regulations is the conservation of wild Brook Trout, the only trout species native to New Jersey. The number of wild Brook Trout populations has significantly declined in our state due to impacts from urbanization, the building of dams and roadways, and the stocking of non-native trout species. Due to growing concern over the plight of Brook Trout, a ***Brook Trout Conservation Zone*** has been established for northwestern New Jersey, where wild Brook Trout are most abundant. Any Brook Trout caught within this zone must be immediately released unharmed. NJDFW no longer stocks Brook Trout (and is currently not stocking Brown Trout). The private stocking of Brook Trout in the Zone will no longer be permitted, because this species can no longer be harvested legally and it prevents interbreeding with wild Brook Trout. Preventing interbreeding helps preserve wild Brook Trout gene pools, preserving their genetic diversity and potential to evolve in response to environmental change.

BROOK TROUT CONSERVATION ZONE
All Brook Trout caught within the zone must be immediately released

The ***Wild Trout Stream*** regulation has been given a facelift. Three designations (described below) will highlight the variety of wild trout fishing opportunities available and better align individual streams with management strategies specific to the wild trout species present. Many streams previously designated as a *Wild Trout Stream* were retained, but some were dropped and others added. All three designations continue to allow anglers to use fly and spin fishing gear, artificial flies and lures only (no bait or bait scent), and harvest season that commences in April (coinciding with the Opening Day of the trout season) and continues through September 15. A new requirement limits anglers to using artificials having a maximum of three hook points, all of which must be barbless. Previously nine, barbed hook points were allowed.

- ***Native Brook Trout Streams*** – 11 streams almost exclusively inhabited by native Brook Trout or anticipated to be so as part of Fish and Wildlife's Brook Trout Restoration efforts, were singled out for this special regulation. Intended to protect and preserve wild Brook Trout populations, anglers are encouraged to harvest, if present, Brown and Rainbow Trout (two per day, species combined, no minimum size) to prevent these non-native species from gaining a foothold (or the upper hand) and displacing Brook Trout. All Brook Trout caught must be immediately released unharmed.
- ***Wild Trout Streams*** – 17 streams having abundant wild Brown Trout and/or Rainbow Trout, that also have (or are connected to streams having) wild Brook Trout have been selected for this designation. The harvest regulations mimic the original *WTS* regulation – a two-trout daily limit (species combined) and 9-inch minimum size, except Brook Trout may not be harvested from streams located within the *Brook Trout Conservation Zone*.
- ***Wild Brown Trout Enhancement Streams*** – 13 streams with an abundance of wild Brown Trout provide excellent angling opportunities for this species, which can reach impressive sizes in some of these streams. The absence of wild Brook Trout in these streams (or nearby) eliminates the concern of species competition. A higher minimum harvestable size (12-inch) applies to Brown Trout and 9 inches for Rainbow Trout, if present, and catch and release on Brook Trout for streams located within the *Brook Trout Conservation Zone*.

In addition to the sweeping regulatory changes described above, a new regulation was implemented in 2018 on streams having abundant wild Brown Trout that Fish and Wildlife also stocks with Rainbow Trout. The ***Trout Stocked Waters – Wild Brown Trout Managed*** regulation is intended to enhance the existing wild Brown Trout fishery in five streams while minimizing impacts to those anglers who primarily fish these waters for stocked trout. Unlike the regulation pertaining to designated *Wild Trout Streams*, anglers fishing these waters will continue to be allowed to use bait and up to nine hook points. However, because wild Brown Trout may reach impressive size in these five streams, a 12-inch minimum size applies for this species (compared to 9-inch limit for Brook and Rainbow Trout) and the daily creel of trout may include no more than two Brown Trout. The conservation measure for Brook Trout (*Catch and Release*) applies to those streams within the *Brook Trout Conservation Zone.*

Changes to the *Wild Trout Stream* regulation and the creation of the *Brook Trout Conservation Zone* are fully explained in an article, "Giving Wild Trout a Helping Hand," that appears in the 2018 New Jersey Freshwater Fishing Digest (see to right). This NJDFW publication, readily available online and wherever NJ fishing and hunting licenses are sold, contains not only freshwater fishing seasons, dates and limits, but informative articles and other details that anglers heavily rely upon. (Federal Grant F-48-R, Project I) (Collenburg, Hamilton, and Shramko)

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 may 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 refined the subwatershed status map to a fine-scale catchment level and NJDFW now 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 2017 a total of 114 surveys were conducted on 54 streams, under a variety of jobs and/or funding sources, which provided data to document the presence of wild trout species. The results from all 114 surveys are summarized below and in the table that follows.

- 36 of 54 streams surveyed had wild Brook and/or Brown Trout (no wild Rainbow Trout).
- 16 streams had only wild Brook Trout.
- 11 streams had only wild Brown Trout.
- 9 streams had both wild Brook and Brown Trout (Tiger Trout, a hybrid of Brook and Brown Trout, were also present in 2 of these streams).

- 7 surveys conducted at locations where previous surveys documented wild Brook Trout, did not yield wild Brook Trout – Black Brook, Cresskill Brook, Drakes Brook (trib.)(Mt. Olive), Lamington (Black) River (trib.)(Ironia), Mine Brook (trib.)(S. of Mine Mtn), Raritan River S/Br (trib.)(S. of Hoffmans), and Sun Valley Brook. Further sampling was recommended to determine if Brook Trout have been extirpated from these streams.
- The Raritan River S/Br was surveyed upstream of the YMCA dam in Mount Olive Twp. to determine if reproducing Brown Trout have established. Previously exclusive to wild Brook Trout, staff found limited numbers of wild Brown Trout (no YOY) following the notching of the dam in 2008. The Brown Trout traversed the notch under high flow conditions. The dam was later rebuilt to its original height; therefore, the notch was no longer present. Fortunate for wild Brook Trout in this watershed, no Brown Trout were found during a 2015 survey or during the recent survey in 2017. Twenty-eight wild Brook Trout were found (Appendix page A50).

Of the 114 surveys, 14 were specifically conducted to investigate Brook Trout status in relation to (1) extirpation concerns based upon recent survey data, (2) positive/negative impacts of barriers such as onstream dams on Brook Trout distribution (downstream water quality/thermal impacts, preventing recolonization upstream of Brook Trout and/or non-native salmonids), or (3) Brook Trout status in catchments lacking survey data that are upstream of catchments where wild Brook, Brown or Rainbow Trout have been documented. The results of these surveys are summarized as follows:

- 3 surveys to determine if Brook Trout have been extirpated from Cresskill Brook, the only stream in the Hackensack watershed known to have wild Brook Trout. Surveys conducted after a 2011 restoration project (dam removal funded through the EBTJV) failed to document Brook Trout. Three surveys conducted in 2017 also did not yield wild Brook Trout. Additional surveys are planned for 2018 to confirm if this species has been extirpated from this stream.
- 3 previously unsampled Pequannock River tributaries were surveyed. Wild Brown Trout occur throughout the Pequannock watershed, but it was hoped that these small tributaries would hold Brook Trout. Wild Brown Trout were found in one of these tributaries in 2017.
- 5 surveys to assess the impact of barriers (dams) on the presence/absence of Brook Trout were conducted on 4 streams in the Big Flat Brook watershed.
    - Brook Trout were discovered in a previously unsampled Big Flat Brook tributary upstream of Lake Wapalanne (thermal impacts downstream of dam suspected).
    - 2 surveys in a Tuttles Corner Brook tributary documented Brook Trout downstream, but not upstream of a dam (dam may preclude upstream colonization/recolonization).
    - Stony Brook upstream of Stony Lake and Little Flat Brook upstream of Hainesville Pond did not yield Brook Trout (low flow and/or dams may preclude Brook Trout downstream from colonizing/recolonizing).
- 1 survey in a Little Flat Brook tributary not previously surveyed – Brook Trout documented.
- 2 surveys to better assess wild Brook Trout distribution – Teetertown Brook (wild Brook Trout only documented) and Electric Brook (wild Brown Trout only documented).

Presence/absence of wild trout species in 114 stream surveys conducted on 54 streams during 2017 in New Jersey, listed by major watershed. BKT= Brook Trout; BNT=Brown Trout; RBT=Rainbow Trout; streams specifically surveyed to assess wild Brook Trout are boldfaced; streams where the standard sampling protocol was not followed are noted by "+"; *WTS* indicates the stream was regulated as a *Wild Trout Stream* in 2017. A trout species was considered wild when young-of-the-year fish were present ("X"); boldfaced "**X**" denotes a new finding of a wild trout species; "*****" denotes only wild trout older than young-of-the-year were present (fin wear used to determine if these fish were wild or hatchery origin).

Stream	County	Location	Wild trout species			Results page #
			BKT	BNT	RBT	
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				A2
Big Flat Brook	Sussex	Downstream of Rt. 560				A3
Big Flat Brook	Sussex	Upstream Blewett Tract (St #1)				A4
Big Flat Brook (trib.) (Lake Wapalanne)	Sussex	Near School of Conservation	**X**			A5
Big Flat Brook (trib.) (W. of Lake Ashroe)	Sussex	Brook Road	X	X		A6
Flat Brook	Sussex	Three Bridges (Flatbrook WMA)			**X**	A7

(continued)

			Wild trout species			Results
Stream	**County**	**Location**	**BKT**	**BNT**	**RBT**	**page #**
Forked Brook	Sussex	Grau Road	X*			A8
Little Flat Brook	Sussex	Deckertown Turnpike				A9
Little Flat Brook (trib.) (Flat Brook Office)	Sussex	Behind Flatbrook office	**X**			A10
Sparta Glen Brook	Sussex	Upstream of Sparta Glen Park	**X***			A11
Sparta Glen Brook	Sussex	Rt. 620 Sparta Glen Park	X*			A12
Stony Brook	Sussex	Upstream of Stony Lk				A13
Tuttles Corner Brook (trib.) (Camp Olympia)	Sussex	Flatbrook Rd, upstream of small pond				A14
Tuttles Corner Brook (trib.) (Camp Olympia)	Sussex	Flatbrook Rd, below small pond	**X***			A15
Upper Delaware (South) Region (Delawanna Creek to Lockatong Creek watersheds)						
Musconetcong River +	Warren	Off Valley Station Rd (upper)				A16
Musconetcong River +	Warren	Off Valley Station Rd (lower)		**X***		A17
Pequest River	Warren	Alphano Road (upper)				A18
Pequest River	Warren	Alphano Road (upper)				A19
Stephensburg Brook (*WTS*)	Morris	Stephensburg Road	X	X		A20
West Portal Creek	Hunterdon	Asbury-West Portal Road	X	X		A21, 60
West Portal Creek	Hunterdon	Asbury-West Portal Road		X		A22, 60
West Portal Creek +	Hunterdon	8 surveys, various locations	X (and Tiger	X Trout)		60
Upper Passaic Region *(Pompton, Pequannock, Wanaque, Ramapo, Upper Passaic, Whippany, & Rockaway River watersheds)*						
Pequannock River	Morris	Hamburg Turnpike, Waterfall Village Apt		X		A23
Pequannock River	Morris	Hamburg Turnpike - Appelt		X		A24
Pequannock River	Morris	Hamburg Turnpike - STCA		X		A25
Pequannock River	Morris	Hamburg Turnpike - upstream		X		A26
Pequannock River (trib.) (Irish Brook)	Passaic	Reeve Avenue				A27
Pequannock River (trib.) (Van Dam)	Passaic	Brandt Lane		**X**		A28
Pequannock River (trib.) (W. of Federal Hill)	Passaic	Hamburg Turnpike				A29
Lower Passaic & Upper Atlantic Region *(Lower Passaic, Saddle, Hackensack, Pascack, & Elizabeth River watersheds)*						
Bear Brook	Bergen	Pine Drive		X*		A30
Cresskill Brook	Bergen	Church Street				A31
Cresskill Brook	Bergen	Duck Pond Road, upstream				A32
Cresskill Brook	Bergen	Deer Hill Road				A33
Passaic River +	Morris	Florham Park				66
Passaic River +	Essex	Fairfield				66
Passaic River +	Passaic	Hawthorne				66
Peach Orchard Brook	Union	Warinanco Park Roadway				A34
St. Gabriel Brook	Bergen	E. Saddle River Road				A35
Raritan Region (Raritan River watershed)						
Beaver Brook	Hunterdon	Old Allerton Road		X		A36
Beaver Brook	Hunterdon	Upstream of Leigh Street		X*		A37
Black Brook (*WTS*)	Hunterdon	Van Syckles Road		X*		A38

(continued)

			Wild trout species			Results
Stream	**County**	**Location**	**BKT**	**BNT**	**RBT**	**page #**
Drakes Brook (trib.) (Mt. Olive)	Morris	Flanders-Bartley Road				A39
Electric Brook	Morris	Fairview Ave		X		A40
Hickory Run (WTS)	Hunterdon	Hickory Run Road	X			A41
Lamington (Black) River (trib.) (Ironia)	Hunterdon	Pleasant Hill Road				A42
Millstone River+ (2 surveys)	Somerset	Griggstown Causeway				103, A43, A44
Millstone River+ (2 surveys)	Somerset	Blackwells Mills Road bridge				103, A45, A46
Millstone River+	Somerset	Above Weston Causeway Dam				103
Millstone River+	Somerset	Below Weston Causeway Dam				103
Millstone River+	Somerset	Near Raritan confluence				103
Mine Brook (trib.) (E. of Mine Mtn)	Somerset	Rippling Brook Way	X*			A47
Mine Brook (trib.) (S. of Mine Mtn) (*TP*)	Somerset	Rippling Brook Way				A48
Oakdale Creek	Morris	Rippling Brook Way	X			A49
Raritan River S/B +	Morris	River Road	X			A50
Raritan River S/B (trib.) (Drakestown)	Morris	Joy Drive	X			A51
Raritan River S/B (trib.) (S. of Hoffmans) +	Hunterdon	Raritan River Road		X		A52
Raritan River S/B (trib.) (S. of Schooleys Mtn)	Morris	Columbia Trail n. of Middle Valley Road	X	X		A53
Raritan River S/B (trib.) (SW of Budd Lake)	Morris	Rt. 46	X			A54
Rinehart Brook (*WTS*)	Morris	Hacklebarney State Park, upstream of main trail	X	X		52, A55, A56
Rinehart Brook + (*WTS*)	Morris	27 surveys, various locations	X (and Tiger	X Trout)		52
Rinehart Brook (trib.) Fairmount) +	Morris	Hacklebarney State Park	X			52
Rockaway Creek, S/Br.	Hunterdon	Kullman Industries Campus Dr.		X		A57
Rockaway Creek, S/Br. (trib.) (Lebanon Boro)	Hunterdon	Main Street		X		A58
Rocky Run (*WTS*)	Hunterdon	Rocky Run Road	X			A59
Spruce Run Creek	Hunterdon	Main Street, Glen Gardner	X	X		A60
Spruce Run Creek	Hunterdon	Rt. 31 near Rocky Run Road	X	X		A61
Stony Brook (WTS)	Morris	Columbia Trail Walking Bridge	X	X		A62
Sun Valley Brook	Morris	Wolfe Road				A63
Teetertown Brook (*WTS*)	Hunterdon	Hollow Brook Road	X			A64
Trout Brook (*WTS*)	Morris	Hacklebarney State Park	X			A65
Turkey Brook (*WTS*)	Morris	Stephens Mill Road	X	X		A66
Willhoughby Brook (*WTS*)	Hunterdon	Rt. 31	X*	X		A67
Lower Delaware Region (Assunpink Creek to Maurice River watersheds)						
Delaware River +	Mer. & Bur.	3 surveys, various locations				69, 122
Game Creek +	Salem	Rt. 40, upstream				72, 123
Scotland Run	Gloucester	Clayton-Williamstown Road				A68

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 2017 staff provided technical assistance to the following projects related to our coldwater resources:

Pequest River (Independence Twp./Warren County) – Two sections of the river within the Pequest WMA (Kenco Property) and a small tributary were electrofished on 8/17/17 to obtain current fisheries data. This section of the Pequest River is classified *Non-Trout* and is not currently stocked with trout by Fish and Wildlife. The surveys on the mainstem were conducted using a nine-person crew (with three back electrofishers) (see Appendix A18 pages A19). Collectively 17 fish species were encountered – American Eel, Sea Lamprey, Redfin Pickerel, Tessellated Darter, Banded Killifish, Bluegill, Pumpkinseed, Redbreast Sunfish, Rock Bass, Common Shiner, Creek Chub, Blacknose Dace, White Sucker, Swallowtail Shiner, Golden Shiner, Creek Chubsucker, and Yellow Bullhead. No trout were found. The tributary was choked with vegetation (watercress abundant) and was spot-checked at several accessible locations using a single backpack electrofisher. Five fish species were documented (Redfin Pickerel, Banded Killifish, Bluegill, American Eel, and Eastern Mudminnow). Long ago the river was channelized and the adjacent land ditched to improve drainage for agriculture. Fish and Wildlife now owns the land and is using a consultant to restore wetlands and a more natural drainage pattern. The project also includes sloping the vertical bank of the Pequest River to reduce erosion, placing coarse woody material (tree root wads and tree trunks) in the river to provide in-stream habitat diversity, and planting riparian vegetation on the sloped bank. The tributary stream will also be realigned to include a meander. When the restoration project is completed Fish and Wildlife plans to stock trout in the river at this location. (F-48-R, Project I) (Hamilton)

Musconetcong River (Franklin Twp./Warren County) – Two sections of river within the Musconetcong River WMA were electrofished on 8/22/17 to obtain current fisheries data (see Appendix pages A16 and A17). These surveys did not follow the established sampling protocol because the nine-person crew could not adequately electrofish the entire width of the river (82 ft wide) using three backpack electrofishers. In addition, the block net used at

the upstream survey boundaries only blocked a portion of the river width and partially failed during both surveys due to the swiftness of the current. These factors allowed fish, especially larger fishes, to elude capture. Consequently, the surveys provide qualitative fish data (i.e. fish species present) and do not reflect the overall number of fish present in the sections surveyed. Species collected (2 surveys combined) included American Eel (143), Blacknose Dace (99), Cutlip Minnow (56), Tessellated Darter (26), White Sucker (20), Longnose Dace (14), Redbreast Sunfish (5), Brown Trout (2), Rainbow Trout (1), Creek Chub (2), and Rock Bass (1). Of the trout captured, none were considered young-of-the-year fish. The Rainbow Trout was a stocked (hatchery origin) fish (10.7 in.) and the smaller of the two Brown Trout (7.6 in.) was considered a wild trout. The origin (wild or hatchery) of the other Brown Trout (9.6 in.) was unclear. Although anglers have reported catching small trout (5 – 6 in.) in this area, which suggests trout may be reproducing in the river (classified *Trout Maintenance*), the survey data was inconclusive in this regard. The lack of deeper pools was noted and anglers fishing slightly downstream in private club waters commented that the trout stocked by Fish and Wildlife on the state property quickly find their way into their private stretch (where an in-stream habitat project was completed over five years ago). Trout Unlimited proposed a habitat enhancement project within this WMA and hired a stream restoration consultant to design and implement the project, subject to Fish and Wildlife approval and issuance of Land Use Regulation permits. (F-48-R, Project I) (Hamilton)

Rinehart Brook - Brook Trout Restoration Project

A Brook Trout restoration project was initiated on Rinehart Brook, a tributary to the Black River within Hacklebarney State Park. The non-native Brown Trout has become the dominant trout species and the native Brook Trout reside in small numbers. The objectives of this study were: to determine if multiple depletion electrofishing could be an efficient manner to remove Brown Trout, to monitor potential rebound effects of the Brook and Brown Trout populations, and to determine if natural boulder waterfalls prevent Brown Trout from recolonization. Capture and removal of Brown Trout were accomplished via multiple electrofishing passes from August 23 to October 3, 2017.

Approximately two miles of Rinehart Brook and approximately 0.5 miles of an unnamed tributary were initially electrofished. Rinehart Brook was divided into six sections that could be electrofished either consecutively or at different times (see Appendix pages A55 and A56). The sections will be described from downstream to upstream. The first section started at the mouth of the Black River and ended at a waterfall what was later described as a potential barrier to fish movement (see photo). The second continued upstream to the beginning of a standardized 150-m stretch that has

Potential barrier to fish movement.

been surveyed for several years as part of a study that aims to better understand the relationship of temperature with various measures of wild trout populations. The third section was the standardized 150-m stretch (so that it could be compared with trout numbers from previous surveys). The fourth section was the longest and continued to a small dam upstream of Hacklebarney Road. The fifth section continued upstream to Old Farmers Road. An unnamed tributary (Rinehart Brook) (Trib)(Fairmont) converges with Rinehart Brook just upstream of Hacklebarney Road. This tributary was also electrofished. A total of 30 surveys were conducted, 29 for removal and 1 to remark fish below the potential barrier. The table below describes the numbers of both Brook and Brown Trout that were captured in each section, followed by the percentage of all trout that were Brook Trout.

The first pass of Rinehart Brook, started above a potential barrier to fish movement and revealed a total of 725 Brown Trout and only 58 Brook Trout (7.4% Brook Trout). All Brown Trout were removed, adipose fin clipped (identifying mark), and released into various sections of the Black River or in Rinehart Brook below the potential barrier. All other species were returned where they were captured.

Beautiful male Brook Trout captured on November 2, 2017

Subsequent passes resulted in fewer Brown Trout and relatively stable numbers of Brook Trout. By the seventh pass, only 9 Brown Trout and 60 Brook Trout were encountered (87.0% Brook Trout). Seventy-seven Brook Trout (and no Brown Trout) were collected on the first pass in the tributary. Additional surveys will resume in 2018, with intentions of continuing to remove Brown Trout that were not captured during 2017. The existing Brook Trout population will be monitored for the next year or two, to determine if they rebound in response to a reduced/eliminated Brown Trout population. An insufficient rebound may result in relocation of Brook Trout from neighboring Trout Brook.

Questions remain in regards to the ability of trout to traverse a series of waterfalls/plunge pools near the stream's confluence with the Black River. To test this, adipose fins were removed from the Brown Trout and were transplanted below the falls in both Rinehart Brook and the Black River. All Brown Trout are examined during subsequent removal efforts, to determine if any marked Brown Trout are found upstream of the falls. Many marked Brown Trout have been found below and in between the series of falls, however none have been re-captured above the falls as of the final electrofishing survey on October 3.

Trout species composition at multiple locations within Rinehart Brook and its tributary during seven complete electrofishing passes to remove Brown Trout.

Pass # and Date	Species Composition	1) Black River confluence – Waterfall	2) Waterfall – Start of standard survey	3) Standard Survey (150 m)	4) Top of standard survey – Dam at Hacklebarney Rd	5) Dam at Hacklebarney Rd – Old Farmers Road	Fairmount Tributary	Rinehart Brook (sections 2-5)	Watershed (Fairmount tributary Brook Trout # from pass 1 carried forward)
Pass 1 8/23 & 8/30/17	Brook	3	6	2	50	0	77	58	135
	Brown	82	160	58	504	3	0	725	725
	Total	85	166	60	554	3	77	783	783
	Brook%	3.5%	3.6%	3.3%	9.0%	0%	100%	**7.4%**	**15.7%**
Pass 1.1 8/23/17	Brook			1					
	Brown			12					
	Total			13					
	Brook%			7.7					
Pass 1.2 8/30/17	Brook			1					
	Brown			4					
	Total			5					
	Brook%			20					
Pass 2 9/1 & 9/7/17	Brook	6	14	1	29	0		44	121
	Brown	39	53	3	149	0		205	205
	Total	45	67	4	178	0		249	326
	Brook%	13.3%	20.9%	25.0%	16.3%	0%		**17.7%**	**37.1%**
Pass 3 9/12/17	Brook	5	8	3	39			50	127
	Brown	18	8	2	92			102	102
	Total	23	15	5	131			152	229
	Brook%	21.7%	50.0%	60.0%	29.8%			**32.9%**	**55.5%**
Pass 4 9/13/17	Brook		6	4	53			63	140
	Brown		5	0	38			43	43
	Total		11	4	91			106	183
	Brook%		54.5%	100%	58.2%			**59.4%**	**76.5%**
Pass 5 9/18/17	Brook		5	1	46			52	129
	Brown		2	0	10			12	12
	Total		7	1	56			64	141
	Brook%		71.4%	100%	82.1			**81.3%**	**91.5%**
Pass 6 9/20/17	Brook		7	2	56			65	142
	Brown		3	0	10			13	13
	Total		10	2	66			78	155
	Brook%		70.0%	100%	84.8%			**83.3%**	**91.6%**
Pass 7 10/3/17	Brook		6	1	53			60	137
	Brown		1	0	8			9	9
	Total		7	1	61			69	146
	Brook%		85.7%	100%	86.9%			**87.0%**	**93.8%**

A final electrofishing survey was conducted on the lower end of Rinehart Brook on November 2. The survey started at the confluence with the Black River and ended at the potential barrier to fish passage, the uppermost waterfall, approximately 125 m upstream. Brown Trout were numerous, with 121 captured. Of this total, 107 were previously clipped, while only 14 were unclipped. The 14 unclipped Brown Trout were subsequently clipped. One Tiger Trout (Brown x Brook hybrid), a YOY (82 mm) was also encountered during this collection. Clipped fish, if recaptured above the potential barrier during future surveys, will indicate that there is passage of fish from the Black River into Rinehart Brook. (F-48-R, Project II) (Crouse)

Naturally born young-of-the-year Tiger Trout (82 mm) captured from Rinehart Brook on November 2, 2017.

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 dumping 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. In the spring of 2016, in-stream habitat restoration was performed by a private consultant in an attempt to revert the stream back to what it was prior to the two flood / landslide events.

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

An electrofishing survey was done on July 12, 2017 to determine the status of the fish population, including native Brook Trout, following restoration efforts (see Appendix page A12). This survey was done with the knowledge that only one complete breeding cycle had taken place since the restoration 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 native Brook Trout are still in the area after the work was done, and if recovery has begun. Two adult/juvenile native Brook Trout were found in 2017. This is exactly the same number of native Brook Trout found in 2016 and 2015 and indicates that the habitat restoration efforts did not have a negative impact on the small native Brook Trout population found previously. Overall, the survey found 338 individual fish representing 4 different species. The 338 individual fish found is comparable to last year when 333 individual fish were collected.

A second electrofishing survey was done also on July 12, 2017 to determine the status of the fish population and wild Brook Trout population upstream of the restoration area on Sparta Glen Brook (see Appendix page A11). This survey will help establish a baseline for the restoration area, to help measure success of the restoration efforts downstream. Two adult/juvenile native Brook Trout were also found in this survey location. This shows that the overall area is not doing well in terms of the Brook Trout population and that the landslide is not the only habitat issue as this survey was done outside of the area directly impacted by the landslide. Temperature of the stream during the survey was 21.7°C and may actually be the biggest limiting factor for the struggling Brook Trout population. Further investigation on temperature would need to occur to be sure if it is the leading cause for the low Brook Trout population. Overall, the survey found 174 individual fish representing 4 different species. (Federal Grant F-48-R, Project II) (Shramko)

Spruce Run: Clean-up of Quarry Discharged Materials (Hunterdon)

Photo taken of Spruce Run (Creek) looking upstream from Van Syckles Bridge on Sunday July 30, 2017.

During the weekend of July 29 and 30, 2017, Eastern Concrete Materials Inc. illegally released a large amount of sediment from their stone quarry in Glen Gardner into Spruce Run Creek. This *Trout Production* stream, a major tributary to Spruce Run Reservoir, supports wild Brook and Brown Trout populations and is also trout stocked. The sediment, composed of pulverized granite, is produced as a waste product from the newly quarried stone. The sediment laden wastewater is then collected in settling basins. After solids settle, the clear top water is permitted by NJDEP to be discharged into the creek. Unfortunately, pumping continued to the point in which sediment was discharged, resulting in a tremendous amount of sediment released into the stream. A 1.7-mile section, from the quarry discharge to Spruce Run Reservoir, was impacted. Accumulations of sediment were estimated at approximately 2-4 inches throughout most of the stream, with most significant accumulations near the point of discharge, with a maximum depth measured at 20 inches. Sediment samples were collected by USGS and a determination was made that the sediments were within human health and safety standards, however the impacts to habitat and aquatic life would be detrimental if not adequately removed.

Various measures of water quality were taken on August 1, with no significant difference above and below the impacted area. Parameters included water temperature, oxygen, conductivity, specific conductance, total dissolved solids, salinity, pH, and alkalinity. Surprisingly, only a few dead fish including Brown Trout and amphibians such as Pickerel Frogs were reported.

Handful of fine sediment (pulverized granite) scraped off the streambed of Spruce Run (left).

Dead young-of-the-year Brown Trout found in Spruce Run during initial inspection by NJDFW (right).

One of two electrofishing surveys conducted on August 1, 2017 to determine status of existing fishery 2 days after sediment was released into Spruce Run.

Two electrofishing surveys were conducted on August 1 to determine if the fish assemblage had survived the initial impact (see Appendix pages A60 and A61). The first survey was conducted in a 150-m section immediately downstream of the discharge and a second 150-m site was sampled approximately 1 mile further downstream. An abundance of wild Brown Trout, including young-of-the-year (YOY), were found at both sites (68 and 52 respectively). A few stocked Rainbow Trout (10 and 3 respectively) and one wild Brook Trout YOY were also found at each site. Other common fish species were encountered as well. Numbers of fish collected were likely underestimated, due to decreased visibility in the turbid water. A healthy fish assemblage was found at both sites, however without a rapid cleanup effort, it was anticipated that they would not survive in the short-term, due to starvation (anticipated loss of aquatic insects over time due to sediment) and/or will not be able to adequately spawn. Spawning would be impacted by the inundations of suitable spawning substrate (gravel) with fine sediment, shifting of sediment smothering eggs/redds (nests), and curtailed movement of fish due to extensive sediment. NJDFW determined a fish salvage was not necessary and electrofishing surveys will be duplicated during the summer of 2018 to assess the status and recovery of the fishery.

