Long Island Alewife Restoration Efforts with Emphasis on the Peconic River – 2018

Prepared by Byron Young

NYSDEC Retired

New York's Citizen Advisory Panel Member to ASMFC Shad and River Herring Board

Peconic River Fish Restoration Commission

Seatuck Environmental Association

This report summarizes the Long Island alewife restoration efforts and presents alewife (*Alosa pseudoharengus)* biological data collected primarily from the Peconic River since 2010. In addition, incidental Alewife biological data collected from other spawning runs around Long Island are also reported here.

The history of the Peconic River effort commenced in 1995 with the support of a Peconic Estuary Program Demonstration Grant to aid alewife passage in the Peconic River. The Peconic Estuary covers the lands draining into Little Peconic Bay, Great Peconic Bay and Gardiners Bay (Figure 1). During 1995 and 1996, alewives were captured below Grangabel Park dam (Figure 2) by dip net and transferred upstream over the dam by bucket. In addition, during the spring of 1996, several hundred alewives were captured from Alewife Creek in Southampton (Figure 3) and stocked above Grangabel Park dam and Upper Mills dam. This effort was undertaken to augment the numbers of alewives captured and transferred at Grangabel Park. Following this effort, students from the Riverhead Middle Schools Science Program, under the guidance of Mr. Robert Conklin, captured alewives at the base of the Grangabel Park Dam and transferred upstream over the dam (1997 through 1999). Through these efforts and the interests of a local community effort (The Peconic River Fish Restoration Commission) private funds were secured to purchase and place an Alaska Steep Pass fish ladder in the north spillway of the Grangabel Park dam. Pursuant to permit conditions the Alaska Steep Pass was placed around March 1 and removed around May 1 annually from 2000 to 2009. A local environmental company, Miller Environmental Inc., Calverton, undertook this labor-intensive effort of placement and removal each year. In addition, Mr. Robert Conklin monitored the fish ladder, and removing debris, a continuous task during the spawning run.

During the period of 2000 – 2009, a proposal was developed cooperatively between the Town of Riverhead, the Peconic Estuary Program, the State Department of Environmental Conservation and the Peconic River Fish Restoration Commission (A local citizens group) to install permanent fish passage at Grangabel Park. With guidance from the US Fish and Wildlife Service a preferred option was selected and an engineering Company with Fish Passage design experience (Malone and McBroom) was selected to prepare the final engineering designs for installation of a nature like fish pass (Rock Ramp). After a protracted permit application process a contactor was selected by the town of Riverhead to conduct the work. A local construction company (Terry Brothers) began the work on the North spillway, in October 2009 upon completion of the North spillway repairs, construction efforts moved to the South spillway and the placement of the rock ramp fish passage in early December 2009. The Rock Ramp fish passage project was completed on February 22, 2010 with the opening of the cofferdam. Alewives were observed ascending the new Rock Ramp three weeks later.

With the completion of a permanent Rock Ramp fish passage during the winter of 2009/2010 a volunteer monitoring program was initiated. This report summarizes the basic biological data collected from 2010 through 2018 for the Peconic River and incidental biological data collected from other streams during the time period. Spawning alewives were captured by dip net, cast net and by hand at the base of Woodhull dam on Little River the first major tributary to the Peconic River and in Alewife Creek by dip net and by hand where it crosses under North Sea Road (Figures 2 and 3). The cast net became the major sampling gear during 2014 after modifications to the Woodhull dam spillway changed the contour of the pool below the dam. Dip nets and small mesh seine nets have been used to augment the cast net in other streams where the cast net was ineffective.

Several attempts have been made to census the Peconic River alewife spawning run using a video camera counting system. This approach while holding merit has been unsuccessful due to the heavy fouling conditions during the spring. The camera and camera housing become fouled very quickly requiring daily maintenance. Due to the lack of permanent staffing the camera equipment and housing could not be properly monitored and maintained thus compromising the ability to capture images. The use of the video camera counting system has been

abandoned until such time as solutions can be found to address the biological fouling or to provide sufficient staffing to maintain and monitor the system.

Alewives begin entering local eastern Long Island streams in the late winter or early spring each year to spawn. Once spawning is completed the adults return to the ocean. These local alewife-spawning runs have generally been self-sustaining albeit at a very low levels. Interest in the alewife restoration efforts and the need to increase protection of this valuable prey resource has grown on Long Island over the past twenty years based upon the success of passage projects in the Peconic River and the Carmans River. The Peconic Estuary Program, the Long Island Sound Study and the Seatuck Environmental Association are promoting increased fish passage around Long Island through partnerships with dam owners and interested parties.