NJDEP's Bureau of Freshwater and Biological Monitoring conducted three macroinvertebrate surveys on August 10. Surveys indicated the macroinvertebrates appeared to be relatively abundant with a variety of species including Stoneflies and Mayflies, resulting in scores of 66.32 and 69.29 (both Excellent) and a score upstream of Van Syckles Road of 58.85 (Good). This initial information was hopeful, that a food supply was present, but it was uncertain how long the macroinvertebrates would survive with extensive sediment, over an extended period of time. Surveys were repeated on November 28, yielding scores of 70.37, 66.90, 65.87 respectively, all considered Excellent and 2 of which had improved since the August 10 surveys. The prognosis based on these surveys was good.

Initially, three sediment curtains were installed near the inlet at Spruce Run Reservoir and a series of seven check dams were installed along the stream to slow velocities, to accumulate sediment in the pools above the dams. Vacuum trucks began to remove material on August 10. Two vacuum trucks, each with a capacity of 3,750 gallons discharged the slurry back into the quarry settling basins. The pace of the clean-up improved when a company specializing in stream restoration utilized an innovative approach to clean up sediment-

Equipment used to vacuum sediment from streambed.

impacted habitats in rivers and streams was hired following their on-site evaluation on August 21. They had the expertise to vacuum sand and sediment from the impacted streambed, leaving the native gravel and cobble substrates. They trained local contractors to implement their techniques. Trash pumps were used to "power-wash" the material, to consolidate it for removal. The NJ Water Supply Authority was concerned with materials entering Spruce Run Reservoir, an important water supply reservoir. Therefore, additional sediment curtains were installed to prevent additional transport of material into the reservoir. A substantial amount of sediment was removed, using heavy equipment, in the inlet of Spruce Run Reservoir.

It was important to minimize environmental impacts to the 1.7 miles of Trout Production section upstream. As a result, several proactive steps were taken, including the prohibition of heavy equipment use in the streambed and precautions to protect the State Threatened Wood Turtle to name a few. A turtle monitor was hired to observe and clear construction areas. Silt fencing and hay bales were installed at the access points to minimize turtle movement into the area.

The cleanup portion of the restoration of Spruce Run and Spruce Run Reservoir was completed on November 29. Sediment was removed from the entire 1.7 miles that were impacted, in addition to the removal of material from the forebay of Spruce Run Reservoir. The cleanup progressed slowly at first, however techniques were refined and progressed more rapidly midway through the clean-up. All six check dams and all sediment curtains were removed, allowing mature trout to make upstream movements for spawning. All access roads have been removed and all soil disturbances were planted with native vegetation. A settlement in principal has been reached. The stream, riparian area, and its inhabitants will continue to be monitored. (Hunter Angler Fund) (Crouse)

Photographs taken before and after the clean-up of Spruce Run: days after discharge (left) and after clean-up (right).

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. The clean-up associated with a truck fire on Interstate 78 resulted in detergent (truck's cargo) washing into the creek, killing thousands of fish in a 2.8-mile section from the I-78 overpass downstream to the Musconetcong River. Prior to the fish kill the wild trout population in the creek had been dominated by Brown Trout and wild Brook Trout were very sparse. Brook Trout, the only trout species native to New Jersey, is in decline statewide and may soon be designated state Special Concern. Slimy Sculpin (soon to be listed state Threatened) also resided in this coldwater stream. Following the fish kill, the Bureau began actively managing this stream for native fishes, with the emphasis on restoring wild Brook Trout by removing the non-native Brown Trout, which directly compete with Brook Trout for cover, food, and spawning habitat. This restoration project (the first of its kind for wild Brook Trout in New Jersey) is using an adaptive management approach, whereby decision-makers learn and gain new insights from data as it is collected and adjust strategies to achieve the outcome desired.

Detergent in West Portal Creek, May 5

Same location, May 6

Representative aquatic organisms killed

In 2016 multiple electrofishing surveys were conducted both upstream and downstream of the I-78 bridge in to assess the recovery of native fishes, while simultaneously removing non-native salmonids (Appendix A21 -A22) . A total of 49 wild Brown Trout, plus 2 Rainbow Trout and 1 Tiger Trout (a sterile hybrid of Brook and Brown Trout) presumably stocked in the Musconetcong River, were removed. Native species encountered were returned to the creek, including 24 wild Brook Trout and other species (Slimy Sculpin, American Eel, Blacknose Dace, Longnose Dace, Creek Chub, White Sucker, and Common Shiner). Although the number of Brook Trout that remained was low, it was theorized that a sufficient number remained that could reproduce successfully (particularly if Brown Trout were absent, or nearly so) and eventually repopulate the stream. Transference of wild Brook Trout from another nearby Musconetcong River tributary to West Portal Creek was considered, but not undertaken to avoid mixing gene pools.

In 2017 ten electrofishing surveys were conducted to assess the reproductive success and status of the wild trout population in West Portal Creek and remove Brown Trout. The entire length of the creek (upstream and downstream of I-78) was surveyed once with the exception of a section that could not be electrofished due to dense overhanging riparian vegetation. In addition, two standard surveys were conducted to replicate those conducted in 2016. A total of 1,527 trout were captured including 1,239 Brown Trout, 224 Brook Trout, and 64 Tiger Trout. The data indicates that Brown Trout continue to outnumber Brook Trout (5:1 ratio). Other species captured during these surveys included Creek Chub, Blacknose and Longnose

Dace, Tessellated Darter, American Eel, White Sucker, and Slimy Sculpin. These species were generally not very abundant, especially Slimy Sculpin.

Nearly all (97%) of the trout captured in the 2017 surveys were young-of-the-year, which indicates that both Brook and Brown Trout reproduced there last fall. The presence of Tiger Trout, which indicates mating success between Brook Trout (typically males) and Brown Trout (typically females), is cause for concern as this suggests mature female Brook Trout are scarce. Brown Trout will likely continue to be the dominate trout species in this stream unless they can be completely eradicated. This would be a decidedly uphill battle unless an instream barrier could be built on the creek near its confluence with the Musconetcong River to prevent wild Brown Trout from nearby tributaries (such as Turkey Hill Brook) from entering and recolonizing West Portal Creek.

Although the outlook for Brook Trout in West Portal Creek appears bleak given the dominance of Brown Trout, it may be possible to establish a viable population upstream of the I-78 culvert where relatively few Brown Trout were found (and removed) in 2016 and only one Tiger Trout was found there in 2017. The culvert is perched which may be beneficial in preventing or discouraging Brown Trout from migrating upstream to spawn. Establishing a wild Brook Trout population in this headwater reach while Brown Trout are still absent, by transferring wild fish from a nearby stream, may help avert extirpation of Brook Trout from West Portal Creek. It is recommended that additional surveys be conducted in 2018 to assess the status of the recovering trout population and determine if Brook Trout restoration should be pursued and to add to our knowledge base as other Brook Trout Restoration projects in New Jersey are considered. (F-48-R, Project II) (Hamilton)

Results of 10 electrofishing surveys conducted in 2017 on West Portal Creek, Hunterdon County, New Jersey. The number of trout outside parentheses indicates young-of-the year (YOY); the number inside parentheses indicates fish older than YOY.

Stream reach - upstream to downstream	Date	Sample length (m)	Wild trout species		
			Brook	Brown	Tiger
Nonstandard surveys (survey length varies)					
H - Headwaters to Bellwood Park Road	8/2/17	675	-	-	-
G - Bellwood Park Road to I-78 culvert	8/2/17	370	-	-	1 (0)
F - I-78 to wood line above Ridge Road	8/2/17	124	-	-	-
Wood line above Ridge Road to Ridge Road	*Not*	*surveyed*			
E - Ridge Road to Asbury-West Portal Road	7/28/17	725	25 (4)	417 (22)	63 (0)
D - Asbury-West Portal Road to Valley Station Road	7/26/17	834	95 (3)	469 (5)	-
C - Asbury-West Portal Road downstream to abandoned RR trestle	7/25/17	549	78 (2)	145 (4)	-
B - Abandoned RR trestle to point 2 km downstream of Valley Station Road	7/21/17	701	6 (0)	48 (5)	-
A - Point 2 km downstream of Valley Station Road Start to confluence with Musconetcong River	7/21/17	914	0 (1)	2 (0)	-
Standard surveys (survey length 150 m)					
Asbury-West Portal Road (start 100 m downstream)	7/20/17	150	10 (0)	119 (0)	-
Asbury-West Portal Road (start 2 km downstream)	7/20/17	150	-	3 (0)	-
			214 (10)	1,203 (36)	64 (0)

COOLWATER / WARMWATER FISHERIES

Coolwater Fisheries Management

In 2016 a three-year initiative (2014-2016) was completed to assess the stocking of coolwater species such as Muskies, Northern Pike, Walleye and Hybrid Striped Bass. These species do not readily reproduce in New Jersey waters and are maintained by annual stocking programs from Fish and Wildlife's Hackettstown State Fish Hatchery. The initiative included a review of management goals and objectives, plus an assessment of current fisheries. The assessment also included an online angler survey concerning angler opinions and experiences on their warmwater/coolwater fishing opportunities in New Jersey. Over 1,000 anglers participated.

A significant part of the coolwater assessment was data collection. To assess the status of these populations, trap nets were set, the most efficient means of capturing these species. Over the course of the study, the Bureau set 273 trap nets, 13 gill nets, and conducted 17 days of electrofishing - over 251 man-days of work. In 2017, significant changes to the State's Coolwater Program were made based on study results. Regulation changes were proposed and formally adopted following a 60-day public comment period. These regulations became effective on February 10, 2018. Sampling findings for each individual waterbody and management recommendations can be found in the final report titled Assessment and Management of New Jersey's Stocked Coolwater Fishes (Appendix G). (F-48-R, Project II) (Collenburg)

Echo Lake Musky (50.2 in. / 33.1 lbs. brought back to Hackettstown State Fish Hatchery for brookstock

The following are changes to the State's Coolwater stocking program:

Muskellunge

- Statewide size limit for Muskellunge increased from 36 to 40 inches
  74% of captured individuals (77) were larger than 36", and 25% were at least or greater than 44".

- Minimum size for *Trophy Musky Waters* increased from 40 to 44 inches
  - 40 to 70% of the individuals captured were over 40", 20 to 26% exceeded 44"
  - Lake Hopatcong and Monksville Reservoir added as Trophy Musky Waters
  - Mountain Lake no longer regulated as Trophy Musky Water.

- Spring yearlings were added to the program and will be stocked in alternating years from fall fingerlings.
  - Stocking yearlings in other states has significantly increased survivability.
  - Studies indicate short-term survival rates of fingerlings (37.7-3.87%).

- Stock Tiger Muskellunge at 0.2/acre in each waterbody receiving Muskies.
  - Lake Musconetcong will only receive Tiger Muskellunge, at a rate of 2/acre.

New stocking rates on waterbodies receiving Muskellunge. Lake Musconetcong was just added to the program and will be stocked with Tiger Muskellunge only at a rate of 2, 10" FF/acre (green).

				2018 and even years			2019 and odd years		
				Pure strain Muskellunge		10% Tiger Muskellunge Bonus	Pure strain Muskellunge		10% Tiger Muskellunge Bonus
Waterbody	County	Acreage	Number/acre	Spring Yearlings	Fall Fingerlings	Fall Fingerlings	Spring Yearlings	Fall Fingerlings	Fall Fingerlings
Greenwood Lake	Passaic	1920	1.5 - 2	0	3648	192	2880	0	0
Mountain Lake	Warren	122	1	0	109	13	122	0	0
Echo Lake	Passaic	280	1.5 - 2	0	532	28	420	0	0
Furnace Lake	Warren	53	1.5 - 2	0	100	5	75	0	0
Lake Hopatcong	Morris	2685	1	2685	0	0	0	2416	269
Monksville Reservoir	Passaic	505	1.5 - 2	760	0	0	0	960	50
Mercer Lake	Mercer	275	1.5 - 2	0	522	28	338	0	0
Little Swartswood Lake	Sussex	75	1.5 - 2	113	0	0	0	142	8
Lake Musconetcong	Morris	329	2	0	0	658	0	0	658
DOD Lake	Salem	120	1.5 - 2	180	0	0	0	228	12
				3738	**4911**	**924**	**3835**	**3746**	**997**

- Two Waterbodies added to the Muskellunge/Tiger Musky Stocking Program
  - DOD Lake – A 120-acre impoundment in Salem County, Muskellunge have been stocked here in the past, but not on a consistent basis.
  - Lake Musconetcong – A 329-acre lake in Morris County, Tiger Muskellunge will be stocked on an annual basis to add an additional opportunity for anglers (see table above).

- Annual stocking ceased at two non-producing waters
  - Despite aggressive stocking fisheries have failed to develop at Carnegie Lake and Manasquan Reservoir.
  - Manasquan will receive hatchery surplus when available

- Stocking rate reduced in select water with over abundant Muskellunge Population
  - An overly abundant population of Muskellunge exists in Mountain Lake. Current stocking rates have been somewhat consistent, but survivability may be high or maybe natural reproduction is occurring and increasing recruitment. Aside from the current Muskellunge population large predators are not common in Mountain Lake and may contribute to the higher survivability of Muskellunge. The fishery is limited by the lack of the once abundant forage base of Yellow Perch and Creek Chubsuckers and a stunted population of Bluegills. The fishery is unbalanced. Muskellunge are not able to reach a size of 40 inches and are stunted based on age-length analysis. The stocking rate will be decreased and focus should be on improving habitat for forage fish.

46.9 in. and 29 lbs. Musky from Monksville Reservoir

Northern Pike

- Annual stocking ceased at two non-producing Northern Pike waters
  - Angler satisfaction and trap net data indicate that the Northern Pike population at Cranberry Lake and Deal Lake is low in abundance.
  - Both locations will be used for surplus when available
  - The online Warmwater/Coolwater angler survey indicated it is underutilized with 91.4% indicating they never fished it for pike.

- Increase stocking rate of Northern Pike on a select water
  - Pompton Lake - Trap net catch rates indicated the population in low to moderate abundance. The abundant forage indicates this fishery can support larger numbers of pike and good habitat exists. The stocking rate will be increased from 10/acre to 15/acre for 4-6" fingerlings.

- Reduce stocking rate of Northern Pike on select waters
  - Budd Lake – Many pike are reaching the stock size of 21 inches, but rarely exceed 27 inches (high PSD and low PSD_p). The population is abundant but appears to be stunted, with a stunted forage base. Reducing numbers should increase overall size.
  - Passaic River – One of the most popular Northern Pike fisheries in the state, anglers commonly report pike weighing up to 20 lbs. and over 40-inches. Online angler survey satisfaction levels for Northern Pike in the Passaic River exceeded all other waterbodies by almost double. Electrofishing surveys show poor condition (low relative weights) of individuals captured as well as limited forage base. It has been heavily stocked in the past and stocking should be decreased to avoid failure of this fishery.

Spruce Run Northern Pike measuring 30.1 inches and weighing 7.3 lbs.

Walleye

- Coordinate stocking rates for Walleye in Greenwood Lake with NYDEC
  - Sampling in 2017 revealed a highly abundant population of Walleye (25/hr) during 6 hours of electrofishing conducted by both NYDEC and NJDFW. Largemouth Bass were low in abundance and have not recovered since 2002 when Largemouth Bass Virus caused a decline in the population. Supplemental stocking of Largemouth Bass has been ongoing since 2012 and over 60,000 2-inch fingerlings have been stocked.

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

- Established a consistent stocking rate of 20 Walleye/acre (80/20 ratio)
  - Stabilization of the stocking rate will allow biologists to better evaluate the fisheries.

New Stocking rates on waterbodies receiving Walleye.

Waterbody	Acres	Stocking	New Stocking Rate	Pond Fingerlings (1-2")	Advanced Fingerlings (2-4")
Canistear Reservoir	350	Maintain	20/acre (80:20)	5,600	1,400
Greenwood Lake	1,920	Maintain	20/acre (80:20)	30,720	7,680
Lake Hopatcong	2,685	Maintain	20/acre (80:20)	42,960	10,740
Monksville Reservoir	505	Maintain	20/acre (80:20)	8,080	2,020
Swartswood Lake	494	Maintain	20/acre (80:20)	7,904	1,976

General Fisheries Surveys

Northern Pike Electrofishing Surveys on Passaic River - Beginning in 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. 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 2017 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. (Hunter and Angler Fund)

A boat electrofishing (0.82 hours) survey was conducted on the Passaic River, Florham Park on 9/28/17. The fish assemblage consisted of 12 species including Northern Pike (2), Black Crappie (17), White Perch (15), Yellow Perch (25), Common Carp (45), Common Shiner (500), Brown Bullhead (10), American Eel (5), Bluegill (10), Pumpkinseed (20), Green Sunfish (2), and Redbreast Sunfish (25). The length range of the Northern Pike was 327 – 545 mm (12.9 – 21.5 in.). The weight range of the Northern Pike was 0.22 – 0.642 kg (0.49 – 1.42 lb.). The relative weights (59 and 99) of the two Northern Pike collected indicate that one was of sub-optimal weight for its length, while the other was of optimal weight for its length.

Passaic River Northern Pike

A second boat electrofishing (1.80 hours) survey was conducted on the Passaic River, Fairfield on 9/28/17. The fish assemblage consisted of eight species including Northern Pike (3), Brown Bullhead (7), Yellow Perch (15), White Perch (25), Largemouth Bass (3), Redfin Pickerel (5), Pumpkinseed (25), and Bluegill (20). The length range of the Northern Pike was 377 – 624 mm (14.9 – 24.6 in.). The weight range of the Northern Pike was 0.25 – 1.548 kg (0.55 – 3.41 lbs.). The relative weights (72, 80 and 93) of the three Northern Pike collected indicate that all three were of sub-optimal weight for their length.

A third boat electrofishing (0.82 hours) survey was conducted on the Passaic River, Hawthorne on 10/19/17. Low water conditions limited the length of river sampled. The fish assemblage consisted of 9 species, including Northern Pike (1 captured, 2 observed / evaded capture), Common Carp (65), Brown Bullhead (10), American Eel (6), Largemouth Bass (3), Rock Bass (1), Smallmouth Bass (2), Redbreast Sunfish (25), and White Sucker (7). The length of the Northern Pike was 624 mm (24.6 in.). The weight of the Northern Pike was 1.56 kg (3.4 lbs.). The relative weight (94) of the Northern Pike collected indicate that it was of sub-optimal weight for its length.

Nineteen of the twenty-three Northern Pike collected / observed in 2015 – 2017 were of sub-optimal weights for their lengths. Additionally, the majority of angler catch photos of Passaic River Northern Pike appeared to be of sub-optimal weights for their lengths. The stocking of surplus Northern Pike in the Passaic River should be discontinued. Annual electrofishing surveys will continue to be conducted at the above three sites to continue to monitor the fishery. (Hunter and Angler Fund) (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)

No lake inventories were conducted in 2017, however a total of 35 boat electrofishing surveys were completed at 24 locations in 2017 (see below). (Smith)

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.

A total of 35 surveys were completed at 24 locations in 2017. Assunpink Lake had the highest CPUE for Largemouth Bass at 60 bass/hr during daytime electrofishing. The largest bass encountered electrofishing this year was from Perrineville Lake on May 4 and weighed 6.99 lbs. Followed by a bass weighing 6.72 lbs. collected at Union Lake on February 27. (Hunter and Angler Fund)

Assunpink Lake (Monmouth) – Assunpink Lake is a 225-acre impoundment located within the Assunpink WMA, 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 2017. An electrofishing survey was completed on April 24, 2017 to assist pathologist Dr. Jan Lovy with the collection of Bluegill, Pumpkinseed, and Largemouth Bass for testing as a follow-up to a spring 2015 fill kill. Assunpink Lake has annual fish kills during the spring. Kills of varying species have been attributed to both bacteria and parasites. Largemouth Bass were observed in good number (n=124) and most were in good condition. A total of 1.16 hr of daytime electrofishing was completed around the perimeter of the lake. Approximately 20 additional Largemouth Bass were observed. These were not collected, since they were actively spawning. Some individuals appeared to be rather thin, including females that had not yet spawned. Not all Largemouth Bass were collected, hence a CPUE was not calculated. Three individuals greater than memorable size (510 mm) were collected, the largest of which measured 530 mm (20.8 in.) and weighed 2.764 kg (6.09 lbs.).

A daytime boat electrofishing survey was conducted on September 21, 2017 to assess the Largemouth Bass population. Sampling occurred around the perimeter of the lake. A total of 66 Largemouth Bass were collected, of which 60 were >200 mm (stock size). The CPUE was 60 bass/hr. A PSD of 51 and a PSD-P of 15 were calculated for Largemouth Bass.

Total electrofishing time was 60 minutes. The Largemouth Bass population in Assunpink Lake currently appears to be to be comprised mostly of smaller fish according to angler reports and survey data. As these fish continue grow the bass fishery is expected to improve. The amount of aquatic vegetation within the lake has recently increased as well. Hydrilla and Water Chestnut both invasive aquatic vegetation species are now established in the lake. Reasonable amounts of aquatic vegetation can improve recruitment, as it provides small fish with a place to avoid predation, allowing for increased survival. Heavy sedimentation in the lake has impacted the fish population. A dredging project is recommended to restore and improve habitat. Continued monitoring of the Largemouth Bass population, and the habitat within the lake is recommended to maintain this popular fishery. (Smith)

Cooper River Park Lake (Camden) – A boat electrofishing survey was completed at Cooper River Park Lake on August 17, 2017 to evaluate the Largemouth Bass and Northern Snakehead population. A total of 44 Largemouth Bass were collected in 1.68 hr of electrofishing. There were 44 fish >200 mm stock size, indicating of CPUE of 26 bass/hr. The PSD of 65 and PSD-P of 11 indicate the population is balanced. No additional stocking of Largemouth Bass is recommended at this time. There were no snakeheads collected, however a Peacock Bass, measuring 248 mm was collected and destroyed. This is the first recorded capture of the non-native species in New Jersey. The fish was most likely released from an aquarium and since they are considered a tropical species, it would not have survived the cold winter temperatures. Releasing any non-native species into New Jersey waters is illegal. Additional species collected included Striped Bass, Alewife, Common Carp, White Catfish, Brown Bullhead, Channel Catfish, Golden Shiner, Eastern Silvery Minnow, Bluegill, Pumpkinseed, American Eel, White Perch, and Gizzard Shad. (Smith)

Delaware River (Burlington) – A boat electrofishing survey was completed at the Delaware River in Bordentown on August 21, 2017 to evaluate the Largemouth Bass and Northern Snakehead population. A total of 61 Largemouth Bass were collected in 1.80 hr of electrofishing. There were 47 fish >200 mm stock size indicating of CPUE of 26 bass/hr. The PSD of 47 and PSD-P of 14 indicate the population is balanced. No additional stocking of Largemouth Bass is recommended at this time. Reproduction of Largemouth Bass appears to be adequate to support the population based on the 14 individuals less the 200 mm stock size. One Smallmouth Bass measuring 475 mm and weighing 1.46 kg was collected. There were no snakeheads collected, however one Grass Carp (weighing approximately 40 lbs.) was collected and destroyed. Two additional Grass Carp of similar size were observed and alluded capture. Grass Carp are a non-native species stocked in a sterile form by permit only, in a limited number of waters that meet specific requirements, to control aquatic vegetation. Their origin is most likely due to escapement from lakes or ponds that connect to the Delaware River.

A boat electrofishing survey was completed at the Delaware River in Trenton on August 22, 2017 to evaluate the Largemouth Bass and Northern Snakehead population. A total of 45 Largemouth Bass were collected in 1.59 hrs of electrofishing. There were 40 fish >200 mm stock size indicating of CPUE of 25 bass/hr. The PSD of 55 and PSD-P of 18 indicate the population is balanced. No additional stocking of Largemouth Bass is recommended at this time. Two Smallmouth Bass measuring 256 and 277 mm, weighing 0.210 and 0.266 kg were collected. There were no snakeheads collected, however two adult snakeheads were

observed. Channel Catfish were abundant and of large size which should provide an excellent fishery for anglers fishing the river.

Striped Bass caught by electrofishing the Delaware River in 2017.

A boat electrofishing survey was completed at the Delaware River in Burlington on August 24, 2017 to evaluate the Largemouth Bass and Northern Snakehead population. A total of 87 Largemouth Bass were collected in 1.90 hr of electrofishing. There were 70 fish >200 mm stock size indicating of CPUE of 36 bass/hr. The PSD of 56 and PSD-P of 4 indicate the population is unbalanced. No additional stocking of Largemouth Bass is recommended at this time. Seventeen Largemouth Bass below the stock size were collected indicating good recruitment. There were no snakeheads observed or collected.

A boat electrofishing survey was completed at the Delaware River in West Deptford on August 28, 2017 to evaluate the Largemouth Bass and Northern Snakehead population. A total of 14 Largemouth Bass were collected in 1.66 hr of electrofishing. There were 12 fish >200 mm stock size indicating of CPUE of 7 bass/hr. Two snakeheads, measuring 720 and 340 mm, were collected. Northern Snakeheads are considered an invasive species and as such both were destroyed.

Continued sampling is recommended to monitor the Largemouth Bass fishery and Northern Snakehead population. Additional species observed included Striped Bass, YOY Alewife and Blueback Herring, YOY American Shad, Menhaden, Common Carp, Channel Catfish, Golden Shiner, Bluegill, Pumpkinseed, American Eel, White Perch, and Gizzard Shad. No Atlantic Sturgeon, a federally listed endangered species, where observed during sampling. (Smith)

Striped Bass caught by electrofishing the Delaware River in 2017.

DOD Lake (Salem) – The DOD Lake WMA is a 120-acre borrow pit located in Penns 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, 2016, and again in 2017. 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 the stocked species listed above were encountered during sampling in 2017, however the stocking of these species should continue in order to increase diversity of the fish population and provide anglers additional fishing opportunities. A boat

electrofishing survey was completed on August 4, 2017 to evaluate the Largemouth Bass and Northern Snakehead population. A total of 70 Largemouth Bass were collected in 1.75 hr of daytime electrofishing. There were 60 bass greater than the 200 mm (8 in.) stock size indicating a CPUE of 34 bass/hr. The PSD was 35 and PSD-P was 15 indicating the population is slightly unbalanced. Northern Snakeheads were first reported in 2014 and their presence was confirmed by NJDFW in 2015. Three Northern Snakeheads were collected during this survey, measuring 382 - 482 mm (15.1 – 18.9 in.). In comparison two Northern Snakeheads were collected in 2015 and eight in 2016. Northern Snakeheads are managed as an invasive species and all were destroyed. The snakehead population will continue to be monitored to determine the impact on the Largemouth Bass population. (Smith)

Egg Harbor Township Nature Reserve Lake (Atlantic) – Egg Harbor Township Nature Reserve Lake is a 29-acre waterbody located within Egg Harbor Township. The lake is located within the 220-acre Egg Harbor Township Nature Reserve and is an old sand quarry. A daytime boat electrofishing survey at the request of the Nature Reserve board members was conducted on August 2, 2017 to assess the Largemouth Bass population. Total electrofishing time was 4,368 seconds (72 minutes). A total of 17 Largemouth Bass were collected which ranged in size from 185 mm to 480 mm (7.3 – 18.9 in.), of which 16 were >200 mm (8 in.) stock size. A Largemouth Bass measuring 480 mm (18.9 in.) and weighing 1.632 kg (3.60 lbs.) was the largest collected during the survey. A total of 37 Pumpkinseed, and 9 young-of-the-year (YOY) Largemouth Bass were also collected during electrofishing. Increased angling pressure can have a negative impact on easily exploitable fish populations in recently made public waters. Artificial habitat, such as brush piles, may be beneficial to the fishery as well. 500 adult Bluegill and 1,125 fingerling Largemouth Bass were stocked on August 15, 2017 to enhance the fishery. Seining (page 89) and a DO/Temp profile (page 143) were also conducted. (Boehm)

Etra Lake (Mercer) – A boat electrofishing survey was completed on October 31, 2017 at Etra Lake, located in East Windsor to evaluate the Largemouth Bass population. No recent electrofishing surveys have been completed for the waterbody. A total of 21 Largemouth Bass were collected in 0.53 hr of electrofishing which translates to a CPUE of 39 bass/hr of stock size bass. This, however, is rather misleading, since the entire perimeter of the lake was sampled in less than an hour. Even though the CPUE suggests a robust population, the size of the lake (less than 10 acres), limited habitat, and presence of water-chestnut restricts the potential to expand the population. No additional stocking of Largemouth Bass is recommended. There is limited shoreline access and launching of trailered vehicles appears to be discouraged based on signs in the parking area. One Tilapia was collected and destroyed. Several others were observed, but avoided collection due to dense aquatic vegetation. Water Chestnut was also documented in Etra Lake for the first time during this survey. (Smith)

Farrington Lake (Middlesex) - A daytime boat electrofishing survey was conducted in Farrington Lake (223 ac) and Selover's Millpond (3 ac) on May 23, 2017 to check Largemouth Bass for possible PCB toxicity. A hydraulic fluid spill occurred in Selover's Millpond, an onstream impoundment of the Lawrence Brook in October 2016. It was determined that high PCB levels were detected and as a result, the Division closed a 1.6-mile section of Lawrence Brook, from Riva Avenue bridge down to Ryders Lane. In order to

determine if the fish are healthy to eat, 10 Largemouth Bass were collected from the site of the spill (Selover's Millpond) and 10 were collected from Farrington Lake (upstream to serve as a control). Live fish were provided to the Division's fish pathologist Jan Lovy, who prepared the fish tissue and sent it out to a private laboratory for PCB analysis, that determined PCB levels in the fish tissue were at safe levels.

It took 1,437 seconds (0.4 hr) to collect 10 legal (greater than 12 in.) Largemouth Bass. They ranged from 309 - 417 mm (12.2 – 16.4 in.) the largest of which weighed 1.250 kg (2.8 lbs.). The largest bass exhibited a characteristic known as "melanism," in which an accumulation of pigment occurs in the superficial tissue, presenting distinct black blotches all over the fish. Although believed to be non-harmful, some believe the melanistic tissue may be a precursor to a form of skin cancer. This specimen and two others from Selover's Millpond were retained and dissected by Dr. Lovy. It was determined that the blotches were very superficial (with no penetration into the muscle tissue) and not indicative of any concerns of malignancy. Other fish species observed included Bluegill, Pumpkinseed, White Perch, Yellow Perch, Brown Bullhead, Common Carp, and Alewife. No additional fish tissue surveys are necessary at this time. (Crouse)

A melanistic Largemouth Bass from Farrington Lake captured in 2017.

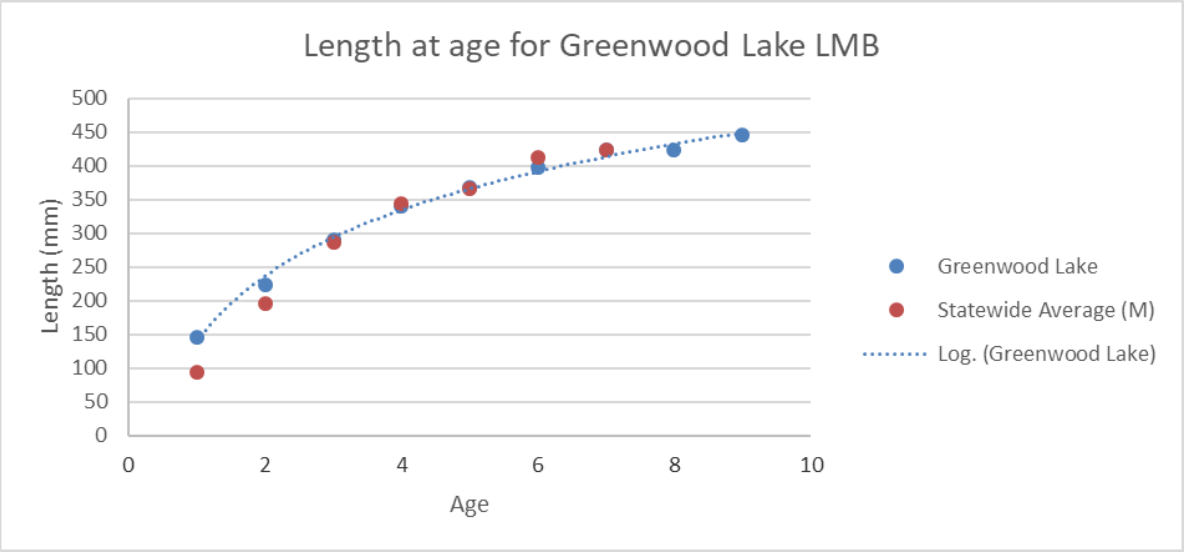
Game Creek (Salem County) – A boat electrofishing survey was completed at Game Creek, a tributary of the Salem River located in Carneys Point on November 1, 2017 to evaluate the Largemouth Bass and Northern Snakehead populations. Northern Snakeheads were first documented in Game Creek in 2016. A total of seven adult snakeheads ranging from 395 – 690 mm (15.6 – 27.2 in.) were collected, and destroyed. Approximately 8-10 additional snakeheads were observed and avoided capture due to the dense emergent vegetation along the shoreline.

Two of the Northern Snakeheads captured and removed from Game Creek in 2017.

A total of 69 Largemouth Bass were collected during 2.0 hr of electrofishing. The CPUE of 33 bass/hr for stock size bass indicates a good population density. The PSD of 62 and PSD-P of 28 indicate the population is balanced. The largest bass collected measured 530 mm and weighed 2.71 kg. Stocking a supplemental YOY Largemouth Bass should be stocked on a bi-annual basis to offset the impacts of tournament mortality. Stocking should be completed at a stocking rate of 25/acre. Monitoring and removal of Northern Snakeheads should continue to determine and reduce any negative effects associated with the introduction of a nonnative species. (Smith)

Greenwood Lake (Passaic) – This is a 1,920-acre lake located on the border of New York and New Jersey in Passaic County. From about 1900 to the late 1950's, the lake was intensively managed as a warmwater/coolwater fishery. From 1958 to 1991 New Jersey and New York cooperatively managed the lake as a two-story fishery. During the early to middle part of this period, Greenwood Lake was noted for its good holdover Brown Trout fishery. By the late 1980's, as water quality deteriorated, the holdover trout fishery disappeared. The lake has excessive nutrients, frequent alga blooms, and an overabundance of rooted aquatic vegetation, which is actively managed for by the Greenwood Lake Commission. It was considered one of the best Largemouth Bass fisheries in the state, hosting numerous bass tournaments. However, in 2002 and 2003 Centrarchid surveys conducted by the New York Department of Conservation (NYDEC) indicated very low catch rates of Largemouth Bass, and in 2007 Largemouth Bass Virus (LMBV) was found. In an attempt to increase the abundance of Largemouth Bass in the lake, NJDFW has stocked over 60,000 two-inch fingerlings between 2012 and 2017. During sampling in 2016, to assess the Musky and Walleye populations, it was observed that the Largemouth Bass population was still low in abundance.

In collaboration with the NYDEC, a total of 6 hr of nighttime electrofishing was conducted on 4 nights between May 15, 2017 and June 1, 2017 to assess the Largemouth Bass population. A total of 58 Largemouth Bass of stocked size or greater (>200 mm) were collected (62 total) for a catch per unit effort (CPUE) of 10 bass/hr. This low catch rate is an indication that the population is still very low in abundance. The proportional size distribution (PSD) of 84 indicates that the average sized Largemouth Bass caught in Greenwood is of a quality size and 26% of those captured reached a preferred size of 15 inches. Growth rates for Largemouth Bass collected (n=32) are generally average compared to statewide averages as indicated by the length at age graph (see figure below).



Length at age of Largemouth Bass in Greenwood Lake determined by scale aging and Fraser-Lee methods (standard age values suggested by Carlander, 1982).

A total of 151 Walleye of stocked size (>250 mm) were captured during this survey for a CPUE of 25 Walleye/hr. This catch rate is an indication that the population of Walleye is highly abundant and reaching good sizes in Greenwood Lake. Almost half (45%) of the Walleye captured exceeded 20 inches. A number of factors may be influencing this imbalance. Walleye and Largemouth Bass are known to be inversely related to each other when it comes to their interspecific species interaction. Typically, balance is extremely difficult to achieve and one will out-compete the other when conditions or circumstance turns in favor of the other. A result of LMBV and the subsequent population decrease of Largemouth Bass could have led to an increase in the Walleye population through filling a habitat niche that was previously occupied by Largemouth Bass and direct competition. Smallmouth Bass were also captured during this survey at a rate of 17 Smallmouth Bass/hr. The number indicates a low to moderately abundant population.

Twin Smallmouth Bass from Greenwood Lake.

Additionally, the data collected indicates that White Perch are the most abundant forage composing 35% of the total catch and a total of 261 captured. The next most abundant forage was Bluegill Sunfish composing 6% of the total catch and a total of 47 captured. White Perch tend to form large populations that can dominate the waters they inhabit because of their large reproductive potential. Multiple states have attempted to reduce populations of White Perch, but have had limited success. Additionally, White Perch are not a favored forage of any predator found in Greenwood Lake which only compounds the problem and leads to their proliferation. It seems unlikely that stocking Largemouth Bass alone will accomplish balance in this fishery and through research of management practices in other states, it seems unlikely that balance can be accomplished between Walleye and Largemouth Bass. Walleye are popular in Greenwood Lake and many anglers target them. The best approach may be to manage for one or two species rather than a balanced fishery for all game fish. Muskellunge and Walleye are abundant in Greenwood Lake and Smallmouth Bass are in low to moderate abundance. In 2018, in collaboration with NYDEC, a management strategy for Greenwood Lake will be developed. (Collenburg)

Lake Lenape (Atlantic) – Lake Lenape is a 350-acre impoundment of the Great Egg Harbor River located in the town of Mays Landing. The lake has a fish ladder with successful anadromous fish passage documented. Atlantic County Parks maintains a public boat ramp which provides angler access. A lake inventory and management plan was completed in 2006. 2,698 fingerling Largemouth Bass were stocked on August 6, 2015. 4149 fingerling Largemouth Bass were stocked on September 6, 2013, and an additional 5000 on July 5, 2013. A day time boat electrofishing survey was conducted on October 23, 2017 to assess the Largemouth Bass population. Total electrofishing time was 91 minutes. A total of 32 Largemouth Bass were collected, indicating a CPUE of 21 bass/hr. A PSD of 80 and PSD-P

56 of were calculated indicating an unbalanced population. A Largemouth Bass measuring 530mm (20.8 in.) and weighing 2.49kg (5.5 lbs.) was collected during the survey. Lake Lenape appears to have a low density Largemouth Bass population comprised of large individuals. Habitat within the lake is limited and appears to be negativity impacting recruitment of Largemouth Bass into the fishery. The majority of suitable habitat is found in the upper end of the lake which is influenced by the Great Egg Harbor River. Winter drawdowns, and abundant boat wakes have significantly reduced main lake habitat availability. Most of the littoral zone is bare sand, devoid of any aquatic vegetation as a result. Water chemistry was collected and pH measured 6.71. Historical records indicate extremely acidic conditions once existed within the lake. However, pH over the past 17 years averages out to 6.11, which is well within the tolerable range of Centrarchids. Artificial habitat in the form of brush piles, which serve to concentrate fish may be beneficial to anglers in the short term, have been implemented in the past. Unfortunately, they provide little benefit to the overall fishery and will do little to increase recruitment or provide a long-term habitat solution. The forage base appears adequate and is made up of Bluegill, Golden Shiner, and Gizzard Shad. Additional sampling of the Largemouth Bass population is needed to help determine future stocking recommendations. Management geared towards habitat improvement and the benefit of the Largemouth Bass population should continue as Lake Lenape is a very popular recreational fishery in Southern New Jersey. (Boehm)

Maskell's Mill Pond (Cumberland) – Maskell's Mill Pond is a 33-acre impoundment located near the town of Canton. The lake is a WMA and a small gravel boat ramp provides public access. A lake inventory was previously completed in 1997. This lake was last sampled in 2013 following a dam repair project in 2011. An electrofishing survey was completed on June 27, 2017 to assess the fish population. A total ten species of fish were collected including Largemouth Bass (51), Black Crappie (23), Bluegill (27), White Perch (12), Chain Pickerel (7), Yellow Perch (32), Golden Shiner, and Brown Bullhead (1), American Eel (65) and Pumpkinseed (23). The CPUE for stock size Largemouth Bass was 30 fish/hr based on the 1.36 daytime electrofishing survey. A seining survey was also completed on June 27, 2017 to assess the reproduction of the warmwater fish population. Additional stocking is not recommended at this time. (Smith)

Newton Lake (Camden) – Newton Lake is a 40-acre impoundment of Newton Creek bordered by Collingswood, Oaklyn and Haddon Township. Greater than half of the lake's shoreline, including the boat ramp, is maintained by the Camden County Parks System. Private residences border the rest of the lake. 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 August 10, 2017 to evaluate the Largemouth Bass and Northern Snakehead populations. A total of 23 Largemouth Bass were collected, of which all were greater than the 200 mm (8 in.) stock size. The CPUE was 14 bass/hr based on 1.57 hr of daytime electrofishing. The largest bass measured 492 mm (19.37 in.) and weighed 2.314 kg (5.10 lbs.). A PSD of 78 and PSD-P of 43 indicate a slightly unbalanced population. A total of three Northern Snakeheads were collected ranging in size from 470 -

680 mm (12.6 - 26.6 in.). Submerged aquatic vegetation, in the form of Hydrilla, was determined to be extremely abundant in 2016, however was absent this year. The overall CPUE of Largemouth Bass and Northern Snakehead appear to both have been impacted by the reduction of aquatic vegetation. The lake will continue to be monitored for the presence of Northern Snakeheads and any impact they may have on the Largemouth Bass population. (Smith)

Pemberton Lake (Burlington) – A boat electrofishing survey was completed at Pemberton Lake WMA on October 17, 2017 to evaluate the Largemouth Bass population. A total of 26 bass were collected in 1.04 hr of daytime electrofishing. The CPUE for stock size bass was 21 bass/hr. A PSD of 36 and PSD-P of 13 indicate the population is unbalanced. The largest bass collected measured 506 mm (2.17 kg). Electrofishing surveys conducted in 2014 and 2009 resulted in CPUEs of 11 and 37 bass/hr. An electrofishing survey conducted in 1994 had similar results but no runtime was recorded to calculate the CPUE. Bass have been relocated to Pemberton Lake twice from fish salvages and appear to have helped the bass population for a short time. The bass population appears to struggle, potentially from high angler harvest, poor habitat, and persistent algae blooms. A total of 9,759 Largemouth Bass were stocked between 2014 and 2015. A total of 30 Largemouth Bass were collected from 20 seining sites indicating a mean of 1.5 bass/site. Seining surveys in 2010 and 1996 resulted in rates of 2.3 and 5.7 bass/site. Largemouth Bass should be stocked in 2018 to offset the limited reproduction documented during the 2017 seining survey. Pemberton Lake is a shallow borrow pit and lacks habitat to sustain a good bass population. Habitat should be increased by felling shoreline trees. (Smith)

Perrineville Lake (Monmouth) – A daytime electrofishing survey was completed at Perrineville Lake, located in Millstone Township, on May 4, 2017 to assess the warmwater fish population. Perrineville Lake is located within the Millstone River drainage and owned by Monmouth County Parks. A small gravel boat ramp and shoreline access along the dam provide ample fishing opportunities for anglers. This approximately 15-acre impoundment of Rocky Brook appears to have a good diversity with 11 species collected including; Largemouth Bass, Bluegill, Black Crappie, Pumpkinseed, Yellow Perch, Chain Pickerel, Brown Bullhead, American Eel, Common Carp, Golden Shiner, and Eastern Mudminnow. The majority of Bluegill and Yellow Perch collected were large individuals. The lake appears to have good habitat including submerged aquatic vegetation, yellow water lily, and felled trees. A total of 38 Largemouth Bass were collected in 30 minutes of electrofishing. The population appears to be balanced based on a PSD of 62, PSD-P of 30 and PSD-M of 11. The two largest bass collected weighed 3.17 kg (6.99 lbs.) and 2.75 kg (6.07 lbs.) and measured 550 mm (21.7 in.) and 532 mm (20.9 in.).

The heaviest Largemouth Bass collected by DFW staff during field sampling in 2017 came from Perrineville Lake.

An additional boat electrofishing survey was completed at Perrineville Lake on October 31, 2017 to evaluate the Largemouth Bass population. A total of 35 bass were collected during 0.65 hr of electrofishing. The CPUE of 52 bass/hr for stock size bass suggests a good density. Extrapolated CPUEs for surveys less than one hr standard electrofishing time may be skewed on small ponds. The PSD of 53 and PSD-P of 20 indicate the population is balanced. A PSD-M of 11 suggests the population is of trophy status. The three largest individuals collected were 539 mm (2.73 kg), 535 (2.88 kg), and 540 mm (3.17 kg). Supplemental stocking of Largemouth Bass should be considered to offset the high harvest from shoreline anglers. Conservation officers report frequent encounters with unlicensed anglers harvesting bass and panfish. The lowly water milfoil and felled trees provide good cover for Largemouth Bass. The forage base appears to be sufficient based on the robustness of the bass. (Smith)

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 for Prospertown Lake 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. Prospertown Lake is a popular location for the increasing number of kayak fishermen in the state and provides them with a unique "paddle only" water to fish, as both electric and gas motors are not allowed. A boat electrofishing survey was completed at Prospertown Lake on February 24, 2017 to evaluate the Largemouth Bass population. A total of 105 Largemouth Bass were collected in 1.75 hr of daytime boat electrofishing. The CPUE for those bass greater than 200 mm (8 in.) stock size was 59 bass/hr. A PSD of 95 and PSD-P of 55 indicate an unbalanced population, but one that meets the criteria for a trophy bass fishery. The PSD and PSD-P were both higher than that observed in 2016 (PSD of 80 and PSD-P of 44) and from 2015 (PSD of 50 and PSD-P of 25).

An additional boat electrofishing survey was completed at Prospertown Lake on September 17, 2017 to evaluate the Largemouth Bass population. A total of 12 Largemouth Bass were collected in 1.02 hr of daytime boat electrofishing. The CPUE for those bass greater than 200 mm (8 in.) stock size was 8 bass/hr. A seining survey was completed on June 29, 2017 to assess the reproduction of Largemouth and evaluate the native pinelands fishes. No additional stocking is required at this time. Additional sampling is recommended to monitor the Largemouth Bass population and remove the overly abundant number of Brown Bullheads from the lake. Future management should focus on maintaining the Largemouth Bass fishery. (Smith)

Rising Sun Lake (Monmouth) - Rising Sun Lake is a 38-acre impoundment located within the Assunpink WMA near the town of Roosevelt. The bass population in Rising Sun Lake was suspected to have been impacted by Largemouth Bass Virus, based on poor angler success for many years. The lake was stocked with supplemental Largemouth Bass in 2011. Boat electrofishing surveys have been completed annually from 2014-2016 to monitor and assess the bass population. Catch rates are rather high and the size structure is out of balance, although some improvement has been made in the last two years. Most individuals are still less than the preferred size (15 in.). Past surveys have been completed during the

summer and fall. A spring survey was completed in an attempt to capture large spawning females.

A daytime boat electrofishing survey was conducted on May 8, 2017 to assess the Largemouth Bass population. Sampling occurred around the perimeter of the lake. Approximately 60-70 Largemouth Bass were collected in 45 minutes of electrofishing. Lengths and weights were not collected on those individuals; however general observations were made of the overall condition. Bass appeared to be in average condition; individuals were released back to the lake as to not disrupt spawning activity. Only one individual greater than 380 mm (15 in.) was collected and weighed approximately 5.5 lbs. Recommendations include increasing the forage base by stocking Yellow Perch and removing approximately 50-100 Largemouth Bass in the 8-12 in size range to increase growth rates of the remaining bass. (Smith)

Ryker Lake (Sussex) – On October 30, 2017 a daytime boat electrofishing survey was conducted to evaluate the fishery. The 30-acre waterbody is located within the Sparta Mountain Wildlife Management Area, has a special Conservation Regulation (7-inch minimum size on sunfish and 10 combined daily limit), and there is project to remove the invasive water chestnut from the lake. The last survey conducted was in 1998. Extensive sampling was done at this time to follow up on reports of larger than average panfish. The survey conducted this year found Yellow Perch, Bluegill, and Chain Pickerel in abundance and of large sizes as well. This survey was conducted, in part, to understand what affect the conservation regulation has on the sunfish population. Data that was collected this year found large Bluegill Sunfish, Pumpkinseed Sunfish, and Yellow Perch as you can see in table below

Big Bluegills from Ryker Lake.

Stock distribution indices for daytime fall electrofishing at Ryker Lake.

Species (w/ accepted PSD ranges)	Size (mm)	Number	PSD	95% CI	PSD_p	PSD_m
Bluegill (20 - 60)	≥ 80	15	87	26	73	0
	≥ 150	13				
	≥ 200	11				
	≥ 250	0				
Pumpkinseed	≥ 80	10	80	38	0	0
	≥ 150	8				
	≥ 200	0				
	≥ 250	0				
Yellow perch (30 - 50)	≥ 130	8	100	13	88	88
	≥ 200	8				
	≥ 250	7				
	≥ 300	7				

Quality Ryker Lake Panfish.

The PSD values for all three species are high, which indicates that the captured fish are larger than average. The PSD-P of 73 for Bluegill indicates that 73% of those captured are larger than 200 mm (7.8 in.). Eighty-one percent of those captured were larger than 5 inches. Sixty-six percent of Pumpkinseed Sunfish were larger than 5 inches and 88% of Yellow Perch were greater than 7 inches. Results from previous surveys conducted in the fall of 1997 and summer of 1998 found 82% of Bluegill Sunfish were larger than 5 inches, 84% of Pumpkinseed Sunfish were larger than 5 inches, and 50% of Yellow Perch were greater than 7 inches. The size distribution of sunfish species does not appear to have changed since the regulation has been enforced, but Yellow Perch size distribution has changed. Sizes of Yellow Perch have seen an increase in sizes since surveys in the late 90's. No minimum size with a limit of 10 per day is the current regulation on Yellow Perch. A total of 14 Largemouth Bass were captured during sampling but at a low catch rate of 15 Largemouth Bass/hr. However, the fishery appears to be well rounded and balanced with a number of different opportunities. The Yellow Perch, for instance, are abundant and large providing another great experience for anglers. Additional data will be collected to monitor this population and regulation in the future. As it was stated earlier, the lake also has excessive vegetation growth and plans are in place to continually manage the water chestnut found here. (Collenburg)

Salem Canal (Salem) – A boat electrofishing survey was completed at Salem Canal on August 9, 2017 to evaluate the Largemouth Bass and Northern Snakehead populations. A total of 60 Largemouth Bass were collected during the 1.86 hr daytime survey. The CPUE for stock size bass greater than 200 mm was 55 bass/hr. A PSD of 43 and PSD-P of 7 suggest the population is slightly unbalanced. Salem Canal is one of the most popular Largemouth Bass tournament locations in the state. Increased tournament mortality appears to be reducing the overall number of Largemouth Bass in the canal while increasing the size of individual fish. Stocking of supplemental YOY Largemouth Bass is recommended on a bi-annual basis to offset the impacts of tournament mortality. Stocking should be completed at a stocking rate of 25 fish/acre. Monitoring and removal of Northern Snakeheads should continue to reduce any negative effects associated with the introduction of the species. A similar survey was completed on Game Creek, a tributary of Salem Canal later in the year. Both waters are managed collectivity. (Smith)

Sheppard's Mill Pond (Cumberland) – An electrofishing survey was completed at Sheppard's Mill Pond on July 26, 2017 to assess the fish population. The 58-acre lake is a newly acquired WMA and part of the Cohansey River WMA. A small sand boat launch is present and provides public access. A total of eight species of fish were collected during the survey including Largemouth Bass (39), Black Crappie (23), Bluegill (14), White Perch (38), Chain Pickerel (8), Yellow Perch (66), Golden Shiner (8), and American Eel (40). Prior to the acquisition by Green Acres, Sheppard's Mill was privately owned and in recent years the dam was replaced. The shoreline is primarily forested, excluding the three residences along the southeastern shoreline. In-water habitat is limited to a few felled trees and sparse

unidentified submerged aquatic vegetation. A few clumps of spadderdock were also present. A number of the Largemouth Bass and Black Crappie collected were rather thin and appeared to be malnourished. The adult White Perch collected were removed from the lake, as the species is undesirable in small sterile ponds and will directly compete with the bass population.

Sheppard's Mill Pond is a perfect candidate for active fisheries management consisting of habitat enhancement and stocking. Overharvest and exploitation, common on newly acquire waters once they become public may have negativity impacted the recreational fishery. As such, approximately 2,500 YOY Largemouth Bass were stocked on August 9, 2017, and adult Bluegill and Fathead Minnows were stocked later in the month. A seining survey was also completed at Sheppard's Mill Pond on July 26, 2017 to assess the reproduction of the warmwater fish population. An electrofishing survey will be completed again during the spring of 2018 to further evaluate the condition of the bass and sunfish population. Additional stocking of Largemouth Bass, Bluegill, and Golden Shiner is anticipated for 2018. (Smith)

Selover's Millpond (Middlesex) - A daytime boat electrofishing survey was conducted in Farrington Lake (223 ac) and Selover's Millpond (3 ac) on May 23, 2017 to check Largemouth Bass for possible PCB toxicity. A hydraulic fluid spill occurred in Selover's Millpond, an onstream impoundment of the Lawrence Brook in October 2016. It was determined that high PCB levels were detected and as a result, the Division closed a 1.6-mile section of Lawrence Brook, from Riva Avenue bridge down to Ryders Lane. In order to determine if the fish are healthy to eat, 10 Largemouth Bass were collected from the site of the spill (Selover's Millpond) and 10 were collected from Farrington Lake (upstream to serve as a control). Live fish were provided to the Division's fish pathologist Jan Lovy, who prepared the fish tissue and sent it out to a private laboratory for PCB analysis, that determined PCB levels in the fish tissue were at safe levels.

It took 3,614 seconds (1.0 hr) to collect 10 legal (greater than 12 inches) Largemouth Bass. They ranged from 302 - 424 mm (11.9 – 16.7 in.) the largest of which weighed 1.550 kg (3.4 lbs.). Two Largemouth Bass exhibited a characteristic known as "melanism," in which an accumulation of pigment occurs in the superficial tissue, presenting distinct black blotches all over the fish. Although believed to be non-harmful, some believe the melanistic tissue may be a precursor to a form of skin cancer. This specimen and one other from Farrington Lake were retained and dissected by Dr. Lovy. It was determined that the blotches were very superficial (with no penetration into the muscle tissue) and not indicative of any concerns of malignancy. Other fish species observed included Bluegill, Pumpkinseed, Black Crappie, Chain Pickerel, White Perch, Yellow Perch, Creek Chubsucker, Golden Shiner, Brown Bullhead, and American Eel. No additional fish tissue surveys are necessary at this time. (Crouse)

Splitrock Reservoir (Morris) – On November 6, 2017 a nighttime boat electrofishing survey was conducted on Splitrock Reservoir 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 public access. A lake inventory was conducted 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 40.3 stock size or larger fish/hr and 52.3 stock size or larger fish/hr, respectively). At that time, it was determined that the lake should be managed strictly for its excellent bass fishery. A survey conducted last year (2016) lasted 2 hr 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. The CPUE (17.6 Largemouth Bass/hr and 5 Smallmouth Bass/hr) was much lower than when the last survey was conducted here. The survey conducted this year lasted 1.3 hr and found a total of 9 Largemouth Bass and 1 Smallmouth Bass. Again, a low CPUE. The cause of the decrease in bass may be due to multiple factors including sampling time. More surveys will need to be conducted until any action is taken. (Collenburg)

Stephens Lake (Atlantic) – Stephens Lake is an impoundment of South River a tributary of the Great Egg Harbor River. The lake is located within Stephens Lake WMA in the town of Estell Manor. The lake is 28 acres in size and a public boat ramp provides angler access. A daytime boat electrofishing survey was conducted on October 23, 2017 to assess the Largemouth Bass population within the lake. Total electrofishing time was 38 minutes. A total of 25 Largemouth Bass were collected, indicating a CPUE of 39 bass/hr. Largemouth Bass ranged in size from 215 mm to 365 mm (8.46 - 14.3 in.). A PSD of 64 and PSD-P of 0 were calculated indicating an unbalanced Largemouth Bass population. Chain Pickerel (21), Bluegill (9), Pumpkinseed (3), Yellow Perch (6), Yellow Bullhead (1), and Pirate Perch (2) were also collected. American Eel and Creek Chubsucker were observed but not collected. Yellow Perch were all large adult individuals that ranged in size from 330 mm to 361 mm (12.9 - 14.2 in.).

A boat electrofishing survey was last conducted on August 14, 2013. Total electrofishing time was 45 minutes. A total of 23 Largemouth Bass were collected, indicating a CPUE of 30 bass/hr. A PSD of 86 and PSD-P of 0 were calculated from the 2013 survey data indicating an unbalanced Largemouth Bass population. Results from the past electrofishing surveys indicate the Largemouth Bass fishery has reminded relatively the same overtime. 2,500 fingerling Largemouth Bass were stocked on July 5, 2013. The catch rate of Largemouth Bass appears to only have slightly increased with this stocking. Suitable habitat, and lack of forage appear to be the primary limiting factors, however mortality associated with angling maybe impacting the bass population as well. Fingerling Largemouth Bass stocked in 2013 would be 4-year-old fish in 2017 and of legal size to harvest. The stocking of Bluegill and Golden Shiner is recommended to improve the fishery and increase the forage base. Stocking of additional Largemouth Bass is not recommended unless the forage base improves. Removal of the large Yellow Perch may be beneficial to reduce competition with Largemouth Bass. Sampling for native pinelands fishes was also conducted on June 26, 2017 using a 20 x 4 ft seine. (Boehm)

Sunset Lake (Cumberland) - Sunset Lake is 88-acre impoundment of the Cohansey River located in Bridgeton. The dam failed in 2012 and remained lowered for nearly three years. Prior to the dam failure, Sunset Lake had an excellent Largemouth Bass population and was regarded as one of the best bass populations in Southern New Jersey. The habitat in Sunset Lake has changed rather significantly after the dam failure. The lake is much shallower as a result of heavy sediment deposition from an upstream impoundment that also failed. The

Town of Bridgeton has also installed a Clean Flow aeration system, without the consultation of Fish and Wildlife. This system has been observed at other locations to increase turbidity, while providing little increase in dissolved oxygen levels. A dam reconstruction project was completed in early 2015 and the lake was restocked with Largemouth Bass and Bluegill that summer. Growth rates of Largemouth Bass appeared to be good when sampled in October 2015.

A daytime boat electrofishing survey was completed on May 10, 2017 to assess the Largemouth Bass population. A total of 48 bass were collected, all of which were greater than the 200 mm stock size. The CPUE was 48 bass/hr based on 1 hr of electrofishing. A PSD of 42 and PSD-P of 6 indicate the population is unbalanced. However, a more pressing issue was discovered during the survey. Common Carp were observed to be extremely abundant, and appear to make up the bulk of the biomass within this lake. Approximately 500-1,000 carp were observed and 150 were removed during the survey.