Following the installation of the Rock Ramp fish passage in 2010, alewives have been captured in the Little River at the base of Woodhull Dam in order to describe their biological characteristics, to develop a base line biological data set for the Peconic River and to present a first order assessment relative to the effectiveness of the rock ramp fish passage project at Grangabel Park dam in Riverhead. Beginning in 2013, sampling was expanded to include Alewife Creek in Southampton. Alewife Creek is the only spawning run on Long Island with no major blockages affecting access to spawning ground in Big Fresh Pond. This report summarizes the biological data for the Peconic River and Alewife Creek, along with recent biological data from two Nassau County streams (Massapequa Creek and Mill River).

Survey Objectives:

1. To determine the presence of spawning alewives upstream of the Rock Ramp;
2. Document the timing of the Alewife run through observations made at three locations on the Peconic River and two locations on Alewife Creek;
3. Visually attempt to estimate the size of the Peconic River spawning run; and
4. Collect biological data from a sample of spawning adult alewives in the Peconic River and Alewife Creek.
5. Assist other with other alewife restoration and survey efforts, as appropriate, around Long Island.

In addition to the collection of biological data an effort has been undertaken to document the number of Long Island streams supporting Alewife spawning runs. The Seatuck Environmental Association in association with the Peconic Estuary Program, the Long Island Sound Study, and the South Shore Estuary Reserve have conducted a Citizen Science based program to search from remnant alewife spawning runs around Long Island. This program was advanced to identify remnant river herring spawning runs and to aid restoration efforts ongoing around Long Island. Table 1 summarizes the identity of confirmed remnant spawning runs on Long Island, to present.

Methods and Materials:

Long Island's two premier alewife spawning streams are found on eastern Long Island.' The largest alewife spawning run occurs in Alewife Creek in Southampton. Alewife Creek runs un-impounded from North Sea to Big Fresh Pond a 64 acre lake (Figure 3). The Peconic River, Long Islands largest stream supports the second largest alewife spawning run. The Peconic River is heavily impounded with five dams blocking access to historic spawning ground (Figure 2). At the present time two fish passage projects have been completed, one at the head of tide (Grangabel Park) and one in the upper reaches of the river at Edwards Avenue. Currently, the fish passage at Grangabel Park provides access to approximately 30 acres of spawning habitat. There is the potential for nearly 300 acres of additional spawning habitat once fish passage projects are completed at Woodhull dam and along the main stem of the Peconic River (Wildwood Lake 64 acres, Forge Pond 120 acres, plus 30 acres above Upper Mills dam).

Beginning in late February each year the Peconic River is visited to determine the commencement date for the annual alewife spawning run. Once fish are observed efforts begin to capture fish from the base of Woodhull Dam on the Little River, which drains the Cranberry bog preserve, and Wildwood Lake.

Biological Data Collected:

Biological data collected include fork and total length, sex, and scale samples from a subsample of those fish measured. The collection of both fork length and total length was undertaken in order to provide a conversion factor when comparing these data to historic data records. Many of the historic records along the coast have used fork length as their primary length measurement.

Alewives were captured by dip net, cast net or by hand at the base of Woodhull dam on Little River, a tributary to the Peconic River (Figure 1). The dip net, or hand capture were the only methods used in Alewife Creek. A ¾ inch stretched mesh by four-foot diameter cast net has been the primary gear employed to capture alewives at Woodhull Dam since 2014. Long handled crab nets (7ft 8 in handle) with a 14 inch diameter ring with a 12 inches deep pocket bearing 2 ¼ inch stretched mesh, a 22-inch hoop by 24 inches deep with an 8 ft. 8 in handle and a 13 inch diameter crab, 12 inches deep with a four-foot handle are also available and employed at times when fish were running into the spillway. Fish are also captured by hand when running up into the shallow waters of the spillway.

Each batch of fish captured is placed in a container(s) with fresh water. Fish are then removed individually from the container palpated to determine sex, measured to the nearest millimeter in fork length and total length and returned to the stream. Scales samples are collected from a subsample of fish measured for subsequent age analysis. Currently scale samples are being archived for future analysis when staffing and time allows.

On each site visit an attempt was made to visually estimate a minimum and maximum number of alewives present. These estimates were used to gauge the strength of the spawning run. Unfortunately, due to variable conditions at a site it was not always possible to obtain anything more than a crude estimate of numbers and in some cases only presence or absence. Alewives at Woodhull Dam, if present, are generally visible attempting to ascend the downstream portion of the box culvert and around the edges of the pool. When the visibility allowed an estimate of abundance was calculated by counting fish in a portion of the pool and then extrapolating to the

whole pool. This effort provides a crude estimate of the spawning run. Seatuck Environmental in cooperation with Cornell Cooperative Extension has attempted to gather more precise counts of the spawning run utilizing a video counter. This effort has not been completely successful to date. The primary difficulties have been staffing to clean and maintain the camera set-up and manage the data.

All observations made while conducting this effort have been submitted to the Seatuck Environmental Volunteer Alewife monitoring program. Data were either recorded on standard data forms provided by the Seatuck Environmental Association and more recently entered directly into the Seatuck Environmental Association's web database. In addition, all data collected have been submitted to Region 1 DEC Fresh Water Fisheries on their standard data sheets for entry into the Statewide fisheries database.

Water temperature is collected by hand held thermometer on each site visit. An attempt to augment water temperature data with Tidbit Water temperature data loggers was undertaken between 2010 and 2015 from late February through late May. Data loggers were placed at three locations on the Peconic River; Upper Mills dam down stream of the gauging station; Woodhull dam downstream of the spillway and; Grangabel Park upstream of the Rock Ramp. In addition, data loggers were placed at two locations in Alewife Creek one down stream of the North Sea Road culvert and a second up stream of the Noyak Road culvert. Tidbit data logger's use was discontinued in 2015, when water temperature data became available from the USGS data station at the 105 Bridge.

Alewife observations were collected for spawning alewives at three locations in the Peconic River during this investigation (Figure 2). Two locations were used in Alewife Creek during this investigation (Figure 3). The Peconic River sites were Grangabel Park at the Rock Ramp and the North spillway; Upper Mills dam approximately 1 mile upstream from Grangabel Park; and Woodhull dam on Little River, which is the first major tributary upstream of the Rock Ramp flowing from Wildwood Lake. The Alewife Creek sites were the culvert under North Sea Road and the culvert under Noyac Road. Data collected at each site followed the procedures established for the Long Island wide alewife survey conducted by the Seatuck Environmental Association (http://www.seatuck.org). To view go to the Seatuck Webpage, then proceed to the

Conservation page and look for the Alewife project. All observational data collected here were reported using protocols established by the Environmental Defense Fund and the South Shore Estuary Reserve and maintained by Seatuck. Standard data collections include date, time, location, water temperature (if possible) weather conditions, alewife presence or absence, and, if present, how many. Notes regarding other species observed at the site were also recorded.

Results:

The first signs of alewives were found on February 21, 2018, when scales were observed along the shoreline below Woodhull Dam. The last alewives observed was on May 10, 2018. Spawning alewives begin entering the Peconic River in late February or early March where they congregate at the base of Woodhull, on Little River providing relatively easy access. Table 2 presents a breakdown of the annual start and end dates along with the number of days the Peconic River was visited for the purpose of collecting biological data collection or observation. Site visits ranged from a low of 22 in 2015 to a high of 46 in 2014, with an average of 35 trips per year.

The peak spawning period based upon the numbers of alewives in the pool below Woodhull Dam varies annually (Table 3) based upon several factors, water temperature, river flow conditions and storm events. Typically, the first spawning fish will arrive in late February to early March with peak spawning usually from early April through mid-April. Alewives have been observed in the river as early as the third week in February (February 19, 2016). Alewives have been observed as late as the last week in May (May 29, 2014). During 2018, Alewives began entering the river during late February only to be slowed by a very cold month of March. As the weather moderated in late March the fish returned in good numbers only to have spawning interrupted by a series of very heavy rain events (3 plus inches of rain in each event) in early April. By the end of April into the first of May the spawning run peaked for a second time and then abruptly ended with rapidly increasing water temperatures.