An additional daytime boat electrofishing survey was completed on May 24, 2017 to further evaluate the Common Carp population. An additional 372 Common Carp were collected and removed from the lake. Supplemental electrofishing is recommended to remove more undesirable Common Carp from the lake which will allow the Largemouth Bass population to improve. Additional stocking of Largemouth Bass is also recommended in 2018. (Smith)

Union Lake (Cumberland) - Union Lake is an 898-acre impoundment of the Maurice River located within the Millville WMA. The lake is one of the largest impoundments in Southern New Jersey and one of the most utilized WMA's in the state. A boat electrofishing survey was completed at Union Lake WMA on February 27, 2017 to evaluate the Largemouth Bass population. A total 101 Largemouth Bass were collected during the 1.83 hr survey. The largest individual was 550 mm (21.7 in.) and 3.052 kg (6.7 lbs.). The CPUE for those bass greater than 200 mm (8 in.) stock size was 54 bass/hr. A PSD of 91 and PSD-P of 62 indicate an unbalanced population but one that meets the criteria for a trophy bass fishery. Willis et al. 1993 suggests that a Big Bass lake would have a PSD of 50-80 and a PSD-P of 30-60 and PSD-M of 10-25.

Union Lake Largemouths (left) and Smallmouth (right).

A lake inventory was completed on Union Lake in 2015, but failed to adequately assess the Black Crappie and Smallmouth Bass populations. A boat electrofishing survey was completed on May 17, 2017 to evaluate the Smallmouth Bass Population, which is rather difficult to sample in Union Lake. The 2015 lake inventory only produced 11 Smallmouth Bass from six electrofishing surveys, totaling 9.35 hr of sampling time. Four Smallmouth Bass were collected from 1.5 hr of daytime electrofishing on May 17, 2017. Smallmouth ranged in size from 346 – 513 mm. Ironically, the largest smallmouth was previously collected on February 27, 2017 during a prior sampling event. A distinguishing mark was present on the operculum. A total of 16 Largemouth Bass were collected ranging in size from 214 – 505 mm. The largest of which weighed 2.12 kg (4.67 lbs.). Catch rates were consistent with previous daytime surveys conducted after spawning had occurred, when most individuals return to deeper waters. Stocking of Smallmouth Bass is recommended in the future.

A boat electrofishing survey was completed on November 3, 2017 to evaluate the Largemouth Bass population. This was the third electrofishing survey for Union Lake in 2017. A total of 53 Largemouth Bass were collected during 1.27 hr of electrofishing. The CPUE was 41 bass/hr for stock size bass suggests a good density. The PSD of 96 and PSD-P of 67 indicate the population is unbalanced, however as mentioned during previous surveys the population distribution is consistent with a "Big Bass" lake. A PSD-M of 4 suggests the population is of trophy status. The three largest individuals collected were 530 mm / 2.61 kg, 530 mm / 2.52 kg and 550 mm / 2.608 kg.

An additional electrofishing survey was completed on November 6, 2017 in conjunction with a Facebook Live broadcast. With the assistance of Matt Hencheck and Jon Carlucci, the Bureau of Freshwater Fisheries successfully completed an electrofishing survey while on Facebook live. The live coverage lasted approximately 25 minutes, until the signal was lost. The broadcast was originally slated for approximately 30 minutes. The video posted to the Division's website had received over 10,500 views in four days. The survey was modified to accommodate the extra personnel on the boat and the allotted live coverage time. Despite the modification, the survey successfully replicated the sampling results from three days prior. A total of 25 Largemouth Bass were collected in 1.07 hr of daytime electrofishing. The CPUE for stock size bass was 23 bass/hr. The PSD of 92, PSD-P of 64, and PSD-M of 4 suggest the population is of Big Bass status.

The Largemouth Bass population appears to have significantly improved in a very short time. The 2015 lake inventory resulted in an overall CPUE of 19 bass/hr with the highest individual CPUE of 37 bass/hr observed in November of that year. In 2017 the CPUEs for stock bass were 54, 41, and 23. The PSD, PSD-P have also improved since 2015. The spring 2015 PSD was 82 and PSD-P was 32; Fall 2015 was 76 and 44 respectively. The 2017 PSD values were 91, 96, and 92 and PSD-P were 62, 67, and 64. These trophy bass do not appear to be caught very often based on the physical condition of the fish with few hook or handling scars. Supplemental stocking of Largemouth Bass should be continued on an annual basis to maintain this outstanding bass population. A seining survey was completed on July 18, 2017 to evaluate reproduction of Largemouth Bass and evaluate the native fish population. Additional sampling is planned for and 2018 to further assess those populations. (Smith)

Warinanco Park Pond (Union) - As part of Union County's 2017 BioBlitz, a boat electrofishing survey was conducted in Warinanco Park Pond on June 17, 2017. This 8-acre pond, located in Roselle, in situated within a recreational park setting in the center of a densely developed residential area. This park is heavily used. The relatively shallow pond is encircled by a walking path and a road. The Environmental Specialist within the Union County Department of Parks and Recreation has made progress in recent years to establish a vegetated buffer around the majority of the pond's edge. The pond is stocked annually with more than 400 Rainbow Trout as a put and take fishery and will not support trout through the summer months. It is also stocked with 30 - 40 Channel Catfish annually that range in length from 10 - 16 in. Nine fish species were collected during 2,497 seconds (0.7 hr) of daytime boat electrofishing. All fish were netted for the first 15 minutes. During this time, native species captured included Brown Bullhead (103), Pumpkinseed (59), and Golden Shiner (7) and non-native species included Bluegill (13), the invasive Green Sunfish (8), Black Crappie (4), Channel Catfish (3), Common Carp (2), and Koi (1). No Largemouth Bass were collected in Warinanco Park Pond. Unfortunately, the pond was dominated by Brown Bullheads, consisting of 103 of the 200 fish collected (52%). The average Brown Bullhead was 156 mm (6.1 in.) in length. The presence of 4 hybrid sunfish was not surprising, considering the turbid water conditions. During the remaining 1,597 seconds (0.44 hr) sunfish and bullheads were not collected and only 4 Black Crappie, 2 Channel Catfish, and 1 large American Eel were collected. As a result of this survey, the Division of Fish and Wildlife may consider removal of Brown Bullheads and plans to stock Largemouth Bass to provide improved recreational opportunities for anglers. (Crouse)

Healthy Black Crappie (left) and Brown Bullhead infested with the parasite know as Yellow Grub (right).

Warmwater Fisheries Assessments / Reproduction Checks / Native Fishes via Seining

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

A seine is a small rectangular net used to collect fish in shallow water. The typical size used by NJDFW is 20 ft x 4 ft. A two-person team, one at each end, pulls the seine through the water when sampling. The net extends horizontally from the surface of the water to the bottom of the lake. Floats attached to the top keep the net on the surface, and weights attached to the bottom keep the net on the bottom. Seines are an effective sampling method used to assess the status of warmwater fish reproduction, which aids in the management of their fisheries and helps assess stocking success or need. Seines also provide a means to sample fish populations in waters that are not easily accessible or conducive to standard electrofishing methods, such as waters with extremely low conductivity. The data gathered from seining surveys is also beneficial in documenting the presence of unique native species as well as invasive species, that can often be missed when sampling with other gear types. A total of 43 lakes and ponds were seined in 2017 during the months of June through early-October. (Hunter and Angler Fund)

Baldwin Lake (Mercer) - A reproduction check was conducted using a 20'x4' seine on Baldwin Lake (14 ac) within the Baldwin Lake WMA on July 24, 2017. This lake is surrounded by residential properties on its northern side and has limited access along its southern side for shoreline angling. The lake has no boat launch and is accessible by foot 0.3 miles from the southeast and 0.5 miles the southwest via wooded paths. Only on-street parking is available. Baldwin Lake has been treated for several years with an herbicide to control the invasive Water Chestnut. Eight seines pulled, yielding an average of 56 Bluegill young-of-the-year (YOY) and 1.6 Largemouth Bass YOY per seine. Other species collected include limited numbers of Pumpkinseed, Black Crappie, Yellow and Brown Bullheads, Banded Killifish, and Green Sunfish (invasive). No native fish of conservation concern were encountered. Seining was difficult due to soft substrate consisting of mud and woody debris and a variety of vegetation including cattails, duck weed, filamentous algae, and unidentified species of pondweed. Herbicide treatments appear to be working to limit water chestnut, as no plants were observed, however seedpods were abundantly found at every seining site. No stocking is necessary at this time. (Crouse)

Batsto Lake (Burlington) – Batsto Lake is a 71-acre impoundment of the Batsto River located within Wharton State Forest in Washington Township. The lake has a fish ladder due to the presence of anadromous river herring. A lake inventory and management plan was completed in 2007. Sampling for native pinelands fishes was conducted on June 27, 2017. A total of 20 locations were sampled around the perimeter of the lake using a 20'x4' seine. A total of 8 species were collected which included Blackbanded Sunfish (56), Bluespotted Sunfish (53), Banded Sunfish (3), unknown *Enneacanthus* sp. (13), Chain Pickerel (13), Swamp Darter (13), Creek Chubsucker (21), Largemouth Bass (2), and American Eel (1).

Water chemistry was recorded and pH measured 6.15. The Largemouth Bass fishery documented in the 2007 lake inventory appears to be in decline based on recent angler reports. The fishery is believed to have been supported by illegal angler introductions.

Seining Batsto Lake.

Water chemistry, in particular periodic fluctuations in pH to highly acidic levels not tolerated by Centrarchids, also contributed to the decline of the introduced Largemouth Bass population. Chain Pickerel, a game fish native to the Pinelands, make up the recreational fishery within the lake. Future management activities should be geared towards the preservation of the unique native fish assemblage which includes Blackbanded Sunfish, a species soon to be designated state Special Concern. Therefore, the stocking of fishes not native to the Pinelands region will not be considered in the future. (Boehm)

Blair Lake (Warren) - On August 31, 2017, Division staff performed a reproductive check on Blair Lake (3.3 ac) located in Blairstown NJ. The Lebanon Field Office was contacted this spring by the local tackle shop asking if we could stock fish in Blair Lake. Freshwater fisheries staff preformed this seining survey to determine if the lake could benefit from additional fish being stocked. Staff collected 5 Largemouth Bass and 56 sunfish in 8 seine pulls. The majority of sunfish collected were native Bluespotted Sunfish. This is unique as most New Jersey ponds outside of the Pine Barrens are dominated by *Lepomis* Sunfish (Bluegill), not the native Bluespotted Sunfish. In addition to this unique sunfish population an even more rare fish was found. Seven soon to be listed state Endangered Bridle Shiner were found. Bridle Shiner populations are very rare and have been declining throughout the state. The presence of the Bridle Shiner combined with the number of native sunfish collected shows that this waterbody is important for its unique fish assemblage and that care should be taken to protect these rare species. Therefore, it has been determined that no new stockings of non-native warmwater species will occur. (Shramko)

Cedar Lake (Atlantic) – Cedar Lake is an impoundment on the Great Egg Harbor River watershed. The lake is located within Cedar Lake WMA and is approximately 10 acres in size. This location was last sampled on July 14, 2016. Additional sampling for native pinelands fishes focusing on *Enneacanthus* sunfishes was conducted on July 19, 2017. A total of ten locations were sampled along the perimeter of the lake using a 20'x4' seine. Species collected included Blackbanded Sunfish a species soon to be designated state Special Concern (83), unknown *Enneacanthus* sp. (17), unknown *Lepomis* sp. (14), Swamp Darter (7), Pirate Perch (3), Bluespotted Sunfish (3), Eastern Mudminnow (1), and Golden Shiner (1). Water chemistry was recorded; pH measured 5.82. No further sampling is needed at this time and stocking is not recommended in the future. Limited potential exists to develop a recreational fishery, and future management should be geared towards the conservation of the native species present. (Boehm)

Citta Boy Scout Camp Pond (Ocean) - Citta Boy Scout Camp Pond is an impoundment of Oyster Creek located in Barnegat. The pond is approximately 12 acres in size and has not been sampled by NJDFW before. A general fisheries survey, at the request of camp personnel, was conducted on June 20, 2017. A total of 15 locations were sampled around the perimeter of the lake using a 20'x4' seine. Species collected included Largemouth Bass (21), Bluegill (1), unknown *Lepomis* sp. (33), Swamp Darter (171), Chain Pickerel (3), Creek Chubsucker (53), Bluespotted Sunfish (3), Banded Sunfish (2), and unknown *Enneacanthus* sp. (1). Adult, Intermediate, and YOY Swamp Darter were collected. Water chemistry was recorded and pH measured 5.57. A few adult Bluegill were observed on spawning beds. Stocking of 1,000 fingerling Largemouth Bass, 300 adult Bluegill, and 300 adult Brown Bullheads is recommended to enhance the existing fish population and provide added recreational potential to the scouts. (Boehm)

Clarks Pond (Cumberland) – Clarks Pond is a WMA Lake located in Fairfield Township, Cumberland County. A seining survey was completed on August 30, 2017 to evaluate the fish population. A total of 10 species were collected consisting of: Yellow Bullhead (3), Creek Chubsucker (12), Yellow Perch (4), Chain Pickerel (7), Golden Shiner (11), Banded Sunfish (6), Bluespotted Sunfish (8), Bluegill (55), Mud Sunfish, a species soon to be designated state Special Concern (2), Pumpkinseed (15), unknown *Enneacanthus* sp. (32), and unknown *Lepomis* sp. (4). The lake was last sampled in 1971. Clarks Pond is popular bass fishing location and receives multiple requests for WMA Fishing Tournament Permits annually. There were no YOY Largemouth Bass collected during seining. An electrofishing survey is recommended to further evaluate the population. Largemouth Bass should be stocked in 2018. (Smith)

Colts Neck Upper Municipal Pond (Monmouth) – In 2012 this pond was completely drawn down for dredging. The fish were salvaged. Upon refilling in 2013, the pond was stocked with Bluegill, Largemouth Bass, Black Crappies, and Brown Bullheads. Seining conducted in 2014 revealed low numbers of the abovementioned fish. At the request of the Municipal Recreation Director, a reproductive check was conducted at Upper Municipal Pond (4.4 ac) in Colts Neck on July 17, 2017. Sixteen seine (20'x4') hauls around the perimeter of the pond revealed Largemouth Bass (10) and Bluegills (28). In 2018, it is recommended that the hatchery stock Bluegills, surplus Channel Catfish, and Largemouth Bass. (Boriek)

Colts Neck Lower Municipal Pond (Monmouth) – In 2012 this pond was minimally drawn down. No fish salvage was required. At the request of the Municipal Recreation Director, a reproductive check was conducted at Lower Municipal Pond (1.6 ac) in Colts Neck on July 17, 2017. Eleven seine (20'x4') hauls around the perimeter of the pond revealed Largemouth Bass (18), Bluegills (10), and Chain Pickerel (1). In 2018, it is recommended that the hatchery stock Bluegills, surplus Channel Catfish, and Largemouth Bass. (Boriek)

Corbin City Impoundments (Atlantic) – Water chemistry was recorded at each of the 3 impoundments on July 19, 2017. Salinity ranged from 8.34 to 11.02 ppt. Mummichogs and Blue Claw Crabs were observed. Sampling for freshwater fish was not conducted. The impoundments are located within Tuckahoe WMA. No future freshwater fisheries management activities are planned for the impoundments due to the high salinity levels. (Boehm)

Country Lakes (Burlington) - Country Lake is a 151-acre impoundment of Pole Bridge Branch a headwater tributary of the North Branch of the Rancocas Creek located within Pemberton Township. A sand boat ramp provides public access once a permit is acquired from the township. Shoreline access is limited to just a few roads with bridge crossings. Private homes line the shoreline around most of the lake. Sampling for native pinelands fishes was conducted on August 31, 2017. A total of 14 locations around the perimeter of the lake were sampled using a 20'x4' seine. A total of ten species were collected which included Blackbanded Sunfish (56), Pumpkinseed (33), Banded Sunfish (25), Pirate Perch (20), Brown Bullhead (10), Yellow Bullhead (9), unknown *Lempois* sp. (4), Chain Pickerel (3), Black Crappie (2), and Swamp Darter (2). Water chemistry was collected and pH measured 5.26. Chain Pickerel are the primary recreational species within the lake and do well in acidic waters. Stocking of warmwater species is not recommended due to the native fish community present, which includes Blackbanded Sunfish, a species soon to be designated state Special Concern, and the low pH found within the lake. Additional sampling is not needed at this time. (Boehm)

Crystal Springs Preserve Ponds (Hunterdon) - Abbreviated surveys were conducted using a 20'x4' seine was conducted on October 17, 2017 at four ponds within the Hunterdon County Park system known as the Crystal Springs Preserve. This was initiated prior to the relocation of salvaged fish from nearby Beisler Lake (6 ac), Crossroads Outdoor Ministries, which is immediately downstream of Crystal Springs Preserve, in the headwaters of Spruce Run. Beisler Lake was lowered in anticipation of dam removal, as NJDEP Dam Safety indicated that the undersized spillway is not in compliance with standards. Little was known about the fish assemblages in the ponds within Crystal Springs Preserve, therefore the seining was conducted to identify potential concerns with the fish relocation. The four ponds were identified as Ponds A (1.9 ac), B (1.7 ac), C (1.0 ac), and D (2.5 ac) and were denoted from downstream to upstream. All ponds contained common warmwater species. Six seine hulls were performed at each pond. Pond A contained Largemouth Bass (1), Bluegill (81), and Yellow Perch (1). Pond B contained Bluegill (233) and Black Crappie (1). Pond C contained Bluegill (201), Pumpkinseed (2), unidentified sunfish of the *Lepomis* genus (205), and Black Crappie (4). Pond D contained Bluegill (16), Pumpkinseed (1), and unidentified sunfish of the *Lepomis* genus (359).

The fish salvage of Beisler Lake was conducted on November 6 and 7, 2017. A total of 3,289 fishes of 10 species were relocated and distributed evenly amongst Ponds A, B, and C. No salvaged fish were stocked in Pond D due to more difficult access. Bluegill composed 45% of all fish, followed by Largemouth Bass and Yellow Perch, each consisting of 10% of the total. Other fishes relocated include Pumpkinseed, Black and White Crappie, Brown Bullhead, Alewife, Golden Shiner, and White Sucker. Two Common Carp of the mirror carp variety were humanely destroyed, as required by permit. (Crouse)

Deal Lake (Monmouth) - Mud Sunfish (soon to be designated species of Special Concern) were collected in Deal Lake by NJDFW in 1951. On July 5, 2017 and July 12, 2017 seining was conducted to determine if Mud Sunfish were still present. A total of 35 seine (20'x4') hauls around the perimeter of the lake revealed Largemouth Bass (6), Bluegill (4), Pumpkinseed (2), *Lepomis* sp. (64), Black Crappie (5), Brown Bullhead (4), *Clupeid* sp. (145), Yellow Perch (1), Common Carp (41), Common Shiner (4), and Gizzard Shad (1). No

Mud Sunfish were collected. Shallow water, deep water, soft bottom, submerged debris, and rip-rap reduced the effectiveness of seining. Deal Lake experienced a fish kill in October 2012, when it was inundated with saltwater from Hurricane Sandy. When the lake's water recovered to freshwater in 2013, the Hackettstown Hatchery restocked the lake with a variety of fingerling warmwater fish. The fish population is still recovering. Anecdotal observations from a reliable Deal Lake angler / resident was that there was an increase in Alewife and Blueback Herring spawning in 2017. No future sampling is required. (Boriek)

East Creek Lake (Cape May) – East Creek Lake is a 69-acre impoundment of East Creek located within Belleplain State Forest. A sand boat ramp provides public access into the lake. Largemouth Bass (3,000) were stocked in 2001. The lake was last sampled for native pinelands fishes on August 4, 2016. Follow up sampling was conducted on July 11, 2017 to better access the *Enneacanthus* species present. A total of 23 locations were sampled around the perimeter of the lake using a 20'x4' seine. Species collected included Creek Chubsucker (257), Blackbanded Sunfish (154), unknown *Lepomis* sp. (145), Bluegill (47), unknown *Enneacanthus* sp. (32), Pumpkinseed (17), Golden Shiner (8), Largemouth Bass (5), Chain Pickerel (4), American Eel (1), Pirate Perch (1), Yellow Bullhead (1), and Yellow Perch (1). Water chemistry was recorded and pH measured 5.95. Blackbanded Sunfish, a species soon to be designated state Special Concern, were abundant once again, with 154 were collected this year and 111 last year. The high number of Blackbanded Sunfish collected is encouraging. Largemouth Bass reproduction and recruitment appears sporadic with only five young-of-the-year (YOY) collected. Additional sampling of the Largemouth Bass population and monitoring of the lake's pH level is needed to determine if continued stocking would be beneficial. (Boehm)

Egg Harbor Township Nature Reserve Lake (Atlantic) – Egg Harbor Township Nature Reserve Lake is a 29-acre waterbody located within Egg Harbor Township. The lake is located within the 220-acre Egg Harbor Township Nature Reserve and is an old sand quarry. A reproduction check at the request of the Nature Reserve board members was conducted on August 2, 2017. A total 20 locations around the perimeter of the lake were sampled using a 20'x4' seine. A total of four species were collected which included Largemouth Bass (64), Bluegill (22), Pumpkinseed (7), and Banded Killifish (1). All Largemouth Bass collected were YOY (young-of-the-year). YOY Largemouth Bass collected during seining indicates successful reproduction of the species; and is to be expected within a sand pond environment. However, no YOY Bluegill or Pumpkinseed were collected during sampling. The stocking of 500 adult Bluegill and 1,125 fingerling Largemouth Bass was conducted on August 15, 2017 to enhance the fishery. (Boehm)

Forge Pond (Ocean) – Forge Pond is a 35-acre tidal ponding area on the Metedeconk River located in the town of Brick. Sampling for native fishes was conducted on June 27, 2017. A total of 19 locations were sampled around the perimeter of the lake using a 20'x4' seine. Species collected included Brown Bullhead (150), Banded Killifish (109), Pumpkinseed (24), Atlantic Silverside (19), Largemouth Bass (17), Pirate Perch (12), Swamp Darter (11), Bluegill (10), Chain Pickerel (5), American Eel (5), Spottail Shiner (4), Yellow Perch (3), and Bluespotted Sunfish (1). All Brown Bullhead, Largemouth Bass, and Chain Pickerel collected were young-of-the-year (YOY). Atlantic Silversides are considered a marine species however, they can be found in brackish waters. Water chemistry was collected at the

boat ramp and upstream within the riverine portion of the Metedeconk River. Water chemistry at the boat ramp was; salinity 3.36 ppt, conductivity 6,129 us/cm, and pH 7.06. Water chemistry upstream within the river was: salinity 0.12 ppt, conductivity 238.4 us/cm, and pH 6.89. Based on the water quality data and fish species collected Forge Pond would be considered brackish water. However, salinities are still within the tolerable range freshwater species. A boat electrofishing survey in the Metedeconk River above the pond is planned for the future to better access the freshwater fishery if water chemistry conditions allow. (Boehm)

Franklinville Lake (Gloucester) – Franklinville Lake is a 33-acre impoundment of Little Ease Run a tributary of the Maurice River, located in the town of Franklinville. A dirt boat ramp at the upper end of the lake and Franklinville Lake Park next to the dam provide public access. Upper Maurice River tributaries are considered historic Ironcolor Shiner locations. Ironcolor Shiners are a species soon to be designated state Endangered and were last collected in the Maurice River drainage from Scotland Run below Malaga Lake in 2016. Sampling for native fishes was conducted on July 5, 2017. A total of 14 locations were sampled around the perimeter of the lake using a 20'x4' seine. A total of 7 species were collected which included Largemouth Bass (33), Bluegill (33), Pumpkinseed (4), Golden Shiner (78), Brown Bullhead (3), Blackbanded Sunfish a species soon to be designated state Special Concern (2), Chain Pickerel (1), and unknown *Lepomis* sp. (175). Ironcolor Shiners were not collected during the survey. Water chemistry was recorded and pH measured 6.45. Management activities should be geared towards the benefit of the existing warmwater fishery. Stocking of additional Largemouth Bass and Bluegill may be considered in the future to enhance the fishery. However, no stocking is recommended at this time. (Boehm)

Frelinghuysen Forest Preserve Pond #1 (Warren) – NJDFW was contacted in early 2016 by Frelinghuysen Township asking if the fish population could be monitored in this newly acquired pond. Division staff performed a reproduction check on the small 1.7 acre pond on July 29, 2016. Unfortunately, the high level of aquatic plants and low water conditions made it difficult to attain accurate information on the fish population and Division staff was only able to collect five Largemouth Bass and five Bluegill Sunfish. The pond was rescheduled to be sampled for 2017 when water conditions may be more favorable. On August 4, 2017, Division staff performed a second reproductive check on the small pond. The pond was dominated by plant growth again making sampling very difficult, but the water levels were higher and staff was able to complete a more intensive survey. The sampling crew performed eight seine pulls and captured Largemouth Bass (21), Bluegill Sunfish (121), Brown Bullhead (6), and Golden Shiner (1). The data collected shows a fairly good mix of Bass to Sunfish, but it was recommended that it should receive a small stocking of Bass and Sunfish to supplement the fishery. Later that summer, Frelinghuysen Forest Preserve Pond received a stocking of 850 Bluegill (2-7 in.), 550 Largemouth Bass (50 10-14 in. and 500 3 in.), 500 Black Crappie (3 in.), 500 Golden Shiners and 1,880 Brown Bullhead (3 in.). (Shramko)

One of eight seine pulls from Frelinghuysen Forest Preserve Pond #1.

Grover's Mill Pond (Mercer) - Shoreline seining was conducted at Grover's Mill Pond (28 ac), located in West Windsor Township, on June 20, 2017. A comprehensive survey at Grover's Mill Pond in 1952 found Ironcolor Shiners, Mud, Banded, Bluespotted, and Blackbanded Sunfishes, Swamp Darter, and Pirate Perch (among other more common species). Interestingly, in a report written in 1952, biologists acknowledged the almost entirely native fish assemblage consisting mostly of acid tolerant species typical of the Pine Barrens was present and that "no additional stocking should be made here." It was unique to find these fishes as far north in New Jersey as West Windsor. Unfortunately, records indicate Largemouth Bass, Black Crappie, and Channel Catfish (among other species) were stocked shortly thereafter. Many of the native species were lost by the time the next logged surveys were conducted in 1970. Surveys were conducted in 2004 (6 seine hulls), prior to a dredging project and native species of conservation concern were not encountered. Common non-native gamefish were encountered, as the only acid tolerant species found were Bluespotted Sunfish, Pirate Perch, Eastern Mudminnow, and Chain Pickerel. As a result, an assortment of warmwater species were stocked in 2009 to bolster the recreational fish population. When seined in 2012 (12 seine hulls), data indicated adequate sunfish (primarily Bluegill), Largemouth Bass, and Black Crappie reproduction was taking place, however Bluespotted Sunfish, Pirate Perch, Eastern Mudminnow, and Chain Pickerel were not encountered.

Similar results were reported in 2017 (14 seine hulls), through a cursory assessment of the existing fish assemblage. Unfortunately, many of the native species once found in this waterbody are no longer present, including the soon to be listed State Endangered Ironcolor Shiner, along with the Blackbanded Sunfish and Mud Sunfish, both soon to be listed State Species of Special Concern. It is believed, these observed trends are representative of the loss of native fishes and the homogenization of our fisheries within New Jersey. (Crouse)

Hammonton Lake (Atlantic) – Hammonton Lake is a 75-acre impoundment of Hammonton Creek a tributary of the Mullica River, located within the town of Hammonton. The lake is NJDFW trout stocked waterbody, that receives both spring and fall stockings. A lake inventory and management plan was completed in 2007 in which no *Enneacanthus* species were collected. *Enneacanthus* species were last documented within the lake in 2009 when six Bluespotted Sunfish and two Banded Sunfish were collected on August 17. Sampling for native Pinelands fishes was conducted on July 17, 2017. A total of 20 locations were sampled around the perimeter of the lake using a 20'x4' seine. A total of 9 species were collected which included Bluegill (123), Golden Shiner (69), Yellow Perch (46), Pumpkinseed (43), Swamp Darter (38), Black Crappie (30), Largemouth Bass (25), Bluespotted Sunfish (14), Chain Pickerel (7), unknown *Lepomis* sp. (671), and unknown *Enneacanthus* sp. (7). All unknown *Lepomis* species collected were young-of-the-year (YOY). Water chemistry was collected and pH measured 7.50. The collection of Bluespotted Sunfish was encouraging. Fish communities are generally useful indicators of aquatic degradation. As land use practices change and urbanization increases water quality typically decreases as a result. Elevated pH levels and the presence of fishes considered nonindigenous to the Pinelands support the above-mentioned statements. However, nonindigenous Pinelands species, which include Largemouth Bass and Bluegill, can provide excellent recreational angling opportunities under the right circumstances. The Largemouth Bass fishery is reported to be comprised of abundant smaller fish with low numbers of larger

individuals. A public boat ramp located at the upper end of the lake provides angler access. A working relationship has been maintained with the Hammonton Lake Committee. Aspects of the Hammonton Lake Management Plan have been discussed including water lowerings, herbicide treatments for aquatic vegetation control, lake aeration systems, trout stocking, and the recreational fishery within the lake. Future management decisions should balance between benefiting the recreational fishery and preserving the unique native Pinelands species within the lake. (Boehm)

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. A seining survey was completed on August 8, 2017 to evaluate the native fish and Largemouth Bass populations in Iona Lake. A total of 10 species were collected from 12 seining locations. Largemouth Bass (15), Brown Bullhead (3), Creek Chubsucker (6), Black Crappie (1), Swamp Darter (3), Chain Pickerel (6), Blackbanded Sunfish (18), Bluespotted Sunfish (6), Bluegill (219), Pumpkinseed (2) and unknown *Enneancanthus* sp. (28). A 2016 survey yielded similar results with the same number of species collected. Due to the presence of some of state's rare native fish species; including Blackbanded Sunfish, a species soon to be designated state Special Concern, the stocking of warmwater fish including Largemouth Bass and Channel Catfish is not recommended. (Smith)

Lake Audrey (Cumberland) - A seining survey was completed on June 12, 2017 to assess the reproduction of Largemouth. A total of 16 locations were sampled using a 20'x6' seine around the perimeter of the lake. A total of eight species were collected consisting of Largemouth Bass (38), Bluegill (1), Pumpkinseed (2), Chain Pickerel (3), unknown *Lepomis* sp. (2), unknown *Enneacanthus* sp. (8), Banded Sunfish (11), and Blackbanded Sunfish, a species soon to be designated state Special Concern (31). Water chemistry was recorded; pH measured 4.84. The low pH level and presence of native species indicate a significant change in water quality and habitat. Native pinelands species were not previously encountered during surveys at Lake Audrey. These fish were introduced in 2012 from a fish salvage at Lake Nummy, due to the proximity and low pH levels. A liming project to increase the pH is anticipated at a later date. The catch and release only regulations for the lake have been removed. (Smith)

Lake Nummy (Cape May) – Lake Nummy is a 26-acre impoundment of East Creek located within Belleplain State Forest. The lake was drained in 2014 to repair the dam. A fish kill consisting of 200 Yellow Perch was reported in July 2011. The lake was last sampled for native pinelands fish on August 23, 2016. Additional sampling to reconfirm the presence of Mud Sunfish, a species soon to be designated state Special Concern, was conducted on July 25, 2017. Mud Sunfish were last reported within the lake before the dam was repaired, but were not collected during last year's sampling. A total of thirteen locations around the perimeter of the lake were sampled using a 20'x4' seine. A total of nine species were collected which included Banded Sunfish (86), Yellow Perch (64), Blackbanded Sunfish, a species soon to be designated state Special Concern (50), Yellow Bullhead (14), Eastern Mudminnow (5), Chain Pickerel (3), Mud Sunfish (3), unknown *Enneacanthus* species (3), Pumpkinseed (2), Bluespotted Sunfish (1), and Pirate Perch (1). Water chemistry was recorded and pH measured 4.95. As noted above Mud Sunfish were collected and therefore

reconfirmed within the lake. Management activities should focus on the management of native Pinelands species within the lake. Additional sampling is not recommended at this time. The lake should not be stocked due to the low pH and the unique native species present. (Boehm)

Lebanon Lake (Burlington) – Lebanon Lake is an 85-acre impoundment of the Rancocas Creek located within Brendan T. Byrne State Forest in Woodland Township. Sampling for native pinelands fishes was conducted on June 23, 2017. A total of 8 locations were sampled around the perimeter of the lake using a 20'x4' seine. A total of 5 species were collected including Blackbanded Sunfish, a species soon to be designated state Special Concern (28), Banded Sunfish (19), Chain Pickerel (12), Swamp Darter (163), and Pirate Perch (2). Water chemistry was recorded and pH measured 4.94.