Spawning Run Estimates:

During 2010 I estimated a spawning run size between 24,000 and 40,000 fish based upon visual observations. I could not make the same estimates during 2011; however, the Seatuck Environmental society was able to secure funds to place a video fish counter at the head of the Rock Ramp to capture images of passing fish. The software that supported this camera system counted the fish passing through the weir constructed to hold the camera. Based upon this effort, a total of 15,000 alewives passed through the weir while the camera was in operation. The camera was not placed until after the spawning run had commenced and due to some logistical issues was not fully operational during the entire spawning run thus making the count a very conservative estimate. Based upon the fact that the camera was operational for about half of the 2011 run, it is safe to assume that the 2011 spawning run were similar to the 2010. However, it appears that alewives were more broadly distributed in the Peconic River above Grangabel Park and in a different fashion than during 2011, unlike 2010 when most of the fish seemed to congregate below the Woodhull dam. The spawning run estimates were based upon observations made below Woodhull dam and at the base of the USGS Gauging Station at Upper Mills dam are presented in Table 4, rounded to the nearest thousand. These estimates represent, at best, a crude estimate of the Peconic Rivers alewife spawning run. The 2018 spawning run (70000 fish) was a strong run despite the bimodal spawning events, ranking a number four out of the last nine years

In addition, observations were made a two other locations on the Peconic River. Observations were made at the gauging station spillway below Upper Mills dam, the next upstream barrier to migration on the main stem of the Peconic River. Alewives have been observed below the gauging station spillway and attempting to pass over the gauging station spillway every year since the Alaska steep pass was placed at Grangabel Park during 2000. The numbers of alewives found here are much smaller than found at the base of Woodhull dam but do indicate a usage of the main stem of the Peconic River and a desire to pass upstream. The first alewife is usually spotted at Upper Mills dam in early to mid-March. Fairly significant numbers of alewives were observed during the first three weeks of April and the last alewife was observed on May 1. Limited attempts have been made to capture alewives at this location.

Observations were also made in Grangabel Park at the Rock Ramp and at the North spillway. We know that alewives utilize this area due to their presence upstream. However, given the turbulent nature of the North spillway and the apparent shift to a night time spawning run through the rock ramp it was difficult observe alewives at this location. One sign that alewives were using the rock ramp was the presence of gulls patrolling the shoreline of the rock ramp or cormorants feeding in the pool below the dam or immediately upstream of the rock ramp.

Length Frequency Data:

Biological data has been collected from a total of 7259 alewives captured, in the Peconic River at Woodhull Dam (Table 4). In addition, smaller number of alewives have been captured and measured from Alewife Creek in Southampton (Table 6) and recently a few alewives have been captured and measured from Massapequa Creek and the Mill River in Nassau County (Table 7). Figure 4 presents a summary of the Peconic River total length frequency from 2010 through 2017.

While limited, these data provide the bulk of the alewife biological information collected on Long Island. The author is aware of limited data collected by the New York Department of Environmental Conservation, Region 1 Fisheries in the Carmans River, The Cornell Cooperative Extension's Marine Program also working in the Carmans River and the Marine Sciences Research Center also working in the Carmans River. These data were not available for presentation in this report. In addition, Dr. Peter Daniels and his graduate students have been working with alewives at Beaver Lake in Oyster Bay and in the Mill River in Rockville Center. The alewives at Beaver Lake are transplants from the Peconic River.

Sex Ratio distribution:

The sex ratio for the data reported here is 1.40:1 (Male to Female). Table 8 presents the sex ratio by year for the Peconic River. These data are consistent with other reports from the

Northeast where males dominate over females. While males and females both enter the Peconic River system at the same time, males dominate early and late. The daily sex ratios, however, do vary greatly, with some days during the height of the spawning run being dominated by females.

Age Structure:

Beginning in 2011, scale samples were collected from a subsample of the alewives captured for age analysis. An attempt was made to collect a scale sample from every third fish measured and to collect a scale samples from across the size range of the fish captured. The scales samples were sent to the NYSDEC, Hudson River Fisheries Unit office in New Paltz for age analysis. Following techniques applied to the thousands of River Herring scales collected by the Hudson River Fisheries Unit, the staff then subset the collections further into size bins and aged a subset of these scale samples. Alewives ranged between 2 and 8 years of age (Table 10) with ages 4, 5 and 6 being the dominant age groups. Since 2014, scale samples have been collected, however these samples are being archived for potential future analyses. The Hudson River Fisheries Unit, which graciously volunteered to age the early scale samples no longer, has the time to address our needs. Their current efforts on the Hudson River cover all three herring species, striped bass and sturgeon so their work schedule is very full. Their efforts in providing ages for three years is greatly appreciated and provide a glimpse into the age structure of the Long Island alewife population.