Additional sampling for native fishes was conducted on June 30, 2017. A total of 8 additional locations were sampled using a 20'x4' seine. A total of 7 species were collected which included Blackbanded Sunfish, a species soon to be designated state Special Concern (113), Banded Sunfish (99), Swamp Darter (51), Pirate Perch (27), Chain Pickerel (12), Mud Sunfish, a species soon to be designated state Special Concern (1), and Yellow Bullhead (1). Water chemistry was recorded and pH measured 5.16. All species collected during both surveys are considered native pinelands fishes. The absence of non-native fish collected during sampling can be attributed to the physiological effects of acidic waters. 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 low pH, location within the Pinelands, and the unique native fish community present. (Boehm)

Little Pine Lake (Burlington) – Little Pine Lake is a 13-acre impoundment of the North Brach of the Rancocas Creek located in the town of Browns Mills. The lake is part of the township's Bayberry Park. A parking lot is present and a small beach area and Bayberry St. provide public access to the lake. Little Pine Lake is the uppermost impoundment above Mirror Lake. Big Pine Lake sits in between Mirror and Little Pine Lake. Sampling for native pinelands fishes was conducted on June 19, 2017. A total of 13 locations were sampled around the perimeter of the lake using a 20'x4' seine. Species collected included Bluegill (120), Swamp Darter (55), Pumpkinseed (39), *Gambusia* sp. (34), Largemouth Bass (7), Bluespotted Sunfish (9), unknown *Enneacanthus* sp. (1), Yellow Perch (1), Golden Shiner (1), and Creek Chubsucker (1). All Largemouth Bass collected were young-of-the-year (YOY). Water chemistry was collected and pH measured 6.25. No additional sampling or stocking is recommended at this time. (Boehm)

Lower Lake (Ocean) – Lower Lake is an impoundment of the North Branch of Forked River located within Lacey Township. The lake is approximately 28 acres in size and is the last downstream impediment before reaching the tidal North Branch of Forked River. A reproduction check was conducted on June 21, 2017. A total of 20 locations were sampled around the perimeter of the lake using a 20'x4' seine. Ten species in total were collected which included Pumpkinseed (54), Brown Bullhead (42), Bluespotted Sunfish (40), unknown *Enneacanthus* sp. (18), Largemouth Bass (17), Mud Sunfish, a species soon to be designed State Special Concern (3), Swamp Darter (3), American Eel (3), Chain Pickerel (2), and Creek Chubsucker (1). All Largemouth Bass and Brown Bullhead collected were young-of-

the-year (YOY), which indicates successful reproduction of both species within the lake. Water chemistry was collected and pH measured 5.21. Due to Lower Lake's role as a successful HOFNOD location, and a locally popular fishing area with ample shoreline access, stocking of surplus Largemouth Bass and Bluegill may be considered in the future to enhance the existing fishery and provide additional angling opportunity. (Boehm)

Makepeace Lake (Atlantic) – Makepeace Lake is a 255-acre impoundment of the Great Egg Harbor River located within Makepeace Lake WMA. The lake was last sampled on August 3, 2016. Additional sampling for native pinelands fishes, and to further access the *Enneacanthus* species within the lake, was conducted on July 24, 2017. A total of ten locations around the perimeter of the lake were sampled using a 20'x4' seine. A total of seven species were collected which included Banded Sunfish (108), Swamp Darter (28), Blackbanded Sunfish, a species soon to be designated state Special Concern (19), Yellow Bullhead (10), Redfin Pickerel (4), Mud Sunfish, a species soon to be designated state Special Concern (3), Eastern Mudminnow (3), and Bluespotted Sunfish (3). Banded Sunfish were abundant with young-of-the-year (YOY), intermediate, and adult individuals all collected during the survey. All three *Enneacanthus* sunfish species were collected. Water chemistry was collected and pH measured 5.07. The collection of Mud Sunfish, Eastern Mudminnow and Redfin Pickerel greatly increases the species diversity within the lake, and is encouraging since they were not found during last year's survey. All fish collected during this survey are considered native pinelands species. The absence of nonnative species can be attributed to the acidic water of the lake. Low pH can act as a barrier preventing the establishment of non-native fishes within pinelands waters. Based on the present native fish community, location within pinelands and lack of potential to develop a recreational fishery this lake should not be stocked in the future. (Boehm)

Maskell's Mill Pond (Cumberland) – Maskell's Mill Pond is a 33-acre impoundment located near the town of Canton. The lake is a WMA and a small gravel boat ramp provides public access. A lake inventory was previously completed in 1997. This lake was last sampled in 2013 following a dam repair project in 2011. A seining survey was also completed on June 27, 2017 to assess the reproduction of the warmwater fish population. A total of 15 locations were sampled using a 20'x6' seine around the perimeter of the lake. A total of seven species were collected consisting Largemouth Bass (2), Mosquitofish sp. (*Gambusia*) (8), White Perch (1), Yellow Perch (1), Golden Shiner (9), Bluegill (391), and Pumpkinseed (13). The pH was 6.64 and surprisingly there were no native Pinelands species collected. Maskell's Mill Pond has rather unique habitat for Salem County which lower pH and sandy soils than surrounding waterbodies. Bluespotted Sunfish were collected during the 1997 lake inventory. Additional seining surveys should be completed in the future to see if Bluespotted Sunfish have re-established. An electrofishing survey was completed on June 27, 2017 to assess the fish population. Additional stocking is not recommended at this time. (Smith)

Menantico Sand Ponds (Cumberland) - Menantico Sand Ponds are located within Menantico Ponds WMA and are part of the Maurice River drainage. A public boat ramp and parking area are present and provide access to the ponds. Sampling for native fishes and evaluation of Largemouth Bass reproduction was conducted on August 4, 2017. A total of 18 locations were sampled using a 20'x4' seine around the perimeter of the lake. Seventeen species were collected which included Largemouth Bass (12), Brown Bullhead (1), Creek Chubsucker (1),

Black Crappie (6), Swamp Darter (5), American Eel (5), Banded Killifish (10), Tadpole Madtom (1), Eastern Mudminnow (8), Pirate Perch (7), Yellow Perch (1), Chain Pickerel (1), Bluespotted Sunfish (143), Bluegill (208), Pumpkinseed (21), Redbreast Sunfish (28), and unknown *Enneacanthus* sp. (226). Species diversity was better than when sampled in 2016 and reproduction of Largemouth Bass appears to consist with past results. The ponds are now more tidally influenced than in years past which allows for increased seasonal movement of fish in and out of Menantico Creek. As a result, it appears the watershed is reverting back to its more natural state. Stocking is not recommended at this time. (Smith)

Metlars Pond (Somerset) - A reproduction check was conducted using a 20'x4' seine on Metlars Pond (2 ac) within Colonial Park within the Somerset County Park system on August 25, 2017. This pond has two onstream impoundments upstream of it (Powder Mill Pond (4 ac) and Spooky Brook Park Pond (12 ac) and one onstream impoundment below it (Duck Pond (1 ac)). Metlars Pond and Duck Pond were drained and dredged in 2013 and restocked in 2014. Stocking included Largemouth Bass (438 at 2 in.), Black Crappie (2,000 at 2 in.), and Bluegill (1,400 at 1 in.). This park is heavily used by the public and parking is readily available. The pond has no boat launch and is accessible by foot along the northern shoreline. Thirteen seine hulls were conducted, yielding an average of 7 Bluegill and 1 Black Crappie per seine. Other species collected at a rate of less than one per seine hull included Redbreast Sunfish, Brown Bullhead, Golden Shiner, and Common Carp. Surprisingly, no Largemouth Bass were encountered, however the seining was done a bit late in the season. No native fish of conservation concern were encountered. Powder Mill Pond and Spooky Brook Park Pond are anticipated to be dredged in the near future. As a result, the ponds will be lowered and fish will be salvaged and relocated into Metlar's Pond and Duck Pond. Salvaged Largemouth Bass should be adequate to repopulate Metlar's Pond, however if none are encountered or if the dredging does not take place, stocking will be recommended in the future. (Crouse)

Mirror Lake (Burlington) – Mirror Lake is a 123-acre impoundment of the North Branch of the Rancocas Creek located in the town of Browns Mills. The lake was last sampled in 2010 when a lake inventory and management plan was completed. Sampling for native pinelands fishes was conducted on June 13, 2017. A total of 18 locations were sampled around the perimeter of the lake using a 20'x4' seine. Species collected included Blackbanded Sunfish (22), Bluespotted Sunfish (21), unknown *Enneacanthus* sp. (22), Chain Pickerel (5), Swamp Darter (22), Bluegill (46), Pumpkinseed (18), Largemouth Bass (8), Yellow Perch (1), and Golden Shiner (1). Bluespotted Sunfish were not collected during the 2010 lake inventory. Confirming the presence of Bluespotted Sunfish, as well as reconfirming the presence of Blackbanded Sunfish, a species soon to be designated state Special Concern is encouraging. Water chemistry was collected and pH measured 6.12. Mirror Lake is a locally popular recreational fishing waterbody. The fishery primarily consists of Largemouth Bass, Chain Pickerel, Bluegill, and Yellow Perch. A public boat ramp is present, along with numerous shoreline access points. No stocking is recommended at this time, however stocking of surplus Largemouth Bass, Bluegill, and Black Crappie may be considered in the future. (Boehm)

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 seining survey was completed on August 11, 2017 to evaluate the reproduction of Largemouth Bass. A total of 17 locations were sampling using a 20'x4' seine. Thirteen species were collected consisting of Bluegill (700), Largemouth Bass (6), Banded Killifish (15), Black Crappie (10), Swamp Darter (15), Pumpkinseed (76), Redbreast Sunfish (7), Brown Bullhead (1), Tadpole Madtom (3), Yellow Perch (5), Creek Chubsucker (2), and Golden Shiner (11). Parvin Lake was last sampled in 2016 by boat electrofishing. A seining survey has not been completed for quite some time, but past surveys yielded similar results. Despite the poor catch rate of YOY Largemouth Bass during the survey the population is stable and anglers consistently catch large bass in the lake. Follow up electrofishing surveys are planned to continue monitoring the Largemouth Bass population. Data collected during those surveys will be used to guide future management decisions. (Smith)

Pemberton Lake (Burlington) – Pemberton Lake is a 20-acre borrow pit located in Pemberton Township. The WMA lake is annually stocked with trout by NJDFW and at one time was considered an excellent Largemouth Bass lake. In more recent years, especially since 2009, algae blooms presumable from excessive nutrient input have plagued the lake. A seining survey was completed on July 20, 2017 to evaluate the Largemouth Bass population. A total of seven species were collected from 20 locations utilizing a 20'x4' seine. Bluegill (249) were the abundant species collected. In addition, Largemouth Bass (30), Black Crappie (54), Banded Killifish (49), Mosquitofish sp. (*Gambusia*) (12), Yellow Perch (7), and Golden Shiner (5) were collected. Reproduction of Largemouth Bass appears limited. A follow-up electrofishing survey was conducted later in the year to better assess the fishery. (Smith)

Pickle Factory Pond (aka West Creek Mill Pond) (Cape May) – Pickle Factory Pond is a 77-acre impoundment of West Creek located along the border of Belleplain State Forest. This location was last sampled on August 15, 2016. Additional sampling for native pinelands fishes focusing on *Enneacanthus* sunfish was conducted on October 5, 2017. A total of 15 locations were sampled using a 20'x4' seine around the perimeter of the lake. Five species were collected consisting of Blackbanded Sunfish; a species soon to be designated state Special Concern (8), Bluespotted Sunfish (3), Pumpkinseed (63), Chain Pickerel (1), and Creek Chubsucker (76). Water chemistry was recorded; pH measured 5.78, temperature 19.5 C, and conductivity was 47.4 us/cm. Adult, intermediate and young-of-the-year (YOY) Pumpkinseed were all collected. Banded Sunfish, a species collected during last year's survey were not collected during this year's survey. Water temperature was significantly cooler this year when compared to the previous survey which is to be expected when sampling in the fall versus summer. Colder water temperatures reduced the amount of aquatic vegetation present, including Bladderwort. There appears to be strong correlation between the presence of Bladderwort and the presence of *Enneancathus* species within pinelands waters. All fish collected are considered native species. The primary recreational fishery present is the Chain Pickerel population, which is self-sustaining. Chain Pickerel are the native game fish of the pinelands and do will in the acidic waters found there. Based on the unique native fish community, low pH and location within the pinelands this lake should not be stocked in the future. (Boehm)

Presidential Lake (Burlington) – Presidential Lake is an impoundment of the Rancocas Creek located in Browns Mills and is 37 acres in size. Sampling for native pinelands fishes was conducted on June 23, 2017. A total of 8 locations were sampled around the perimeter of the lake using a 20'x4' seine. Species collected included Brown Bullhead (168), Yellow Bullhead (5), Blackbanded Sunfish, a species soon to be designated state Special Concern (89), Banded Sunfish (11), Mud Sunfish, a species soon to be designated state Special Concern (8), Swamp Darter (85), Bluegill (24), Pumpkinseed (32), Largemouth Bass (43), Chain Pickerel (6), and unknown *Enneacanthus* sp. (15). All Largemouth Bass and unknown *Enneacanthus* species collected were young-of-the-year (YOY). Water chemistry was collected and pH measured 5.34. The recreational fishery within the lake primary consists of Chain Pickerel. Chain Pickerel are the native game fish species of the Pinelands, and as such do well in the acidic water found there. No additional sampling is recommended at this time. Due to the low pH, location within the pinelands, and presence of unique native species of conservation concern no stocking of any kind should take place. (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 for Prospertown Lake 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. Prospertown Lake is a popular location for the increasing number of kayak fishermen in the state and provides them with a unique "paddle only" water to fish, as both electric and gas motors are not allowed. A seining survey was completed on June 29, 2017 to assess the reproduction of Largemouth and evaluate the native pinelands fishes. A total of 14 locations were sampled using a 20'x6' seine around the perimeter of the lake. A total of eight species were collected consisting of Largemouth Bass (38), Bluegill (37), Pumpkinseed (1), Black Crappie (19), Swamp Darter (18), Yellow Perch (4), Chain Pickerel (8), Brown Bullhead (92) and unknown *Lepomis* sp. (31). Water chemistry was recorded; pH measured 7.58. No *Enneacanthus* species were collected during the survey. The elevated pH level and abundance of non-native species are not favorable conditions for native Pinelands fishes.

A boat electrofishing survey was completed at Prospertown Lake on February 24 and September 17, 2017 to evaluate the Largemouth Bass population. No additional stocking is required at this time. Additional sampling is recommended to monitor the Largemouth Bass population and remove the overly abundant number of Brown Bullheads from the lake. Future management should focus on maintaining the Largemouth Bass fishery within the lake. (Smith)

Rainbow Lake (Salem) – Rainbow Lake is a WMA located in Pittsgrove Township downstream of Parvin State Park. The lake is an impoundment of Muddy Run, a tributary of the Maurice River. A total of nine species of fish were collected during the seining survey on August 16, 2017. A similar composition of species was collected in 2001 when a lake inventory was completed. At that time 15 species were collected. A total of nine species were collected during the 2017 survey and included: Largemouth Bass (4), Bluegill (243), Pumpkinseed (304), Golden Shiner (36), Black Crappie (3), Bluespotted Sunfish (1), Swamp

Darter (1), White Perch (7), *Enneacanthus* sp. (23), and *Lepomis* sp. (17). Noteworthy was the difference in the number of Largemouth Bass collected in 2001 and 2017. There was a total of 60 YOY Largemouth Bass collected in 2001 from 10 locations (6 fish/site) and four collected in 2017 from 15 locations (<1/site). A supplemental seining survey should be completed to evaluate the spawning success of Largemouth Bass in 2018. Additional Largemouth Bass should be stocked in 2018. (Smith)

Sheppards Mill Pond (Cumberland) – A seining survey was completed at Sheppard's Mill Pond on July 26, 2017 to assess the fish population. The 58-acre lake is a newly acquired WMA and part of the Cohansey River WMA. A small sand boat launch is present and provides public access. A total of 20 locations were sampled using a 20'x 6' seine around the perimeter of the lake. A total of three species were collected consisting Black Crappie (6), Chain Pickerel (3), and Bluegill (883). Water chemistry was recorded; pH measured 7.34. An electrofishing survey was also completed at Sheppard's Mill Pond on July 26, 2017 to assess the reproduction of the warmwater fish population.

Sheppard's Mill Pond is a perfect candidate for active fisheries management consisting of habitat enhancement and stocking. Overharvest and exploitation, common on newly acquire waters once they become public, may have negativity impacted the recreational fishery. As such, approximately 2,500 YOY Largemouth Bass were stocked on August 9, 2017, and adult Bluegill and Fathead Minnows will be stocked later in the month. An electrofishing survey will be completed again during the spring of 2018 to further evaluate the condition of the bass and sunfish population. Additional stocking of Largemouth Bass, Bluegill, and Golden Shiner is anticipated for 2018. (Smith)

Stephens Lake (Atlantic) – Stephens Lake is an impoundment of South River a tributary of the Great Egg Harbor River. The lake is located within Stephens Lake WMA in the town of Estell Manor. The lake is 28 acres in size, and a public boat ramp provides angler access. Sampling for native pinelands fishes was conducted on June 26, 2017. A total of 18 locations were sampled around the perimeter of the lake using a 20'x4' seine. Species collected included Largemouth Bass (100), unknown *Enneacanthus* sp. (35), Creek Chubsucker (31), Bluegill (24), Blackbanded Sunfish, a species soon be to designated state Special Concern (13), Pumpkinseed (7), Bluespotted Sunfish (10), Pirate Perch (2), Swamp Darter (2), and Chain Pickerel (1). All Largemouth Bass collected were young-of-the-year (YOY). The number of YOY Largemouth Bass collected suggests successful spawning. The lack of Bluegill and Pumpkinseed YOY collected is concerning and may indicated over predation and a limited forage base within the lake. Water chemistry was collected and pH measured 6.30. Additional sampling is planned this fall to further assess the fishery. A daytime boat electrofishing survey was conducted on October 23, 2017 to assess the Largemouth Bass population within the lake. (Boehm)

Tuckahoe Impoundments (Cape May) – Water chemistry was collected at Tuckahoe Impoundments #1 and #2 on July 21, 2017. Impoundment #1; salinity measured 6.85 ppt and conductivity was 1,3231 us/cm. Impoundment #2; salinity measured 7.89 ppt and conductivity was 13,830 us/cm. Mummichogs and Blue Claw Crabs were observed at both locations. Sampling for freshwater fish was not conducted due to the high salinity levels. Anglers were present when water chemistry data was being collected. A White Perch was

observed being caught, and several individuals were crabbing. The impoundments are located within Tuckahoe WMA. The management of the impoundments has shifted towards waterfowl habitat improvement and as such future freshwater fisheries activities will no longer be conducted. (Boehm)

Tuckahoe Lake (Cape May) – Tuckahoe Lake is a 19-acre impoundment located within Tuckahoe WMA. The lake is a NJDFW trout stocked waterbody and was last sampled on August 3, 2016. Additional sampling for native pinelands fishes was conducted on July 21, 2017. A total of eight locations were sampled using a 20'x4' seine around the perimeter of the lake. Eight species were collected which included *Gambusia* sp (12), Pumpkinseed (5), Bluegill (5), Bluespotted Sunfish (9), Golden Shiner (4), Creek Chubsucker (3), Yellow Bullhead (2), and Chain Pickerel (1). Water chemistry was recorded; pH measured 6.74. A similar species composition was collected during last year's sampling. Only Largemouth Bass were missing from this year's survey. Mowing along the spillway road is recommended to control Phragmites and provide increased shoreline angling access. No further sampling is needed at this time, and stocking of warmwater species is not recommended due to the limited potential to develop a recreational fishery outside of the spring trout stocking. (Boehm)

Turn Mill Pond (Ocean) – Turn Mill Pond is a 64-acre impoundment located within Colliers Mills WMA. Unconfirmed reports of Ironcolor Shiners, a species soon to be designated state Endangered, have been received by NJDFW personnel for the Collier Mills WMA lakes. Sampling for native fishes was conducted on July 10, 2017. A total of 16 locations were sampled around the perimeter of the lake using a 20'x4' seine. Species collected included Bluegill (114), Yellow Perch (33), Swamp Darter (26), Creek Chubsucker (25), Banded Killifish (25), Largemouth Bass (16), Chain Pickerel (6), Golden Shiner (6), Brown Bullhead (3), Pirate Perch (1), unknown *Lepomis* sp. (4), and unknown *Enneacanthus* sp. (2). No Ironcolor Shiners were collected during the survey. Water chemistry was recorded and pH measured 7.05. The pond receives an annual stocking of a mixture of warmwater fish including Largemouth Bass, Bluegill, Channel Catfish, and Brown Bullhead for the Kids Fishing Area at the NJDFW Outdoor Expo. Turn Mill Pond also received fish from the 2011 fish salvage of Prospertown Lake. Despite all the past stockings a viable recreational fishery has not developed, because of this no additional stocking is recommended in the future outside of the Expo stocking. (Boehm)

Union Lake (Cumberland) – At 898-acres Union Lake is the largest impoundment in southern New Jersey and one of the most popular WMA lakes. The lake has been surveyed often to guide stocking efforts and to maintain and enhance the fisheries present. A seining survey was completed on July 18, 2017 to evaluate reproduction of Largemouth Bass and evaluate the native fish population. A total of 31 locations were sampled utilizing a 20'x4' seine around the perimeter of the lake. Two seining crews were present to expedite the survey and avoid variability of seining on numerous days. A total of 11 species were collected which included Largemouth Bass (18), Black Crappie (2), Banded Killifish (3), Tadpole Madtom (4), Golden Shiner (10), Blackbanded Sunfish, a species soon to be designated state Special Concern (1), Bluespotted Sunfish (38), Bluegill (238), Pumpkinseed (9), and Redbreast Sunfish (6). The most notable species collected was the one Black Banded Sunfish. The species was not found during seining surveys in recent years.

Largemouth Bass recruitment appears to be low despite good electrofishing survey CPUE numbers. Lack of shallow cover in and around spawning areas limits the success of reproduction at Union Lake. Habitat appears suitable to maintain native *Enneacanthus* species populations within the lake as well. Multiple boat electrofishing surveys were also conducted in 2017. (Smith)

White Lake (Warren) – On July 26, 2017, Division staff performed a reproductive check on White Lake (65 ac) in Warren County. Staff was able to do 22 seine pulls around the perimeter of the lake, but seining sites were difficult to find due to large stands of Phragmites dominating the lake shore. Thirty-eight sunfish (Bluegill (20) and Pumpkinseed (18)), Mosquitofish sp. (*Gambusia*) (8), Banded Killifish (48), Chain Pickerel (3), and Largemouth Bass (2) were collected. This lake is more difficult than most to attain accurate data on the current fishery through the use of seines, as the habitat type found around the perimeter of the lake does not hold many fish. The unique marl substrate does not support much plant life that would otherwise act as cover for fish. In addition to the lack of aquatic vegetation habitat, the marl then quickly drops off into depths to deep to seine. Finally, many locations around the lake have been dominated by *Phragmites australis*, an invasive grass found in wetlands in New Jersey. This plant's reedy structure makes it very difficult to nearly impossible to pull a seine through and accurately collect fish. Therefore, the fish data collected is presumed incomplete and further surveys with different survey equipment would need to be performed to attain more complete knowledge on the status of the fishery. (Shramko)

Wilson Lake (Gloucester) – Wilson Lake is a 58-acre impoundment of Scotland Run, a tributary of the Maurice River, located in the town of Clayton. The lake itself is located within Scotland Run Park, which is part of the Gloucester County Parks system. A large cement boat ramp, two docks, and ample parking ensure excellent public fishing access on the lake. A seining survey was completed on August 8, 2017 to evaluate the Largemouth Bass and native fish populations and reconfirm the identification of species collected in a 2016 seining survey. A total of 10 species were collected from 12 locations using a 20'x4' seine. Largemouth Bass (17), Bluegill (218), Bluespotted Sunfish (17), Blackbanded Sunfish, a species soon to be designated state Special Concern (6), Swamp Darter (6), Yellow Perch (12), Chain Pickerel (4), Golden Shiner (1), Pumpkinseed (55), and Banded Killifish (2) were collected. The upper Maurice River drainage is considered within the historic range of Ironcolor Shiners. No Ironcolor Shiners were collected or observed during the survey. A backpack electrofishing was conducted below the dam, downstream of Wilson Lake earlier in the year with no Ironcolor Shiner collected either. Wilson had a major dam repair in 2014 and the lake was significantly lowered during the winter. Largemouth Bass were restocked in 2015. Additional stocking of Largemouth Bass may be considered to support the recreational fishery. Wilson is a locally popular fishing area and supplementing the existing Largemouth Bass population with stocking may continue to increase angler usage and enjoyment. (Smith)

Protection and Restoration of Inland Fisheries and Aquatic Habitats: Warmwater

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.

In 2017 staff provided technical assistance to the following projects related to our warmwater resources:

Lake Hopatcong Hydro-Raking Pilot Project – The activity of hydro-raking is considered unregulated by NJDEP Land Use Regulation, however, NJDFW's Bureau of Freshwater Fisheries' believes it constitutes dredging and should be regulated to minimize impacts to the lake's fishery. An onsite inspection of this project was conducted early in the afternoon on April 3, 2017, but unfortunately the equipment was not being operated. This 15-day pilot project was delayed from the original start date of March 15 due to ice on the lake and is progressing much slower than anticipated. Multiple concerns were verbally conveyed to Parks and Forestry, the Lake Hopatcong Foundation, the contractor, and NJDFW's Environmental Review Section including the slow progress (work not occurring daily despite good weather), the potential to interfere with trout stocking, and the Opening Day of the trout season (just 4 days away), as well as disturbances to warmwater fish spawning, and the lack of silt fencing around the muck deposited on the shore line. (Hunter and Angler Fund) (Hamilton)

Hydro-raking spoils pile at Lake Hopatcong

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 wellbeing. 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 and Hunter and Angler Fund)

Millstone River (Somerset) - The Millstone River Restoration Project aims to restore connectivity of the Millstone River by removing dams. The Weston Causeway Dam, located just downstream of the Wilhousky Street bridge in Manville was the first impediment to fish passage on the Millstone River. This dam was 133 feet long and 5 feet high. Originally a mill dam at the Weston Mill, this site included a gristmill, sawmill, dam, and associated waterpower features. The dam was repaired with concrete in the early 20th century, but retained earlier masonry elements underneath. The dam had no current purpose; the mill buildings were claimed by arson in July 1983. In recent years, the dam had partially failed and was removed in August of 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 on the Raritan River near its confluence with the Millstone River, approximately 1.5 miles downstream of the Weston Causeway Dam. This system supports a diverse recreational fishery, composed of over fifty species.

Weston Mill Dam (photo by John Jengo) (left) and after removal of dam (right).

In anticipation of the removal of the Weston Causeway Dam, five electrofishing surveys were conducted during the fall of 2016 and spring of 2017 to establish a baseline 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). The monitoring program outlined for these surveys to be replicated during each of the three spring and fall seasons post dam removal. Surveys were led by NJDFW and assisted by partners from USFWS and Stony Brook-Millstone Watershed Association. (Hunter and Angler Fund) (Crouse)

Fifty fish species collected at three locations in the Millstone River downstream of the Weston Causeway Dam.

Fish Species	near confluence with Raritan River by Electrofishing Boat (season / year)			below Weston Causeway Dam by Electrofishing Boat (season / year)			below Weston Causeway Dam (seine) (season / year)		
	F/16	Sp/17	F/17	F/16	Sp/17	F/17	F/16	Sp/17	F/17
Largemouth Bass	8	9	3	17	5	17	2		
Smallmouth Bass	2	3	1	9	1	6	1		
Rock Bass				1	5				
Striped Bass				1					
Bluegill			6	16	11	22	11		
Pumpkinseed			1	8	3	2	1		
Redbreast Sunfish	9	29	17	43	57	46	10		
Green Sunfish		2			1	3	1		
Lepomis hybrid									
Bluespotted Sunfish				1	2		10		
Black Crappie					1				
White Crappie						1			
White Perch		1	2	3	11		3		
Shield Darter									
Tessellated Darter									
Channel Catfish	4	2	5	5	7	5			
Flathead Catfish									
White Catfish	1		1		2				
Yellow Bullhead		1	1	3		2			
Brown Bullhead				1		4			
Margined Madtom									
Tadpole Madtom									
Yellow Perch	4			22	2		3		
Walleye		1	2	3		1			
Muskellunge			1	1					
Northern Pike									
Chain Pickerel			1	9	2	4	3		
Redfin Pickerel						1			
Rainbow Trout					4				
American Shad		13		15	1	50			
Blueback Herring					4				
Gizzard Shad		3	3		3				
Common Carp	12	52	25	48	9	15			
Grass Carp			1						
Blacknose Dace									
Longnose Dace									
Creek Chub									
Fallfish									
Comely Shiner		2	4	2	1	2			
Common Shiner		5	1						
Golden Shiner				6					
Satinfin Shiner				1	1				
Spottail Shiner		8	79	1	11	14			
Swallowtail Shiner									
Banded Killifish									
White Sucker				10	8	6			
Creek Chubsucker				20	2	4	2		
Sea Lamprey									
American Eel	9	5	88	25	48	36			
Mosquitofish sp.		4					18		
Oriental Weatherfish									

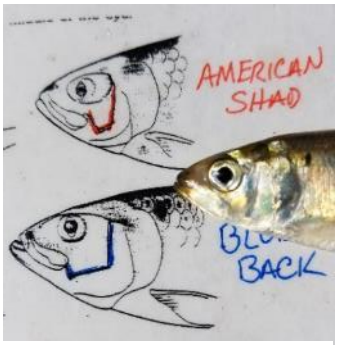
Fifty fish species collected at three locations in the Millstone River upstream of the Weston Causeway Dam.

Fish Species	above Weston Causeway Dam by Electrofishing Boat (season / year)			below Blackwells Mills Dam by Electrofishing Barge (season / year)			below Griggstown Causeway by Electrofishing Barge (season / year)		
Season / Year	F/16	Sp/17	F/17	F/16	Sp/17	F/17	F/16	Sp/17	F/17
Largemouth Bass	24	7	9	1	2	3	2		4
Smallmouth Bass	4	2		4	2	3			
Rock Bass			1	1	1				1
Striped Bass	4			2					
Bluegill	25	5	17	43	22	109	42	7	37
Pumpkinseed	3	1		9	9	7	1	1	8
Redbreast Sunfish	37	18	38	113	46	106	48	2	63
Green Sunfish	1		2	6	15	7	4		5
Lepomis hybrid						3			
Bluespotted Sunfish									
Black Crappie	2			1	1	8			3
White Crappie									
White Perch	2	5							
Shield Darter		1		3		6	7	1	6
Tessellated Darter		1	1	130	25	77	46	35	142
Channel Catfish		2	18		1	1			
Flathead Catfish			1						
White Catfish			1	2					2
Yellow Bullhead	3		6	13	2	3	8		2
Brown Bullhead		1	1			4			
Margined Madtom				2	1	4			
Tadpole Madtom				2	2	2	2	1	1
Yellow Perch	11		5	3					
Walleye									
Muskellunge									
Northern Pike						1			
Chain Pickerel	11		10	5	2	1	2	1	1
Redfin Pickerel				1	1				
Rainbow Trout									
American Shad					1				
Blueback Herring									
Gizzard Shad	2	1							
Common Carp	33	35	15						
Grass Carp	1	1							
Blacknose Dace							2	1	1
Longnose Dace				1	1		6	2	10
Creek Chub	2		1						5
Fallfish				6		10	2	1	4
Comely Shiner	2			2		5	1		10
Common Shiner		4		8		4	1	2	13
Golden Shiner	75	6	1						
Satinfin Shiner	1			7		17	46	3	24
Spottail Shiner	34	2	6	76		105	21	38	328
Swallowtail Shiner							4		30
Banded Killifish				1	3		22	15	13
White Sucker	5	4	3	9	2	26	1	8	27
Creek Chubsucker			2	1					
Sea Lamprey				1					1
American Eel	54	11	150	274	56	72	257	44	145
Mosquitofish sp.				2	1		1	2	
Oriental Weatherfish				2					

Millstone River (downstream of Weston Causeway Dam near Raritan confluence) – The first boat electrofishing survey location in the Millstone River is near its confluence with the Raritan River. This location is approximately a half mile downstream of the former Weston Causeway Dam. Each survey is conducted in within the same 700 m stretch and is conducted for 1 hour. An assortment of 23 fish species have been collected thus far. On average, the most numerous species have been American Eel (34), Common Carp (30), Spottail Shiner (29), and Redbreast Sunfish (18). This river supports moderate numbers of other game species including Largemouth Bass, Smallmouth Bass, and Channel Catfish. Three Walleye have been collected from this site thus far, measuring 400 – 545 mm (16 - 21 in.). A Muskellunge measuring 727 mm (28.6 in.) and 2.338 kg (5.2 lbs.) was also recorded during Fall of 2017. The most substantial finding includes the first confirmed run of adult American Shad, when 13 were observed during the Spring of 2017. One species soon to be listed as state Species of Special Concern, the Comely Shiner (6) was also found at this site. Invasive species found at this location include Green Sunfish and Grass Carp. The Grass Carp was 1,168 mm (46.0 in.) long and weighed 23.5 kg (51.8 lbs.).

Emily Powers (NJDEP Seasonal Fisheries Technician) and Cathy Marion (USFWS Biologist) holding 46 in. / 51.8 lb. Grass Carp

Millstone River (immediately downstream of Weston Causeway Dam) – The second boat electrofishing survey location in the Millstone River is immediately downstream of the former Weston Causeway Dam. Each survey is conducted in within the same 700 m stretch and is conducted for 1 hour. An assortment of 33 fish species have been collected thus far. The most substantial initial findings include the first confirmed run of adult American Shad (n=1) and Blueback Herring (n=4) below the dam during the fall of 2016. During the fall of 2016, 15 juvenile American Shad encountered at the base of the Weston Causeway Dam. Approximately 50 American Shad were observed in this section during the fall of 2017. A subsample of 8 individuals (98 – 126 mm) were netted a few hundred meters downstream of the former location of the Weston Causeway Dam. On average, the most numerous species have been Redbreast Sunfish (49), American Eel (36), Common Carp (24), American Shad (22), Bluegill (16), and Largemouth Bass (13). During the spring of 2017, one American Shad was captured below the Blackwells Mills Dam. This was prior to the removal of the Weston Causeway Dam, however it was in a state of partial breach due to a partial failure. Juvenile Striped Bass were found both upstream and downstream of the Weston Causeway Dam also indicating the partial breach allowed fish passage. Low numbers of Comely Shiner (soon to be listed as state Species of Special Concern) were also found at this site. Four stocked Rainbow Trout were also encountered during the spring of 2017. Invasive species encountered from this section include Green Sunfish and Flathead Catfish (1 in 2013) which were removed.



One of approximately 50 juvenile American Shad observed during the Fall

Millstone River (immediately upstream of Weston Causeway Dam) – The third site has been routinely surveyed by boat electrofishing is located immediately upstream of the Weston Causeway Dam. Each survey is conducted in within the same 700 m stretch and is conducted for one hour. An assortment of 31 fish species have been collected thus far. Although juvenile American Shad were found below the dam during the fall of 2016 and 12 adults were found below the dam spring of 2017, none have been found in the section immediately upstream of the dam. On average, the most numerous species have been American Eel (71), Redbreast Sunfish (31), Common Carp (27), Golden Shiner (27), Bluegill (16), Spottail Shiner (14), and Largemouth Bass (13). Invasive species encountered includes Green Sunfish, Grass Carp, and the first Flathead Catfish documented upstream of the dam (removed in August). The large Grass Carp was approximately 40 in. long and weighed 14.0 kg (30.8 lbs.).

First Flathead Catfish documented upstream of former Weston Causeway Dam during fall of 2017 electrofishing survey.

Millstone River (below Blackwells Mills Dam) – Two monitoring stations were established at a distance upstream of the Weston Causeway Dam. The first was conducted approximately 5 miles upstream at the base of the Blackwells Mills Dam with a Smith Root electrofishing barge (see Appendix pages A45 and A46). The standardized survey length is 150 m. This was the most diverse site yet, consisting of 34 fish species. On average, high numbers of American Eel (134), Spottail Shiner (90), Redbreast Sunfish (88), Tessellated Darter (77), and Bluegill (58) are found at this location. This location was very difficult to sample during the spring, as it was problematic to wade under high flow conditions of 207 CFS, as compared to typical fall base flows of 60 to 100 CFS. As a result, there was a significant drop in the number of individual fish collected from fall of 2016 (731 individuals of 31 species) and fall of 2017 (584 individuals of 23 species) as compared to spring of 2017 (196 individuals of 21 species). The most significant capture was an adult American Shad during spring of 2017 that measured 524 mm (21 in.) and one 10-inch Striped Bass. This indicated that they could traverse the partially breached Weston Causeway Dam. This site was also accessible to an abundance of American Eels. Two species soon to be listed as state Special Concern (Comely Shiner and Shield Darter) have been found at this location. 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. Invasive fishes are regulated as potentially dangerous species and must be destroyed, two of which have been found at this site (Green Sunfish and Oriental Weatherfish).

10-inch Striped Bass from Millstone River

Millstone River (below Griggstown Causeway) - The final monitoring location is found at the Griggstown Causeway, approximately 9 miles upstream of the Weston Causeway Dam. This wadeable site is surveyed with a Smith Root electrofishing barge (see Appendix pages A43 and A44). The standardized survey length is 150 m, however only 86 m could be surveyed during the spring of 2017 due to excessive depth, with flows of 207 CFS. As a result, only 164 fish and 17 species were collected during survey. Species diversity (27) is high at this site, with only 6 non-native species present. On average, high numbers of American Eel (149), Spottail Shiner (129), Tessellated Darter (74), Redbreast Sunfish (37), Bluegill (29), and Satinfin Shiner (24) are found at this location. Most of the American Eel were collected in the rip-rap under the bridge. The only anadromous species that has been encountered during any of the surveys at this location is the Sea Lamprey (1), which were also documented upstream of both the Blackwells Mills Dam and the Weston Causeway Dam in 2013 (previous to the partial breaching of the dam) and indicates that neither dam was a complete impediment to Sea Lamprey migration. Two species soon to be listed as state *Special Concern* were found, including Comely Shiner and Shield Darter. Tadpole Madtoms were found at this location, which is one of the few locations in NJ it is found north of the geologic fall line. This site consistently produces relatively few non-native piscivores (16 combined Largemouth Bass, Rock Bass, and the invasive Green Sunfish) and an average of 37 Bluegills. The Green Sunfish were removed from the stream, as required by the regulations governing the possession or release of "potentially dangerous fish" (invasive).

With improved fish passage and the river reverting back to a more natural flow regime, one might anticipate several responses in the fish assemblage. It is anticipated that the most beneficial change in fish assemblage would be opening additional stream mileage to migratory species such as American Shad, Blueback Herring, and Striped Bass. Non-native predators such as Walleye and Musky may also move upstream. Invasive species such as the Flathead Catfish appear to have already moved upstream. As habitat shifts from lake-like habitat to more stream-like habitat species such as Smallmouth Bass might outnumber Largemouth Bass. There might also be changes in sensitive native species such as Comely Shiner and Shield Darter. This is why it is important to continue the monitoring program for each of the three spring and fall seasons following dam removal. (Hunter and Angler Fund) (Crouse)

Musconetcong River (Hunterdon) - 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 and 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 partners meet periodically during the year to discuss and plan dam removal projects.

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. Sections of the Musconetcong River are designated in the National Wild and Scenic Rivers program. From 2008 to 2016 the Partnership, led by the Musconetcong Watershed Association, orchestrated the removal of five dams on the river's mainstem – Riegelsville (2011), Finesville (2011), and Hughesville (2016) dams on the lower Musconetcong River, and further upstream (near Hackettstown) the Gruendyke Mill (2008) and Seber (2009) dams.

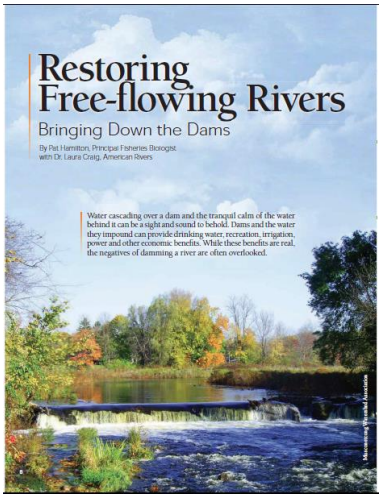
The removal of the three lowermost dams on the river has opened nearly six miles of river to important migratory fishes like American Shad, river herring, and Striped Bass. The Partnership continues to work on other dam removals on the mainstem of the Musconetcong River. The current focus is removal of the 37-foot high dam at Warren Glen. The Army Corps of Engineers has taken the lead on the Bloomsbury Dam removal, which is less than two miles upstream from the Warren Glen Dam. (Federal Grant F-48-R, Project II) (Hamilton)

The first American Shad caught below the Warren Glen Dam (2017).

In June 2017 a historic and exciting milestone in this river's restoration was achieved when the Bureau confirmed the return of adult American Shad to the Musconetcong River. Adult shad return from the ocean to the Delaware River each spring to spawn in freshwaters, but their migration into the Musconetcong River has been blocked by multiple dams for at least a century. The presence of this benchmark species upstream of the Hughesville Dam site was very significant as it demonstrated an immediate ecological benefit that resulted from the demolition of the dam the previous fall. Underwater video of the small school of adult shad was taken and posted on social media (https://www.facebook.com/NJFishandWildlife/videos/1534621739893440/?fref=mentions).

The return of American Shad to the river also caught the attention of National Public Radio (station WHYY, Philadelphia) which resulted in a segment heard by listeners throughout NJ, PA, and DE (https://stateimpact.npr.org/pennsylvania/2017/08/16/dam-removal-helps-american-shad-return-after-disappearing-for-centuries/).

An article – *Restoring Free-Flowing Rivers: Bringing Down the Dams* – which explained the legacy of dam building, the ecological and social benefits associated with removing them, and highlighted successful dam removal projects in New Jersey, was published in Fish and Wildlife's 2017 New Jersey Freshwater Fishing Digest.



Paulins Kill (Warren) - 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. No fish sampling was done in 2017 as flows during the spring anadromous migration period were too high and not conducive to sampling techniques. Additional sampling is planned for the spring of 2018 and will continue into future years to document pre and post dam removal fish assemblages.

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. Lower than average water levels during the spring of 2015 aided sampling efforts,

however 2016 water levels were closer to average making sampling more difficult and 2017 flows and water levels were too high for effective sampling efforts.

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 it 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.

American Shad caught electrofishing below the Columbia Lake Dam

Although 2017 did not have any additional fish sampling surveys, a substantial amount of progress was completed towards the removal of the Columbia Lake Dam. Fish passage design through the Route 80 overpass has been approved by engineers, NJDFW, and USFWS fish passage professionals. This took many meetings, on-site and otherwise, as this area has unique fish passage issues due to flow, slope, and existing scour protection for the Route 80 overpasses. A multiple weir structure design was finally agreed upon by engineers and fish passage design professionals. De-watering of the lake and fish salvage is planned to begin in the spring of 2018 and deconstruction of the dam is scheduled to begin in June of 2018. (Federal Grant F-48-R, Project II) (Shramko)

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 2017 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 had been monitored by the NJ Bureau of Freshwater Fisheries from 1996 through 2003, and in 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. The final report compiling all their years of study, which includes tagging results and high definition widow imagery analysis, will be available January 2018. (Hunter and Angler Fund) (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)

Brook Trout
(soon to be Special Concern)

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.

Status Evaluation of Native Freshwater 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. 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)

Shield Darter
(soon to be Special Concern)

American Brook Lamprey
(soon to be Special Concern)

Sixty-five species were evaluated by an expert panel, 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 *). 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. Results are listed below.

Ironcolor Shiner
(soon to be listed Endangered)

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

State Wildlife Action Plan

During 2015 through 2017 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 drafted the revised version of the plan in 2017, that was open for public comment. The final plan will be submitted to the U.S. Fish and Wildlife Service in 2018. An up to date Wildlife Action Plan is 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.

Blackbanded Sunfish
(soon to be Special Concern)

Fisheries related duties of the SWAP included a variety of tasks, 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). (Hunter and Angler Fund) (Crouse)

Native Species Data Collection Efforts

During 2017, 22 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 and 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 2017 searching for less common freshwater fish species.

Waterbody	Survey Date	Significance	Page #
Upper Delaware North & Wallkill Region (Shimmers Brook to Paulins Kill and Wallkill River watersheds)			
Blair Lake (Sussex)	8/31/17	Bridle Shiner and Bluespotted Sunfish in 2017.	86
Lower Passaic & Upper Atlantic Region (Lower Passaic, Saddle, Hackensack, Pascack & Elizabeth to Toms River watersheds)			
Deal Lake (Monmouth)	7/5/17	Mud Sunfish 1951. No Mud Sunfish 2017.	64 88
Forge Pond (Ocean)	6/27/17	No previous data. Bluespotted Sunfish 2017.	89
Raritan Region (Raritan River watershed)			
Crystal Springs Preserve Ponds (Hunterdon)	10/17/17	No previous data. No rare fish found 2017.	88
Lower Delaware Region (Assunpink Creek to Maurice River watersheds)			
Country Lakes (Burlington)	8/31/17	Swamp Darter 2010. Blackbanded, Banded Sunfish, Swamp Darter in 2017	88
Franklinville Lake (Gloucester)	7/5/17	Blackbanded, Bluespotted 2005. Swamp Darter 1973. Banded 1972. Mud Sunfish 1958. Franklinville Lake is near historic Ironcolor Shiner sites. Blackbanded Sunfish 2017.	90
Iona Lake (Gloucester)	8/8/17	Historic Ironcolor Shiner, Banded, Mud Sunfish 1955. Blackbanded, Bluespotted, unknown *Enneacanthus* sp., Swamp Darter 2016 and 2017. No Ironcolor Shiner in 2017.	92
Lebanon Lake (Burlington)	6/23 & 6/30/17	Blackbanded, Banded, Mud Sunfish, Swamp Darter 2017	93
Menantico Sand Pond (Cumberland)	8/4/17	Blackbanded, Banded, Bluespotted Sunfish in 2016. Bluespotted and unknown *Enneacanthus* sp, Swamp Darter 2017	94
Mirror Lake (Burlington)	7/13/17	Blackbanded, Swamp Darter 2010. Banded 1969. Bluespotted 1968. Mud Sunfish 1951 Blackbanded, Bluespotted, unknown *Enneacanthus* sp, Swamp Darter 2017	95

List of sites surveyed in 2017 searching for less common freshwater fish species (continued).

Presidential Lake (Burlington)	6/23/17	Blackbanded, Banded, Mud, unknown *Enneacanthus* sp, Swamp Darter 2017	97
Scotland Run (Gloucester)	7/13/17	Ironcolor Shiner, Bluespotted, Blackbanded Sunfish downstream in 2002. Ironcolor Shiner, Bluespotted, Mud Sunfish downstream in 2016 Swamp Darter, Bluespotted Sunfish in 2017	A68
Lower Atlantic Coastal (Sloop Creek to Dennis Creek watersheds)			
Cedar Lake (WMA) (Atlantic)	7/14 & 19/17	Blackbanded, unknown *Enneacanthus* sp., Swamp Darter found in 2016. Blackbanded, Bluespotted, unknown *Enneacanthus* sp., Swamp Darter found in 2017.	86
East Creek Lake (Cape May)	7/11/17	Blackbanded, Banded, Bluespotted, Mud Sunfish 1952. Blackbanded, unknown *Enneacanthus* sp. 2017	89
Hammonton Lake (Atlantic)	7/17/17	Blackbanded, Banded, Bluespotted, Mud Sunfish 1957. Bluespotted, unknown *Enneacanthus* sp., Swamp Darter 2017.	91
Lake Nummy (Cape May)	7/25/17	Blackbanded, Banded 2016. Bluespotted 1956. Mud Sunfish 1955. Blackbanded, Banded, Bluespotted, Mud Sunfish 2017.	92
Makepeace Lake (Atlantic)	7/24/17	Blackbanded, Banded Sunfish 2016. Blackbanded, Banded, Bluespotted, Mud Sunfish, Swamp Darter in 2017	94
Pickle Factory Pond (aka West Creek Mill Pond) (Cape May)	10/5/17	Blackbanded, Banded, Bluespotted Sunfish 2016. Blackbanded, Bluespotted Sunfish 2017.	96
Stephens Lake (Atlantic)	6/26/17	Blackbanded, Bluespotted, unknown *Enneacanthus* sp, Swamp Darter 2017.	81 98
Tuckahoe Impoundments (Cape May)	7/21/17	Did not seine due to elevated salinity of 7.89 ppt.	98
Tuckahoe Lake (Cape May)	8/3/17	Mud Sunfish 1950. Banded, Bluespotted Sunfish 1999. Banded Sunfish 2016. Bluespotted Sunfish (other uncommon natives not found) 2017	99
Turn Mill Pond (Ocean)	6/10/17	Banded Sunfish, Swamp Darter 1966. Mud Sunfish 1993. Bluespotted, unknown *Enneacanthus* sp, Swamp Darter 2017.	99

Mud Sunfish
(soon to be Special Concern)

In addition to the sites that were surveyed specifically for rare native species, all 199 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 2017, 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.

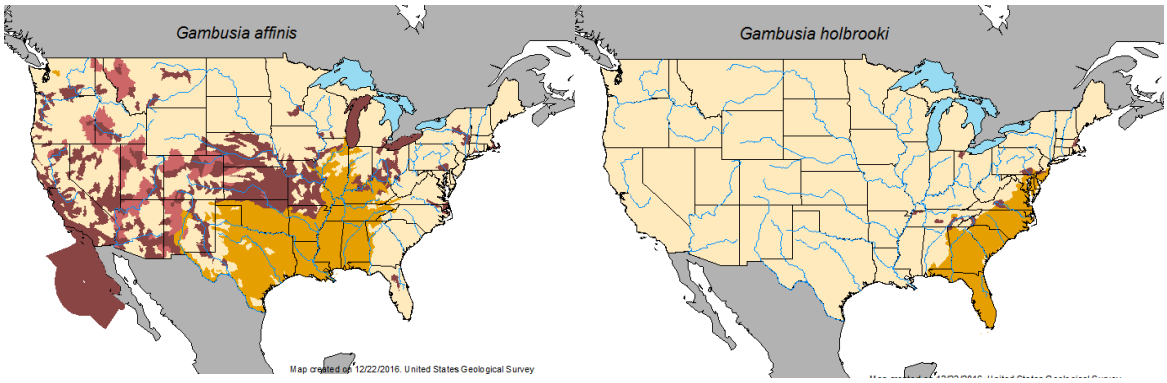
List of soon to be listed as state Endangered, Threatened, or Special Concern, including number of locations in which each species was encountered during 2017.

Species	Proposed status after Delphi and ENSAC review	Number of sites	New sites in FishTrack Database
Bridle Shiner	Endangered	1	1
Ironcolor Shiner	Endangered	0	0
Slimy Sculpin	Threatened	13 (3 from 1 stream)	5
American Brook Lamprey	Special Concern	2	2
Brook Trout (see Wild Brook Trout Assessment page 47)	Special Concern	34 (9 from 3 streams)	3
Blackbanded Sunfish	Special Concern	15	5
Comely Shiner	Special Concern	6 (6 from 1 river)	0
Northern Hog Sucker	Special Concern	1	0
Mud Sunfish	Special Concern	6	3
Shield Darter	Special Concern	9 (7 from 2 rivers)	0

Bridle Shiner (soon to be listed Endangered)

Mosquitofish

The Eastern Mosquitofish (*Gambusia holbrooki*) is native to the southeastern United States, with its northern range limit 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 Non-Indigenous 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 and 6 sites in 2017. Many of them were retained for future laboratory identification and are temporarily referenced generally as Mosquitofish sp./ *Gambusia* 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 II) (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. 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 sp*.), 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 in which invasive fish species were found in 2017 are listed in the table below, however Green Sunfish were excluded as they are now fairly widespread, found at 15 locations in 2017, 12 of which are new documentations. Green Sunfish are now found in 15 of 21 counties.

Locations surveyed in 2017 in which invasive fish species (not including Green Sunfish) were encountered.

Location	Drainage	Date	Species Targeted	Sampling Gear	Run Time (Hours)	Number of Fish
Cooper River Park Lake*	Cooper River	8/17/17	Northern Snakehead & Peacock Bass	Electrofishing	1.68	0 1
Delaware River (Bordentown)*	Delaware R.	8/21/17	Northern Snakehead & Grass Carp	Electrofishing	1.80	0 3
Delaware River (Burlington)*	Delaware R.	8/24/17	Northern Snakehead	Electrofishing	1.90	0
Delaware River (Trenton)*	Delaware R.	8/22/17	Northern Snakehead	Electrofishing	1.59	0
Delaware River (West Deptford)*	Delaware R.	8/28/17	Northern Snakehead	Electrofishing	1.66	2
DOD Lake*	Delaware R.	6/28/17	Northern Snakehead	Electrofishing	1.6	8
Game Creek*	Salem River	7/22/17	Northern Snakehead	Electrofishing	1.0	2
Game Creek*	Salem River	11/1/17	Northern Snakehead	Electrofishing	2.0	7
Millstone River*	Raritan	5/4/17	Grass Carp	Electrofishing	1.0	1
Millstone River*	Raritan	10/4/17	Grass Carp	Electrofishing	1.0	1
Newton Lake*	Newton Cr.	8/10/17	Northern Snakehead	Electrofishing	1.0	6
Salem Canal*	Salem River	8/9/17	Northern Snakehead	Electrofishing	1.86	1
Silver Lake	Cooper R.	7/7/17	Asian Swamp Eel	Electrofishing	1.22	55
Silver Lake	Cooper R.	7/13/17	Asian Swamp Eel	Electrofishing	0.80	87
Silver Lake	Cooper R.	10/19/17	Asian Swamp Eel	Electrofishing	0.84	30
St. Gabriel Brook*	Saddle River	8/3/17	Oriental Weatherfish	Electrofishing	0.3	3

* Sampled as part of other field activities

Asian Swamp Eel

Asian Swamp Eel

Silver Lake (Camden) – Backpack electrofishing surveys have been conducted annually at Silver Lake to monitor the invasive Asian Swamp Eel population since 2008, when they were first discovered there. Monitoring and control of them 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. In 2017 three backpack electrofishing surveys were completed at Silver Lake (10 acres) on July 7, July 13, and October 19 to monitor the invasive Asian Swamp Eel population. A total of 55 Swamp Eels were removed during 1.22 hours of electrofishing on July 7. A total of 87 were removed from 0.80 hours of electrofishing on July 13. Thirty Swamp Eels were removed on October 19 during 0.84 hours of backpack electrofishing. Increased monitoring and removal efforts will continue in 2018. The catch-per-unit-effort (CPUE) of 60 fish/hr was higher than 2016 (42 fish/hr) and higher than the mean CPUE (34 fish/hr) since sampling began in 2008. (See table and figure below). (Federal Grant F-48-R, Project II) (Smith)

History of Asian Swamp Eel collection at Silver Lake, Camden County.
CPUE (fish/hr) of Asian Swamp Eels collected from Silver Lake 2008 – 2017

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
2017	172	2.86	60
Total	1,809	50.52	35

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Northern Snakehead

Northern Snakehead from Cooper River Lake 2015

Cooper River Park Lake (Camden) – A boat electrofishing survey was completed at Cooper River Park Lake on August 17, 2017 to evaluate the Northern Snakehead population. None were collected during the 1.68 hour boat electrofishing survey, however a Peacock Bass, measuring 248 mm was collected and destroyed. This is the first recorded capture of the species in New Jersey. The fish was most likely released from an aquarium and since they are considered a tropical species, it would not have survived the cold winter temperatures. Stocking any fish species into New Jersey waters is illegal without a permit. (Federal Grant F-48-R, Project II) (Smith)

Delaware River (Burlington) – A boat electrofishing survey was completed at the Delaware River in Bordentown on August 21, 2017 to evaluate the Northern Snakehead population. Northern Snakeheads are considered an invasive species and as such both were destroyed. There were no snakeheads collected, however one Grass Carp (weighing approximately 40 lbs.) was collected and destroyed. Two additional Grass Carp of similar size were observed and alluded capture. Grass Carp are a non-native species, stocked in a sterile form by permit only, in a limited number of waters that meet specific requirements, to control aquatic vegetation. Their origin is most likely due to escapement from lakes or ponds that connect to the Delaware River.

Three additional boat electrofishing survey were completed at the Delaware River to evaluate the Northern Snakehead population. The second was in Trenton on August 22, 2017, where no snakeheads were collected, however two adult snakeheads were observed. A third survey was completed in Burlington on August 24, 2017 and no snakeheads were observed or collected. A fourth survey was completed in West Deptford on August 28, 2017 and two snakeheads, measuring 720 and 340 mm, were collected. Continued sampling is recommended to monitor the Northern Snakehead population. (Federal Grant F-48-R, Project II) (Smith)

DOD Lake (Salem) – The DOD Lake WMA is a 120-acre borrow pit located in Penns Grove. A lake inventory and management plan was completed in 2002. A boat electrofishing survey was completed on August 4, 2017 to evaluate the Northern Snakehead population. Northern Snakeheads were first reported in 2014 and their presence was confirmed by NJDFW in 2015. DOD Lake is connected to the Delaware River via a pipe with a tidal gate. Three Northern Snakeheads were collected during this survey, measuring 382 - 482 mm (15.1 – 18.9 in.). In comparison two Northern Snakeheads were collected in 2015 and eight in 2016. Northern Snakeheads are managed as an invasive species and as such all were destroyed. The snakehead population will continue to be monitored to determine the impact on the Largemouth Bass population. (Federal Grant F-48-R, Project II) (Smith)

Game Creek (Salem County) – A boat electrofishing survey was completed at Game Creek, a tributary of the Salem River located in Carneys Point on July 22 to evaluate the Northern Snakehead population. Northern Snakeheads were first documented in Game Creek in 2016. A total of two snakeheads, measuring 420 and 541 mm were collected during the 1.0 hour daytime electrofishing survey.

Two Northern Snakeheads captured and removed from Game Creek in 2017.

A second boat electrofishing survey was completed at Game Creek, in Carneys Point on November 1, 2017 to evaluate the Northern Snakehead population. A total of seven adult snakeheads ranging from 395 – 690 mm (15.6 – 27.2 in.) were collected and during 2.0 hour survey. Approximately 8-10 additional snakeheads were observed and avoided capture due to the dense emergent vegetation along the shoreline. Monitoring and removal of Northern Snakeheads should continue to determine and reduce any negative effects associated with the introduction of a non-native species. (Federal Grant F-48-R, Project II) (Smith)

Newton Lake (Camden) – Newton Lake is a 40-acre impoundment of Newton Creek bordered by Collingswood, Oaklyn and Haddon Township. Greater than half of the lake's shoreline, including the boat ramp, is maintained by the Camden County Parks System. Private residences border the rest of the lake. 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 August 10, 2017 to evaluate the Northern Snakehead populations. A total of three Northern Snakeheads were collected, ranging in size from 470 - 680 mm (12.6 - 26.6 in.), were collected during the 1.57 hour daytime survey. Submerged aquatic vegetation, in the form of Hydrilla, was determined to be extremely abundant in 2016, however was absent this year. The overall CPUE of Northern Snakehead appears to have been impacted by the reduction of aquatic vegetation. The lake will continue to be monitored for the presence of Northern Snakeheads and any impact they may have on the Largemouth Bass population. (Federal Grant F-48-R, Project II) (Smith)

Salem Canal (Salem) – A boat electrofishing survey was completed at Salem Canal on August 9, 2017 to evaluate the Northern Snakehead population. There was one Northern Snakehead, measuring 500 mm, collected during the 1.86 hour electrofishing survey. Monitoring and removal of Northern Snakeheads should continue to reduce any negative effects associated with the introduction of the species. A similar survey was completed on Game Creek, a tributary of Salem Canal later in the year. Both waters contiguous and managed collectivity. (Federal Grant F-48-R, Project II) (Smith)

Oriental Weatherfish

The Oriental Weatherfish (*Misgurnus anguillicaudatus*), one of ten fish species regulated as an invasive species in NJ, was recently confirmed in one new site, St. Gabriel Brook, in 2017. A population was also discovered in Whites Pond (Bergen) in 2016. Both locations are within the Saddle River Watershed, which was first documented in the Saddle River in 2001.

Live Oriental Weatherfish (above)

Sexual dimorphism male on left and female on right (below)

Oriental Weatherfish were also confirmed in the Raritan Watershed. In 2015, NJDFW staff responded to an angler that reported catching three in a minnow trap from a pond in the headwaters of 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. Upon further field investigation in 2015, 73 Oriental Weatherfish were documented and removed by NJDFW staff at several locations. Locations include adjacent tributaries, downstream in the Neshanic River, and approximately 11 miles downstream from the original encounter in the 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. (Federal Grant F-48-R, Project II) (Crouse)

Miscellaneous Non-native Species

Several species that are non-native to New Jersey waters were reported and confirmed in 2017 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. Releasing or stocking any fish in the state of New Jersey is illegal without a permit issued by the NJDFW. When encountered in the wild, NJDFW personnel remove both invasive and non-native species that are not managed as game species. (Federal Grant F-48-R, Project II) (Smith)

Two miscellaneous non-native species, not listed on the "potentially dangerous" list, were collected in 2017. A Peacock Bass was collected at Cooper River Park Lake, while sampling for Northern Snakeheads. This is the first recorded capture of the species in New Jersey. The fish was most likely released from an aquarium and since they are considered a tropical species, it would not have survived the cold winter temperatures.

A Tilapia was collected at Etra Lake during an electrofishing survey targeting Largemouth Bass. Tilapia are native to the African continent and are a popular food fish raised in the aquaculture market.

Location	Drainage	Date	Species	Number Captured	Gear	Page #
Cooper River Park Lake	Delaware River	8/17/2017	Peacock Bass	1	Electrofishing Boat	69
Etra Lake	Millstone River	10/31/2017	Tilapia sp.	1	Electrofishing Boat	71

Possibly first Peacock Bass caught in NJ in Cooper River Lake (2017)

Etra Lake Tilapia (2017)

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 at least 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 2017

Water Chestnut was only found in one new location in 2017, Etra Lake, during a boat electrofishing survey (page 71).

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).

In 2017, Cyanobacteria was confirmed at 21 waterbodies throughout the state. The first outbreak of the year was reported at Swartswood Lake on June 20, 2017. The final outbreaks, Manny's Pond (Hunterdon) and Budd Lake (Morris) continued as late as December 20, 2017. Leads on eight other waterbodies were reported, however when tested, Cyanobacteria was not found. Division staff continued to monitor the outbreaks on two Division Wildlife Management Areas, Amwell Lake and Penbryn Lake. Advisories were posted at each of the locations for the duration of the blooms and until cyanobacteria was confirmed not to be present. Laboratory analysis and HAB response coordination is handled by DEP's Bureau of Freshwater and Biological Monitoring. (Barno)

Waterbodies where Cyanobacteria was confirmed in 2017.

Waterbody	County	Township	Began	Ended
Swartswood Lake	Sussex	Stillwater Twp.	6/20/2017	7/2/2017
Shabakunk Creek/Lake Sylva	Mercer	Ewing Twp.	7/13/2017	8/8/2017
Branch Brook Lake	Essex	Newark	7/13/2017	12/20/2017
Deal Lake	Monmouth	Deal	7/18/2017	12/1/2017
Colonial Lake	Mercer	Lawrence Twp.	7/21/2017	8/8/2017
Amwell Lake	Hunterdon	E. Amwell Twp.	7/28/2017	8/15/2017
Pemberton Lake	Burlington	Pemberton Twp.	8/3/2017	12/20/2017
Lake Sara	Burlington	Mt. Laurel	8/8/2017	11/27/2017
Swartswood Lake	Sussex	Stillwater Twp.	8/10/2017	8/18/2017
Fletcher Lake	Monmouth	Bradley Beach	8/11/2017	9/8/2017
Lake Sylva/Colonial Lake/Shabakunk Creek	Mercer	Ewing/ Lawrence Twp.	8/25/2017	9/1/2017
Swartswood Lake	Sussex	Stillwater Twp.	9/4/2017	12/12/17
Sunset Lake	Somerset	Bridgewater Twp.	9/17/2017	12/20/2017
Washington Valley	Somerset	Bridgewater Twp.	9/18/2017	12/20/2017
Lake Ceva	Mercer	Ewing Twp.	10/4/2017	11/15/2017
Penbryn Lake	Camden	Winslow Twp.	10/10/2017	11/27/2017
Pompton River	Morris/Passaic	Lincoln Park/ Wayne	10/17/2017	10/26/2017
Lincoln Park Community Lake	Morris	Lincoln Park	10/24/2017	11/15/2017
Budd Lake	Morris	Mt. Olive Twp.	11/15/2017	12/20/2017
Manny's Pond	Hunterdon	Union Twp.	11/30/2017	12/20/2017
Wanaque Reservoir	Passaic	Ringwood Borough	12/3/2017	12/7/2017

Drought Watch/Warning

As noted in the 2016 Annual Report, 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. 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.

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 increased water temperatures, inadequate oxygen, lower flows, etc. However, due to the existing exceptionally low stream conditions, the newly proposed passing flows were, in some cases, well beyond any flows previously experienced in over 60 years. As a result, impacts to aquatic biota under these extreme conditions are difficult to predict.

The Drought Warning remained in effect until April 12, 2017, when it was lifted for 12 of 14 counties in the northern, central, and northern coastal regions of New Jersey. The Drought Watch for four counties in the southwestern part of the state was also lifted. Hunterdon and Somerset Counties remained under a Drought Warning for an additional four months, lifted August 18, 2017, as both Round Valley and Spruce Run Reservoirs were below normal capacity. Round Valley was at about 72 percent capacity and Spruce Run was at about 69 percent capacity. This allowed for continued modified passing flows designed to conserve storage.

Fish Contamination

Selover's Millpond / Lawrence Brook (Middlesex) -

A daytime boat electrofishing survey was conducted in Farrington Lake (223 ac) and Selover's Millpond (3 ac) on 5/23/17 to check Largemouth Bass for possible PCB toxicity. A hydraulic fluid spill occurred in Selover's Millpond, an onstream impoundment of the Lawrence Brook in October 2016. It was determined that high PCB levels were detected and as a result, the Division closed a 1.6-mile section of Lawrence Brook, from Riva Avenue bridge down to Ryders Lane. In order to determine if the fish are healthy to eat, 10 Largemouth Bass were collected from the site of the spill (Selover's Millpond) and 10 were collected from Farrington Lake (upstream, to serve as a control). Live fish were provided to the Division's fish pathologist Jan Lovy, who prepared the fish tissue and sent it out to a private laboratory for PCB analysis, that determined PCB levels in the fish tissue were at safe levels.

Electrofishing Selover's Mill Pond near site of contamination.

It took 3,614 seconds (1.0 hour) to collect 10 legal (greater than 12 inches) Largemouth Bass in Selover's Millpond. They ranged from 302 - 424 mm (11.9 – 16.7 in.), the largest of which weighed 1.550 kg (3.4 lbs.). Other fish species observed included Bluegill, Pumpkinseed, Black Crappie, Chain Pickerel, White Perch, Yellow Perch, Creek Chubsucker, Golden Shiner, Brown Bullhead, and American Eel. It took 1,437 seconds (0.4 hours) to collect 10 legal Largemouth Bass in Farrington Lake. They ranged from 309 - 417 mm (12.2 – 16.4 in.), the largest of which weighed 1.250 kg (2.8 lbs.). Other fish species observed included Bluegill, Pumpkinseed, White Perch, Yellow Perch, Brown Bullhead, Common Carp, and Alewife.

Melanistic Largemouth Bass captured from Farrington Lake in 2017.

Two Largemouth Bass from Selover's Millpond and one from Farrington Lake exhibited a characteristic known as "melanism," in which an accumulation of pigment occurs in the superficial tissue, presenting distinct black blotches all over the fish. Although believed to be non-harmful, some believe the melanistic tissue may be a precursor to a form of skin cancer. Specimens were retained and dissected by Dr. Lovy. It was determined that the blotches were very superficial (with no penetration into the muscle tissue) and not indicative of any concerns of malignancy. No additional fish tissue surveys are necessary at this time. (Hunter and Angler Fund) (Crouse)

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 2017, the Bureau of Freshwater Fisheries responded to fish health concerns at seven waterbodies:

Country Farms Road Pond (Burlington) – Country Farms Road Pond is a small retention pond approximately 1.5 acres in size located within Evesham Township. A fish kill was reported by Evesham Township Public Works on June 29, 2017. A fish kill investigation was conducted shortly after the call was received. The Health Department was present upon arrival. No foreign odors or chemicals were observed. Approximately 300, 8-12-inch Gizzard Shad were found dead throughout the pond. A small school of Bluegill and a Common Carp were seen "gulping air" at the surface. This behavior is an indication of low dissolved oxygen levels. Water chemistry data confirmed this. Dissolved oxygen levels within the pond measured 1.21 mg/L. Low dissolved oxygen levels combined with low water within the pond appear to be the primary cause of the fish kill. Additionally, storm runoff appears to be the only source of input, as no creek or stream was found entering the pond. Water temperature was 26.4℃, salinity 0.08ppt, and pH 7.25. (Boehm)

First Neshanic River - (Hunterdon) - On October 23, 2017 a complaint was received by the DEP Action Hotline, that indicated a discharge of sludge to the First Neshanic River, Raritan Township, Hunterdon County. NJDEP Compliance and Enforcement conducted an investigation and confirmed that Johanna Foods Inc. (JFI) was the source of the unpermitted discharge. Sludge was observed from JFI's discharge point to a drainage ditch and along the ditch bottom approximately 100 feet to its intersection with First Neshanic River. The river showed areas of impact for approximately 1,800 feet downstream to the southbound side of the Route 202/31 Bridge. Compliance and Enforcement issued a Notice of Violation to JFI, which is a manufacturer of yogurt and juice products. JFI processes a significant amount of sludge / food waste residuals on-site. JFI has an on-site wastewater treatment plant with a discharge of approximately 270,000 gallons per day to the Raritan Township Municipal Authority under an SIU (pre-treatment) NJPDES Permit. The sludge is de-watered and is typically land applied to one of two farms.

White Sucker observed swimming in clear water flowing over top of thick sludge material coating bottom of stream on November 14, 2017.

Equipment used to vacuum sludge from the streambed of the First Neshanic River.

On October 23, JFI manually removed a significant amount of sludge from the drainage ditch. Compliance and Enforcement conducted investigations at First Neshanic River on October 27 and November 3 after significant rain events. Some foam was evident on the River for 100-200 feet downstream of the discharge point. Areas of sludge accumulation remain for as far as 1/3 mile from the Route 202/31 Bridge. The water was predominantly clear and there is no evidence of a fish kill.

Streamside Environmental conducted initial cleanup efforts, which commenced on December 4. A joint site visit was conducted by BFF and Compliance and Enforcement on December 5 to evaluate initial cleanup efforts. Through and including December 8, a total of approximately 270,000 gallons of water/material was removed from the stream and processed at Johanna Foods. This volume was removed from the original silt curtain location, under the bridge, and approximately 50-100 feet upstream. The road on JFI property was completed on December 8. On December 9, Streamside commenced material removal, starting at the discharge point and working downstream. Upon successfully cleaning of a significant portion of stream, it became evident that a second source was present, because the material had reappeared. This material is thought to be seeping through the stream bank, a few feet downstream from the drainage ditch (sludge discharge location). A coagulant or polymer may have been added to this material, based on its reaction in the stream water. JFI's certified laboratory collected upstream and downstream samples in the hopes of identifying the material. Clean up was suspended until the source is identified and terminated. A corrective action plan was submitted by JFI. The remediation will be ongoing in 2018. (Hunter and Angler Fund) (Crouse)

Sediment disturbance in deep pool underneath the Route 202 / 31 bridge crossing of the First Neshanic River.

Pompton Lake – A fish kill at Pompton Lake was reported on April 10, 2017 and investigated on April 12, 2017 with fish pathologist Jan Lovy. Bluegill was the affected species and approximately 100 were found dead. Unfortunately, no live and infected specimens were encountered to bring back to the lab for necropsy. The likely cause was bacterial. (Collenburg)

Raritan River, South Branch (Morris) – A fish kill was reported below Budd Lake in the Raritan S/Br at the Smithtown Road bridge and investigated on March 8, 2017. Water chemistry samples were collected from the bridge, where twenty-five to thirty dead or dying White Perch were observed. It appeared that the fish had been dying over a period of time: some were significantly bloated, partially eaten, or desiccated, while some still had visibly moving fins or gills. The water was clear, and did not have any visible oil sheen or unusual foaming. No unusual smells were noted. No other species seemed to be affected by the kill, with some unidentified sunfish behaving normally. Several other locations were inspected, each with dead White Perch observed. NJDFW fish pathologist Dr. Lovy obtained fish specimens for laboratory analysis.

This fish kill may or may not be related to winter kill or the Columnaris bacteria outbreak that occurred on June 1, 2016. It was estimated that the 2016 kill affected approximately 700 White Perch, 20 Black Crappie, 2 Bluegill, and 5 Bullhead Catfish. The 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. It was 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. Moribund White Perch and Black Crappie were also occasionally encountered during several electrofishing surveys in the South Branch of the Raritan River, within a mile of Budd Lake approximately 7 years ago. (Sedor and Crouse)

Royce Brook (Somerset) - A fish kill in the Royce Brook in Hillsborough was reported to the DEP Action Hotine on July 19, 2017. Conservation Officer Doug Applegate investigated the site on July 20. Twenty to thirty dead fish were observed. Redfin Pickerel, Redbreast Sunfish, Common Shiner, American Eel, Banded Killifish, and possibly Mummichog were identified. All fish were "bleached out," apparently dead for more than 24 hours and had accumulated in one riffle. No smell or sheen was observed on the water. Many live fish were observed, along with amphibians and crayfish, all appeared healthy. A pond upstream from the site was inspected and no dead fish were observed, in fact people were fishing. The property owner reported that most of the fish were 1-4 inches, which is probably representative of the size distribution of fish in Royce Brook and not an indication of it affecting small fish only. The likely factor that led to the fish kill seems to have been low dissolved oxygen levels experienced during the recent series of days over 90°F. (Crouse)

Spruce Run (Hunterdon) - On the weekend of July 29 and 30, 2017, Eastern Concrete Materials Inc. released a large amount of sediment from their stone quarry in Glen Gardner into Spruce Run Creek (see photos). This *Trout Production* stream, a major tributary to Spruce Run Reservoir, supports a wild Brook and Brown Trout populations and is also trout stocked. The sediment was composed of pulverized granite that is produced as a waste product of newly quarried stone. The sediment laden wastewater was then collected in settling basins. After solids settle the clear top water was discharged into the creek. Unfortunately, pumping continued to the point in which sediment was illegally discharged, resulting in a significant amount of sediment released into the stream. A 1.7-mile section of the stream, from the quarry discharge to Spruce Run Reservoir was impacted. Accumulations of sediment was estimated to be approximately 2-4 inches throughout most of the stream, with most significant accumulations near the point of discharge. Maximum sediment depth was measured at 20 inches. Sediment samples were collected by USGS and a determination was made that the sediments were within health and safety standards, however the impacts to aquatic life would be detrimental if not adequately removed.

Various measures of water quality were taken on August 1, with no significant difference above and below the impacted area. Parameters included water temperature, oxygen, conductivity, specific conductance, total dissolved solids, salinity, pH, and alkalinity. Surprisingly, only a few dead fish including Brown Trout and amphibians such as Pickerel Frogs were reported.

Two electrofishing surveys were conducted on August 1 to determine if the fish assemblage had survived the initial impact (see Appendix pages A60 and A61). The first survey was conducted in a 150-m section immediately downstream of the discharge and a second 150-m site was sampled approximately 1 mile further downstream. An abundance of wild Brown Trout, including young-of-the-year (YOY), were found at both sites (68 and 52 respectively), a few stocked Rainbow Trout (10 and 3 respectively), and one wild Brook Trout YOY was found at each site. Other common fish species were encountered as well. Numbers of fish collected were likely under-estimated, due to decreased visibility in the turbid water. A healthy fish assemblage was found at both sites, however without a rapid cleanup effort, it was anticipated that they would not survive in the short-term, due to starvation (anticipated loss of aquatic insects due over time due to sediment) and/or will not be able to adequately spawn. Spawning would be impacted by lack of suitable spawning substrate (gravel), shifting of sediment smothering eggs/redds (nests), and curtailed movement of fish due to extensive sediment. DFW has determined a fish salvage was not necessary. Electrofishing surveys will be duplicated during the summer of 2018 to assess the status of the fishery. For more detailed information regarding the clean-up of Spruce Run, please refer to page 57.

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)

Camp Roosevelt (Watson's Mill Pond) – Fish and Wildlife was contacted by the Division of Dam Safety and Flood Control on July 28, 2017, indicating that the dam had failed at Watson's Mill Pond, located within the Camp Roosevelt Scout Camp in Alloway Township, Salem County. Water levels were dropping at approximately 1 inch per hour. A fish salvage was conducted and approximately 1,000 fish were removed and relocated. The fish population consisted of Bluegill (500), Yellow Perch (50), White Perch (100), Black Crappie (100), Largemouth Bass (50), Golden Shiner (50), Chain Pickerel (20), Pumpkinseed (100), American Eel (10), and Brown Bullheads (20). Approximately 750 fish were relocated to Alloway Lake and 250 to Memorial Lake in Woodstown. Approximately 30 Common Carp, an invasive species, were removed and disposed of on-site. NJDFW will restock the lake following dam and water control structure repairs. (Smith)

Delaware and Raritan Canal – Kingston (Middlesex) - On June 16, 2017 a concerned angler reported that fish were stranded and appeared to be stressed in a small ponded area between the D&R Canal and the Millstone River at Kingston. Approximately 20 Common Carp and a variety of other fish species were found residing in the shallow pond. A 20'x5' seine was used to collect fish. White Perch, Golden Shiner, American Eel, Redbreast Sunfish, and Channel Catfish were relocated to the D&R Canal, as water in the pond was likely to decline and threaten fish survival. According to New Jersey Statute, it is unlawful to relocate carp, therefore 12 Common Carp were removed and destroyed. A second site visit was conducted on June 26, 2017. Three more dead carp were observed, in addition to a few dozen live Bullfrog tadpoles. Due to the configuration of the waterway connecting the canal and river, it is likely that fish will continue to become periodically trapped. No further action is necessary at this time. (Crouse)

Removal of stranded Common Carp from the D&R Canal.

Kazmar Pond Fish Salvage (Sussex) – Kazmar Pond, located in Wawayanda State Park, has a dam that NJDEP Dam Safety determined to be unsafe and in need of repair. Instead of repairing the dam, it was decided to remove the dam and drain the pond. This pond is not used for fishing very much, as its location makes it difficult for anglers to access. Due to the lakes location, it is also not possible to access the pond with the Division of Fish and Wildlife's electrofishing boat, making a fish salvage difficult, if not impossible. It was decided that the best possible way to salvage fish from Kazmar Pond would be to drain the lake as quickly as possible to allow the fish to move downstream into Double Kill Creek and collect the fish in the stream environment. The stream has a firmer substrate that would allow backpack electrofishing and seining efforts. As it turned out, there was hardly any fish in the lake and a fish salvage was not necessary. The lack of fish found in the lake was most likely due to habitat manipulation and lake level changes from previous attempts to lower the lake several years earlier by Parks and Forestry staff, when the dam was notched. (Shramko)

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 game species). 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).

Double backpack electrofishing crew

Data from 53 electrofishing surveys conducted in 2017 can be used to assess the current classification based on presence of trout or trout associated species of streams in the state's Surface Water Quality Standards. Although two of the surveys were performed specifically for

classification purposes, the remaining 51 are valuable in confirming existing classification as well as identifying potential upgrades.

Streams recommended for upgrades include Bear Brook (Park Ridge) (currently [FW2-NT(C1)] by default because not previously surveyed), however data from 2017 indicates it should be upgraded to FW2-TM(C1), with an Incidence of Occurrence value of 33.6 (Table 2). Cresskill Brook (Demarest) is classified as FW2-NT(C1), however the Incidence of Occurrence value of 24.0 warrants an upgrade to FW2-TM(C1). Finally, YOY Brook Trout were found in two unnamed tributaries to the Raritan River S/Br that currently have a default classification of [FW2-NT]. Both streams were previously recommended for upgrade to FW2-TP(C1) and were recommended to be named Raritan River S/Br (trib.)(Drakestown) and Raritan River S/Br (trib.)(SW of Budd Lake).

Five streams currently have default classifications that were confirmed, therefore they could now be individually listed in the Surface Water Quality Standards. St. Gabriel Brook (Saddle River) has a default classification of [FW2-NT(C1)] and the Incidence of Occurrence value of 16.9 obtained in 2017 indicates it can now be individually listed (Table 2). Three unnamed tributaries in the Flat Brook watershed with default classifications all resulted in finding young-of-the-year (YOY) trout. Suggested names for these unnamed tributaries are: Big Flat Brook (trib.)(Lake Wapalanne), Big Flat Brook (trib.)(W of Lake Ashroe), and Little Flat Brook (trib.)(Flat Brook Office). An unnamed tributary to Rockaway Creek, S/Br currently has a default classification of [FW2-TP(C1)] and this was confirmed by finding YOY Brown Trout. This would allow for this unnamed tributary to be individually listed as FW2-TP(C1); if so it is recommended to name this tributary Rockaway Creek, S/Br (trib.)(Lebanon Boro).

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 2017 data confirmed the classifications of 22 stream segments (28 surveys) and no action is required (Table 3). 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 cannot be re-established. This was true for 15 surveys at 12 locations in 2017, therefore no action is required at this time (Tables 4).

The process of assessing the Surface Water classifications of individual waterways has resulted in two inconsistencies of stream classification between N.J.A.C. 7:9B and the related NJDEP Surface Water Quality GIS layer (version 201012). Oakdale Creek is currently classified as FW2-TP(C1) within the Administrative Code, however it is labeled as “Lamington River UNT” and classified as FW2-NT within the GIS layer. Classifications within the Administrative Code and the GIS layer need to be reviewed to determine if additional discrepancies exist for the Clove Brook Watershed, which originates from Lake Marcia and flows to flows to the state line. (Federal Grant F-48-R, Project I) (Crouse)

Table 2. Summary of recommended surface water classification changes supported by 9 surveys conducted in 2017 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 North & Wallkill Region (Shimmers Brook to Paulins Kill and Wallkill River watersheds)									
*Big Flat Brook (Trib.) (Lake Wapalanne)	Entire length, including all tributaries	41º13'22.6"	74º45'0.9"	[FW1-TP]	FW1-TP(C1)	NA	Brook	7/20/17	A5
* Big Flat Brook (Trib.) (W of Lake Ashroe)	Entire length, including all tributaries	41º11'30.0"	74º50'6.5"	[FW2-TP(C1)]	FW2-TP(C1) [a]	NA	Brook & Brown	8/1/17	A6
* Little Flat Brook (Trib.) (Flat Brook Office)	Entire length, including all tributaries	41º11'43.4"	74º50'41.0"	[FW2-TP(C1)]	FW2-TP(C1)]	NA	Brook	7/13/17	A10
Lower Passaic & Upper Atlantic Region (Lower Passaic, Saddle, Hackensack, Pascack & Elizabeth to Toms River watersheds)									
*Bear Brook (Park Ridge)	Spring Valley Road to Woodcliff Lake, including all tributaries	41º01'58.1"	74º03'34.2"	[FW2-NT(C1)]	FW2-TM(C1)	33.6	Brown [b]	8/14/17	A30
Cresskill Brook (Demarest)	Duck Pond Rd. bridge to Tenakill Brook	40º55'41.0"	73º56'27.1"	FW2-NT(C1)	FW2-TM(C1)	24.0	None	8/8/17	A33
St. Gabriel Brook (Saddle River)	Entire length, including all tributaries	41º1'16.6"	74º5'55.6"	[FW2-NT(C1)]	FW2-NT(C1)	16.9	None	8/3/17	A35
Raritan Region (Raritan River watershed)									
*Raritan River S/Br (Trib.) (Drakestown)	Entire length	40º51'9.5"	74º46'01.4"	[FW2-NT]	FW2-TP(C1) [a]	NA	Brook	8/29/17	A51
*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	8/29/17	A54
*Rockaway Creek, S/Br (Trib.) (Lebanon Boro)	Headwaters to confluence with Rockaway Creek, S/Br, including all tributaries	40º38'31.7"	74º49'39.9"	[FW2-TP(C1)]	FW2-TP(C1)	NA	Brown & Rainbow [c]	8/29/17	A58

[a] Potential change also supported by data collected previously
[b] Young-of-the-year trout not present, however trout from older year classes present.
[c] Stocked trout
* Indicates unnamed tributary as recognized by SWQS. Name given is recommended by NJDFW.

Table 3. Electrofishing surveys conducted in 2017 by NJ Division of Fish and 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 "2017 Investigation and 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	8/8/17	A1
Upper Delaware (South) Region (Delawanna Creek to Lockatong Creek watersheds)								
Pequest River (Vienna)	Tranquility bridge to Lehigh and HudsonRiver railway bridge	40º53'17.9"	74º54'12.7"	FW2-NT	9.9	None	8/17/17	A18
Pequest River (Vienna)	Tranquility bridge to Lehigh and HudsonRiver railway bridge	40º52'47.3"	74º54'20.7"	FW2-NT	9.1	None	8/17/17	A19
Stephensburg Brook (Stephensburg)	Entire length	40º47'34.7"	74º52'16.6"	FW2-TP(C1)	NA	Brook & Brown	8/14/17	A20
West Portal Creek (West Portal)	Entire length	40º39'46.6"	75º02'0.1"	FW2-TP(C1)	NA	Brook & Brown	7/20/17	A21
West Portal Creek (West Portal)	Entire length	40º40'52.7"	75º01'49.1"	FW2-TP(C1)	NA	Brown	7/20/17	A22
Upper Passaic Region (Pompton, Pequannock, Wanaque, Ramapo, Upper Passaic, Whippany, & Rockaway River watersheds)								
Pequannock River (Kinnelon)	Macopin Reservoir outlet to Hamburg Turnpike bridge in Pompton Lakes Borough	41º00'14.7"	74º20'58.0"	FW2-TP(C1)	NA	Brown & Rainbow [c]	7/11/17	A23
Pequannock River (Kinnelon)	Macopin Reservoir outlet to Hamburg Turnpike bridge in Pompton Lakes Borough	41º00'7.8"	74º18'59.4"	FW2-TP(C1)	NA	Brown & Rainbow [b]	7/11/17	A24
Pequannock River (Kinnelon)	Macopin Reservoir outlet to Hamburg Turnpike bridge in Pompton Lakes Borough	40º59'57.4"	74º18'19.7"	FW2-TP(C1)	NA	Brown & Rainbow [b]	7/10/17	A25
Pequannock River (Kinnelon)	Macopin Reservoir outlet to Hamburg Turnpike bridge in Pompton Lakes Borough	40º59'58.2"	74º17'53.1"	FW2-TP(C1)	NA	Brown & Rainbow [b]	7/10/17	A26
Raritan Region (Raritan River watershed)								
Beaver Brook (Annandale)	Beaver Ave. bridge downstream to the lower most I-78 bridge	40º38'18.9"	74º52'49.9"	FW2-TP(C1)	NA	Brown & Rainbow [b]	8/16/17	A36
Beaver Brook (Clinton)	Lower most I-78 bridge downstream to, the South Branch Raritan River	40º38'13.9"	74º54'23.9"	FW2-TM	29.1	Brown [a]	8/16/17	A37

Table 3 (continued)

Raritan Region (Raritan River watershed) (continued)								
Electric Brook (Schooley's Mtn)	Entire length	40º47'19.0"	74º46'39.9"	FW2-TP(C1)	NA	Brown	7/19/17	A40
Hickory Run (Califon)	Entire length	40º42'55.8"	74º51'45.5"	FW2-TP(C1)	NA	Brook	8/11/17	A41
Oakdale Creek (Chester)	Entire length	40º47'52.1"	74º41'55.1"	FW2-TP(C1)	NA	Brook	7/26/17	A49
Raritan River S/Br (Trib.) (S. of Hoffmans)	Entire length	40º41'47.2"	74º52'13.1"	FW2-TP(C1)	NA	Brown	7/19/17	A52
Raritan River S/Br (Trib.) (S. of Schooleys Mtn.)	Entire length	40º46'25.8"	74º48'22.8"	FW2-TP(C1)	NA	Brook & Brown	7/31/17	A53
Rinehart Brook (Hacklebarney)	Entire length	40º44'40.0"	74º44'10.0"	FW2-TP(C1)	NA	Brook & Brown	8/23/17	A55
Rockaway Creek, S/Br (Clinton)	Headwaters to Readington Township boundary including all tributaries	40º38'23.8"	74º49'22.8"	FW2-TP(C1)	NA	Brown	8/29/17	A57
Rocky Run (Lebanon)	Entire length	40º41'41.0"	74º54'36.9"	FW2-TP(C1)	NA	Brook	8/11/17	A59
Spruce Run (Glen Gardner)	Source to, but not including, Spruce Run Reservoir	40º41'26.1"	74º56'9.3"	FW2-TP(C1)	NA	Brook & Brown	8/1/17	A60
Spruce Run (Glen Gardner)	Source to, but not including, Spruce Run Reservoir	40º40'53.0"	74º55'25.8"	FW2-TP(C1)	NA	Brook & Brown	8/1/17	A61
Stony Brook (Washington)	Entire length	40º47'49.6"	74º45'17.3"	FW2-TP(C1)	NA	Brook & Brown	8/21/17	A62
Teetertown Brook (Lebanon)	Entire length	40º45'0.4"	74º50'43.1"	FW2-TP(C1)	NA	Brook	7/31/17	A64
Trout Brook (Hacklebarney)	Entire length	40º45'05.0"	74º43'52.5"	FW2-TP(C1)	NA	Brook	8/23/17	A65
Turkey Brook (Mt. Olive)	Entire length	40º50'18.7"	74º44'29.7"	FW2-TP(C1)	NA	Brook & Brown	8/14/17	A66
Willhoughby Brook (Buffalo Hollow)	Entire length	40º40'18.5"	74º54'49.5"	FW2-TP(C1)	NA	Brook [a] & Brown	8/10/17	A67
Lower Delaware Region (Assunpink Creek to Maurice River watersheds)								
Scotland Run	Maurice River Main Stem (Willow's Grove)	39º39'17.8"	75º03'5.5"	FW2-NT	4.8	none	7/13/17	A68

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

Table 4. Electrofishing surveys conducted in 2017 by NJ Division of Fish and 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 cannot be re-established. Reproducing trout species is determined by the presence of young-of-the-year trout. Data are found in report titled "2017 Investigation and 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	41º11'54.9"	74º49'5.1"	FW2-TP(C1)	31.9	Rainbow [b]	8/15/17	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	41º12'23.5"	74º48'22.3"	FW2-TP(C1)	27.7	Rainbow [b]	8/15/17	A4
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	41º11'30.6"	74º50'34.6"	FW2-TP(C1)	19.8	none	8/1/17	A4
[c] 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)	NA	Brown	8/9/17	A7
Forked Brook (Stokes State Forest)	Entire length	41º14'20.9"	74º44'42.3"	FW2-TP(C1)	53.4	Brook [a]	8/8/17	A8
Little Flat Brook (Layton)	State park boundary to, but not including, tributary described below, to confluence with Big Flat Brook	41º17'5.7"	74º45'25.2"	FW1-TP	32.1	none	7/20/17	A9
Sparta Glen Brook (Sparta)	Entire length	41º2'19.0"	74º36'57.2"	FW2-TP(C1)	36.1	Brook [a]	7/12/17	A11
Sparta Glen Brook (Sparta)	Entire length	41º2'18.1"	74º36'42.0"	FW2-TP(C1)	36.1	Brook [a]	7/12/17	A12

Table 4. (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	40º56'26.9"	73º56'1.6"	FW2-TP(C1)	32.1	none	8/21/17	A31
Cresskill Brook (Alpine)	Source to Duck Pond Rd. bridge, Demarest	40º56'41.0"	73º56'27.1"	FW2-TP(C1)	16.0	none	8/8/17	A32
Raritan Region (Raritan River watershed)								
Black Brook (Polktown)	Entire length	40º39'39.0"	74º56'54.6"	FW2-TP(C1)	35.7	Brown [a]	8/10/17	A38
Drakes Brook (Trib) (Mt. Olive)	Source downstream to Central Railroad bridge	40º49'54.8"	74º42'59.8"	FW2-TP(C1)	14.2	none	7/26/17	A39
Lamington (Black) River (Trib)(Ironia)	Source downstream to, but not including, Bryant Pond	40º49'58.9"	74º37'25.6"	FW2-TP(C1)	0	none	7/26/17	A42
Mine Brook (Trib) (E of Mine Mt.)	Entire length	40º42'56.0"	74º35'42.6"	FW2-TP(C1)	30.9	Brook [a]	7/27/17	A47
Mine Brook (Trib) (S of Mine Mt.)	Source downstream to Douglass Road Bridge	40º42'7.9"	74º36'30.6"	FW2-TP(C1)	17.1	none	7/27/17	A48
Sun Valley Brook (Mt. Olive)	Entire length	40º51'1.8"	74º45'24.0"	FW2-TP(C1)	26.6	none	8/21/17	A63

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

[b] Stocked trout

[c] Only one young-of-the-year present during 2017 survey. No YOY found during numerous surveys in recent history. More data needed prior to recommending upgrade.

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-ft 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) (Crouse)

One water temperature and dissolved oxygen profile was conducted in 2017. It was conducted during the summer months and can be used to use for classification purposes in the Surface Water Quality Standards (Table 6). This survey confirmed the existing classification, therefore no additional surveys are necessary for classification purposes at this time.

Egg Harbor Township Nature Reserve Lake (Atlantic) – Egg Harbor Township Nature Reserve Lake is a 29-acre waterbody located within Egg Harbor Township. The lake is located within the 220-acre Egg Harbor Township Nature Reserve and is an old sand quarry. A dissolved oxygen temperature profile was completed on August 2, 2017. The deepest recorded depth was 19 feet and suitable dissolved oxygen levels to support aquatic life were found down to 13 feet within the lake, however no trout supporting water (see below). Water chemistry was recorded; conductivity measured 51.8 us/cm, salinity 0.02 ppt, and pH 8.64. (Boehm)

Table 6.— Summary of temperature and dissolved oxygen profile conducted during the summer months on one lakes in 2017. Results page number references in *2017 Investigations and 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
Lower Atlantic Coastal (Sloop Creek to Dennis Creek watersheds)					
Egg Harbor Township Reserve Pond	FW2-NT(C1)	none	confirmed	8/2/17	71 & 89

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

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)

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

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 have 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 2017 trout season was Saturday, April 8th. The weather was pleasant with partly cloudy skies, but with windy conditions, which was still far better than last year where some locations received up to 3 inches of snow on opening day. The difficulty facing anglers in 2017 was high flows and off colored water especially on the streams and rivers along with the usual colder water temperatures. Several inches of rain over the two weeks prior to opening day had the streams and rivers running very fast and high and the water was off colored making it difficult for anglers to spot and target fish. Of the 41 surveys conducted, 30 were on lakes and ponds. 1,810 anglers were observed fishing (an average of ~60 anglers per waterbody) on just the lakes and ponds alone. This number is up from last year's opening day when 664 anglers were observed on 18 lakes and ponds surveyed (an average of ~37 anglers per waterbody). It is important to note, that the number of anglers fishing is much higher than last year partially due to the popularity of Spring Lake in Monmouth County which was not surveyed last year.

Spring Lake has a very popular kid's fishing derby on opening day annually. This year about 666 anglers, many of them children, were fishing Spring Lake. If we remove the Spring Lake anglers from the calculation, survey clerks recorded 1,144 anglers on 29 waterbodies statewide (an average of ~39 anglers per waterbody). This is slightly better than the 37 anglers per waterbody recorded on 18 lakes and ponds last year.

Trout-stocked Lakes and Ponds Results

In some locations trout fishing was fantastic. Several anglers expressed what a wonderful day of fishing they had and thanked the Division of Fish and Wildlife for their efforts in making the 2017 opening day a huge success. Mountain Farm Pond (Hunterdon), Silver Lake (Sussex) and South Vineland Park Pond (Cumberland), to name a few, were by far the place to be on opening day as anglers had the highest catch rates per angler at 2.10 fish per angler, 1.30 and 0.94 fish per angler respectively.

Unfortunately, trout were not as cooperative in all the lakes and ponds across the state. The higher than usual, murky 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.

The following waterbodies had a total of five or fewer trout reportedly caught by all anglers. The number of anglers ranged from 87 to 26.

- Burnham Park Pond – 87 anglers caught 1 trout
- Birch Grove Park Ponds – 85 anglers caught 2 trout
- Rosedale Lake – 44 anglers caught 2 trout
- Laurel Pond – 39 anglers caught 5 trout
- Mt. Hope Pond – 31 anglers caught 0 trout
- Tuckahoe Lake – 29 anglers caught 3 trout
- Colonial Lake – 26 anglers caught 0 trout

The following waterbodies also reportedly caught five trout or less, but had considerable fewer anglers (7-16 anglers total):

- Swedesboro Lake – 16 anglers caught 1 trout
- Lake Shenandoah – 15 anglers caught 0 trout
- Columbia Lake – 14 anglers caught 1 trout
- Lake Musconetcong – 13 anglers caught 0 trout
- Mill Pond – 9 anglers caught 2 trout
- Mountain Lake – 7 anglers caught 0 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. 2017 results showed the worst anglers success rates compared with previous opening days. 2017 had a success rate per angler of 0.22 fish per angler or just over 1 fish for every 5 anglers. The poor success in 2017 can be attributed to higher water flows, off colored water, and cold water temperatures. The most successful opening day was in 2008 when 0.73 trout were caught per angler. See table below for more detail.

Jonathan Paterno holds one of the coveted broodstock from South Vineland Park Pond.

Yearly comparison of angler success rate

		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	AVERAGE
Total	**Anglers**	1115	853	1095	1462	1675	1918	1830	2100	664	1810	**1452**
	# Trout	814	485	551	669	1107	1354	996	960	380	402	**772**
	Trout/Angler	0.73	0.57	0.50	0.46	0.66	0.71	0.54	0.46	0.57	0.22	**0.53**

Some waterbodies have been producing consistently bad opening day success rates. The following waterbodies in Table below will continue to be monitored, but if their success does not change, they could be dropped from the trout stocking program in the future.

A complete list of the 2017 Opening Day angler success on the lakes and ponds can be found in the appendix of this report along with information on angler success.

Waterbodies with consistent poor angler success.

County	Waterbody	Acres		2010	2011	2012	2013	2014	2015	2016	2017	AVERAGE
Mercer	Colonial Lake	10	**Anglers**	58			50	22	28	50	26	**39**
			# Trout	4			8	0	2	0	0	**2**
			Trout/Angler	0.07			0.16	0	0.07	0	0	**0.06**
Atlantic	Heritage Park Pond	6	**Anglers**					14	25	7	21	**23**
			# Trout					1	3	0	2	**3**
			Trout/Angler					0.07	0.12	0	0.1	0.13

Trout-stocked Streams and Rivers

Angler William Gunderman proudly holds his first trout of the season, caught at Franklin Pond Creek.

Photo Credit: Lisa Kisch, 04/09/2016

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.

Angler surveys and counts were conducted on 11 streams or small sections of streams in 2017. A total of 161 anglers were surveyed. The catch rate was very inconsistent. The larger rivers had very high flows and the water was off colored making it very difficult for anglers to target and catch trout. Despite the difficult conditions, a few anglers found some success at the Musconetcong River, the Pohatcong Creek and the Pequannock River with catch rates nearing 1 fish per angler. Anglers struggled a little bit more than average on the Pequest and the Paulinskill in the small sections that were surveyed.

The smaller streams had better conditions, but the catch was still inconsistent. Some smaller streams like the Hakihokake Creek and India Brook anglers did well, while others like Lopatcong Creek, and Pophandusing Creek had few anglers and no fish were caught from 8:00 until the time they were surveyed.

In summary, opening day on the streams and rivers was hit or miss with difficult fishing conditions especially on the bigger rivers. A few anglers did well even under the difficult conditions, but overall fishing streams and rivers was slow and difficult.

A complete list of Opening Day angler counts on streams and rivers can be found in appendix of this report along with information on angler success.

In Summary

Opening Day success in 2017 was varied. The cold water temperatures and high stream flows 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. Surprisingly, some anglers fishing streams, even with the higher than average flows, were still quite successful, but unfortunately the average angler's success rate was far lower than past opening days. The average angler's catch rate was 0.22 fish per angler on ponds and lakes. This is much lower than the average angler success rate of 0.53 fish per angler fishing ponds and lakes.

The overall number of opening day anglers counted in this year's survey was 1,810 anglers. This number is higher than the average number of anglers since 2008, but was highly influenced by

Spring Lake in Monmouth County which had over 600 anglers. The sunny and 50°F forecasted temperatures definitely had people out fishing, but the colder water temperatures and higher flows kept many fish from biting. Spring Lake had the largest showing of anglers with 666 individuals fishing. But the place to be was Mountain Farm Pond in Hunterdon County as 82 trout were caught by 39 anglers (2.10 fish per angler). Not bad for 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, lower flows, and milder days prevail.

Reports and detailed results noted by volunteer survey clerks for each waterbody surveyed can be found in the appendix of this report.

Acknowledgements
New Jersey Division of Fish and Wildlife's Bureau of Freshwater Fisheries staff would like to thank the following Volunteers and DEP staff who make this project possible every year. Together with NJDFW staff angler counts were conducted on 40 waterbodies across the state. A special note of thanks is also extended to Fisheries Technician Chuck Sedor for coordinating the volunteer efforts.

Survey Clerks			
Name	**Affiliation**	**Name**	**Affiliation**
Aysia Gandy	WCC	Betsy Isley	WCC
Justin Fuller	WCC	John Miraglia	WCC
Amy Loesser	WCC	Matt Mattei	WCC
Cathy Beil	WCC	Rob Sexton	WCC
Hung Le	WCC	Patience Armstrong	WCC
Ed Ward	WCC	James Becker	WCC
Jim Velcheck	WCC	Sami Doganay	WCC
Joe DeFelice	WCC	Amanda Van Buskirk	WCC
Dave Bright	WCC	Travis Prefach	WCC
Donna Herrmann	WCC	Kathy Collins	WCC
Tito Ramirez	WCC	Patricia Walker	WCC
Daniel Simmler	WCC	Randall Fiore	WCC
Fred Klein	WCC	Bill Praschil	WCC
Lauren Rojewski	WCC	Domenic Lanciano	WCC

Reports and detailed results noted by volunteer survey clerks for each waterbody surveyed can be found in Appendix F of this report. (Federal F-48-R, Project III) (Shramko)

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 resource users and the resource. (Federal Grant F-48-R, Project III)

In 2016 seven special regulation areas were included in the logbook program and the logbooks results were compiled (see table below). A total of 78 anglers were issued logbooks for the program, receiving a total of 84 logbooks (some anglers needed more than one logbook to record all their trips). Despite efforts to encourage logbook returns, only 13 anglers (16%) returned their logbooks, down from a 19% return rate in 2015. Collectively, the 13 logbook anglers logged 194 trips to 5 of the 7 special regulation trout fishing areas and spent a total of 958.5 hours fishing these areas. The Big Flat Brook / Flat Brook *Catch and Release* (*C&R*) area was the most commonly visited site with 74 trips (38%), followed by the Musconetcong River *YTCA* (70 trips, 36%), and the Ken Lockwood Gorge *C&R* section of the South Branch Raritan River (34 trips, 18%). The remaining 14 trips (8% of total) were to the Pequest River *STCA* (11 trips, 6%) and the S/Br. Raritan River – Claremont Stretch *YTCA* (3 trips, 2%). No fishing trips were recorded for the Toms River *YTCA* or the Pequannock River *TCA*. Anglers fished an average of 1.4 to 4.6 hours per trip; the highest average trip lengths were on the Ken Lockwood Gorge (4.6 hrs/trip), the Musconetcong River (4.5 hrs/trip), and Pequest (2.9 hrs/trip). The logbook data includes trips that were taken to the *STCA*s at times when the special regulations were not in effect. Fly fishing gear was used by anglers for most trips; only 3 trips (2%) by one angler used both spin and fly fishing gear.

Logbook anglers recorded a total catch of 1,118 trout. Catch and release fishing was practiced by all participants in the study; no fish were recorded as kept (or unrecorded). Angler catch rate averaged 1.2 trout/hr, down from 2.0 in last year's survey. Catch per hour ranged (by special regulation area) from 0.7 – 1.6 trout/hour. The average number of trout caught per trip was 4.5, and by special regulation area ranged from 1.4 – 7.2 trout/trip. These catch rates are noticeably lower than previous year's logbook reports (2013 – avg. 7.0/trip, 1.8/hr., 2014 – avg. 5.2/trip, 1.9/hr., 2015 – avg. 8.0/trip, 2.0/hr.). While it is difficult to say why with certainty, participating anglers frequently mentioned very low water levels in their fishing notes, which may have led to reduced fishing success. The highest catch rates (per hour and per trip) occurred in the Musconetcong River *Point Mountain YTCA* (1.6/hr, 7.2/trip). The lowest catch rate was on the *Claremont YTCA* on the South Branch of the Raritan River (0.7 trout/hr and 1.4 trout/trip). Most trip reports were close to the average, though ten trips were recorded with more than 20 fish caught, with the highest being 35 fish in one trip to the Flat Brook.

Of the total trout caught, anglers recorded the species for all but two fish. Overall Rainbow Trout were caught most frequently (96%), followed by Brown Trout (1.6%), and Brook Trout (1.4%). Two Tiger trout (Brook X Brown hybrid) were recorded in the Ken Lockwood Gorge (9 and 10 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 fish coloration. Anglers reported catching 35 (3%) wild trout and 1,066 (96%) stocked trout. 17 (1%) trout were recorded as species origin unknown, indicating that most anglers were confident in their ability to distinguish wild from stocked fish. This may be in part due to the state's exclusive stocking of Rainbow trout; anglers feel confident that any Brook or Brown trout they catch are either wild in origin or stocked privately. Wild Rainbow trout are relatively uncommon in New Jersey.

The average size of trout caught (results not provided in the table) was 284 mm (11.2 in.) and they ranged in size from 101 mm (4 in.) (Brook trout, Musconetcong River) to 685 mm (27 in.) (Rainbow trout, Pequest River *STCA*). Fifty-four % (606) of trout recorded fell within 9 to 11 inches, typically stocked by the Pequest Trout Hatchery. Eighty % (896) 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 19 logbooks returned by 13 anglers.

Total number of trips	Hours Per Trip	Number of trout caught by species[1]				Total trout caught	Number of trout caught by origin			% caught	Number of caught per	
		BKT	BNT	RBT	UNK		Wild	Stocked	UNK[1]		Hour	Trip
Big Flat Brook / Flat Brook (Catch & Release Area)												
76	2.9	3	1	360	0	360	4	359	1	1%	1.6	4.8
Musconetcong River – Point Mtn. (Year-Round Trout Conservation Area)												
70	4.6	11	5	484	2	502	28	465	9	5%	1.6	7.2
S/Br. Raritan River – Ken Lockwood Gorge (Catch & Release Area)												
34	4.5	0	12	211	2*	225	2	216	7	4%	1.5	6.5
Pequest River (Seasonal Trout Conservation Area)												
11	3.3	0	0	28	0	28	0	28	0	0%	0.8	2.5
S/Br. Raritan River – Claremont Stretch (Year-Round Trout Conservation Area)												
3	1.4	1	0	2	0	3	1	2	0	33%	0.7	1.4
Pequannock River (Seasonal Trout Conservation Area)												
-	-	-	-	-	-	-	-	-	-	-	-	-
Toms River (Year-Round Trout Conservation Area)												
-	-	-	-	-	-	-	-	-	-	-	-	-

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 2017, 88 logbooks were prepared and distributed to anglers who indicated they regularly fish the seven stream sections described above. The data from these logbooks will be compiled and the results summarized in the 2018 Investigations and Management of New Jersey's Freshwater Fisheries Resources report.

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, "Giving Wild Trout a Helping Hand" and explains new regulations geared towards protecting wild trout populations. The second feature article is titled "Managing Monster Muskies," which describes sampling efforts and the results that lead towards new regulations to manage for bigger Muskies. The Freshwater issue of the Digest is perhaps the most widely distributed publication throughout the Department.

Division of Fish and Wildlife Mobile Trailer

Bureau staff participated on the planning team for the Mobile Conservation Outreach Trailer Project (MCOT). The 27-ft trailer will contain interactive exhibits that inform the public about NJDFW's fish and wildlife management activities and conservation successes resulting from the partnership with the Wildlife and Sportfish Restoration Program (WSFR). The purpose is to increase public knowledge of NJDFW and its mission, as well as to highlight how WSFR helps to meet agency goals. Assistance was provided in developing story lines related to freshwater fisheries research and management activities (fish sampling and fish culture) and to explain how scientific data collected by the Bureau was used to develop a statewide stream classification system to protect surface waters). Staff also provided photos and artifacts to be used in displays. (Hamilton)

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.

Merrill Creek Reservoir - The annual fisheries management meeting with staff that manages Merrill Creek Reservoir, their consultant, and NJDFW staff was held on March 3, 2017 to review and discuss the fisheries data collected in 2016 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 potential introduction of another salmonid species (Landlocked Salmon) was discussed and favorably received. (Hamilton)

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 2017, 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 21, 2017. 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. Presentations included results from the three-year Coolwater Fisheries Assessment of Walleye, Musky, Northern Pike, and Hybrid Striped by Fisheries Biologist Scott Collenburg and a review of warmwater fish production by Tyler Tresslar. All Bureau of Freshwater Fisheries staff attended the meeting and answered questions from anglers.

Outdoor Writer's Workshop – Fisheries Biologist Scott Collenburg prepared and presented a PowerPoint presentation on the Coolwater Fisheries Assessment and various Bureau of Freshwater Fisheries activities, including highlights from the Bureau's 2016 Field Sampling Season.

Round Valley Trout Association – Biologist Shawn Crouse prepared and presented a PowerPoint presentation at Round Valley Trout Association's meeting held on March 23, 2017. Information provided included important dates, upcoming NJDFW events, current research and management of Round Valley Reservoir, with a focus on the Lake Inventory and Management Plan.

South Jersey Freshwater Fisheries Forum – Thirty-five anglers attended the annual South Jersey Fisheries Forum held on February 25, 2017 at the Batsto Visitor's Center. Principal Biologist, Christopher Smith presented highlights of warmwater lake electrofishing surveys and Fisheries Biologist, Scott Collenburg presented results of the Coolwater Fisheries Assessment. A question and answer period and open discussion followed the presentations.

Trout Meeting – Ninety-seven anglers attended the annual Trout Meeting held on February 25, 2017 at the Pequest Trout Hatchery. Ed Conley, 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 potential Wild Trout Regulations. An extensive question and answer period, and open discussion followed the presentations.

Wild Trout Stream Regulation - During the spring, staff biologists attended meetings of 10 Trout Unlimited chapters to present recommendations and solicit angler feedback regarding potential changes to the *Wild Trout Stream* regulations and the establishment of a Brook Trout Conservation Zone.

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 9 and 10, 2017, 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) (Staff)

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 1 and 2, 2017, 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) (Staff)

Assisted at the **Pequest Teen Angler Event (14th Annual)** held on July 22, 2017 at the Pequest Fish Hatchery's Fishing Education Pond. There were 65 anglers, 12 – 20 years old with 17 of them being current license holders. There were also 98 adults accompanying them, with 28 being current license holders. Fishing was red hot with lots of fish caught. The action kept up right to the end. Every angler caught multiple fish with one young angler claiming he caught 22 fish. Most of these fish were in the 15- 23.5 in. range.

<u>Totals</u>

Trout caught and released:	> 400
Trout kept 15 - 23.5 inches:	186
Trout kept under 15 inches:	3
Hooking mortalities:	6

(Hunter and Angler Fund) (Boriek)

Largest Rainbow Trout of the day measuring 23.5 in. and weighing 9.89 lbs.

NJDEP's Youth Fishing Derby was held at Stacy Pond in Trenton on June 3, 2017. An estimated 75 youth participated in the fishing derby and an estimated crowd of 150 participants and volunteers experienced the event. (Hunter and Angler Fund) (Boriek)

Union County's 2017 BioBlitz was held at Warinanco Park on June 17th, 2017. The fish team, led by New Jersey Department of Environmental Protection, Division of Fish and Wildlife, sampled Warinanco Park Pond and the Peach Orchard Brook. The team used a variety of sampling methods including boat electro-shocking (using mild electrical currents to temporarily stun the fish for easy capture and identification) and seining. Eleven fish species were collected. Native species include Pumpkinseed, Brown Bullhead, Golden Shiner, Banded Killifish, Mummichog, and American Eel. Non-native species include Channel Catfish, Common Carp, Bluegill, Black Crappie, and the invasive Green Sunfish. Many Brown Bullheads were infested with parasitic flatworm known as Yellow Grub, a trematode that encysts on the exterior of the host fish and is visible to the naked eye (see below). It requires fish-eating birds, snails, and fish hosts to complete their life cycle. It is common New Jersey waters and poses little fisheries concerns and no threat to human health.

Interestingly, no Largemouth Bass were collected in Warinanco Park Pond. As a result, the Division of Fish and Wildlife plans to stock it to provide improved recreational opportunities for anglers. Due to passing thunderstorms, the fish team was unable to conduct the waterfront public presentation, however the fish booth was popular among children, that were excited to handle many of the fishes collected from the park and learned fish identification. For more information on Warinanco Park Pond see the write up on page 84 of the *Warmwater Fisheries Assessments via Electrofishing* section in this report. (Hunter and Angler Fund) (Crouse)

Common Name	Comments	Warinanco Park Pond	Peach Orchard Brook
American Eel	native	x	
Common Carp	non-native	x	
Golden Shiner	native	x	
Black Crappie	non-native	x	
Pumpkinseed	native	x	x
Bluegill	non-native	x	x
Green Sunfish	non-native	x	x
Brown Bullhead	native	x	
Channel Catfish	non-native	x	
Banded Killifish	native		x
Mummichog	native		x

Healthy Black Crappie (left) and Brown Bullhead infested with the parasite know as Yellow Grub (right).

OTHER FISHERIES RELATED ACTIVITIES

Permits

The Bureau of Freshwater Fisheries reviewed and issued 536 permits in 2017 to provide for the effective management and protection of the state's aquatic resources (see table below). These permits encompass nine 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) (Staff)

Permits issued by the Bureau of Freshwater Fisheries in 2017

Permit Type	Number
Baitfish - Commercial	3
Fish Stocking	148
Trout in the Classroom (Fish Stocking)	4 new156 existing
Gill Net – Staked - Commercial	0
Gill Net – Drifting - Commercial	0
Haul Seine - Commercial	1
Miniature Fyke/pot	0
Scientific Collecting	67
Special Use Limited License	27
Water Lowering	134
Total	**536**

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 2017 there were 160 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 a 64% return rate in 2015. In comparison, only 24% of reports were received in 2014. 2017 was another successful year with a return rate 62%. The four most popular waters in 2017 were Union Lake (33 tournaments), Salem Canal (31 tournaments), Lake Assunpink (25 tournaments), and DOD Lake (18 tournaments). Salem Canal had the most significant change in the number of tournaments held, down from 46 in 2016. The largest bass reported to date was a 7.39-pound Largemouth Bass from Maskells Mill Pond followed closely by a 6.74-pound Largemouth Bass from Assunpink Lake. Assunpink Lake has shown a significant increase in the number of five-pound bass, with 9 bass caught over five pounds.

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 2018.

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.

All 2017 field survey data has been inputted and validated for accuracy. No major updates or changes to the *FishTrack* database occurred in 2017, beyond routine maintenance and quality assurance / quality control measures. 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)

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