Water Temperature Data and Stream Flow:

Water temperature data are collected during each visit to the Peconic River by hand held thermometer. In an effort to improve upon the site visit water temperature data; water temperature data loggers were placed in the river adjacent to observation points collecting water temperature at six-hour intervals for the duration of the spawning season. The data for 2011, 2012, and 2013 are presented in Figures 5, 6, and 7. There is no discernable difference between the four locations. The United States Geological Survey (USGS) established a water monitoring station at the Route 105 Bridge in August of 2012. Water temperature data has

been downloaded from that data string to overlap the alewife spawning run periods, late February through the end of May, Figures 8 through 14).

Stream flow data has been gather from the Upper Mills gauging station and is presented in Figure 15. These data demonstrate that the Peconic River is currently in a period of low flow and has been for several years. The 75 year average flow for the Peconic River at the Upper Mills gauging station is 40 cubic feet per second with a minimum of 13 cubic feet per second in 1966 and a maximum of 135 cubic feet per second in 1978. While no attempt has been made to correlate stream flow to the Peconic River alewife spawning runs it is suspected that high flow rates and low flow rates will have an effect on the spawning run.

Discussion:

These data represent multi-year first order effort to quantify the timing and extent of the Peconic River Alewife run. The effort described above is a completely volunteer program operating on limited personnel funds and when available volunteer help. All data collected are provided to the New York State Department of Environmental Conservation's Fresh Water Fisheries Unit, per Scientific Collectors License conditions, for inclusion in the statewide fisheries database. Additionally, the data and this report are made available to the Peconic Estuary Program, and all other interested parties.

The 2013 alewife spawning run in the Peconic River was the largest observed since the installation of the rock ramp in 2010. It is uncertain whether this is a result of increased access to historic spawning ground in the impoundment above Grangabel Park or other positive factors affecting survival and spawning. The apparent spawning run increase is great news for the Peconic River alewife stock and the restoration efforts underway. Since 2013, the alewife spawning run has shown a good deal of variability. Some of this variability may be due to prevailing spring weather conditions ranging from abnormal high temperatures to abnormally low temperatures. In addition, Long Island has experienced a prolonged period of low rain fall as evident by river flow data (Figure 14).

These data provide conclusive evidence regarding the success of the Rock Ramp fish passage at Grangabel Park. All parties involved in this effort should take pride in their success.

The collection of Peconic River alewife biological data will be undertaken again during 2019 with a target of 600 alewives for length and sex information, scales from approximately 200 fish, water temperature data collections, and another set of in the field observations. An attempt will be made to collect biological data from Alewife Creek during 2019, in cooperation with the Peconic Bay Keeper program with a target of 200 length and sex samples, scale samples from 1/3 of those fish. Moreover, an attempt will be made to collect 50 fin clip samples for genetic analysis in cooperation with Dr. Peter Daniels at Hofstra University. Likewise, efforts to support biological data collections from Massapeaqua Creek in Massapequa and the Mill River in Rockville Center will be undertaken.

The primary focus will remain on the Peconic River during 2019. The Peconic River has approximately 275 acres of impounded waters behind the four remaining dams remaining reconnection to the Marine environment. Fish passage efforts continue for three of the four dams, with fish passage at the Edwards Avenue dam being complete. There are three impediments to fish passage on the main stem of the Peconic River (Upper Mills, Forge Road, and the USGS gauging station weir downstream of Upper Mills dam). Plans are under developed for each of these impediments. The Woodhull dam fish passage project on Little River that flows from Wildwood Lake and enters the Peconic River immediately upstream of the rock ramp at Grangabel Park is a major restoration effort for the Peconic River watershed. It is anticipated that the Woodhull dam site will be construction ready, hopefully, during 2019. The other sites on the Peconic River are still a few years away.

It is difficult to project the impacts to alewife spawning with the potential reopening of a major portion of the Peconic River in the future. It would be safe to assume a conservative doubling of the current spawning run and more likely greater than doubling. None of this will happen quickly, as it takes years to develop, fund, and implement a fish passage project. Once a new fish passage is in place it will take several years to determine the results, as adults will need to

reach the reopened spawning grounds and then waiting for the offspring to return in three to five years.

The data reported here while not robust do provide a glimpse into the biological characteristics of the Long Island Alewife spawning runs. It is encouraging to see increased interest in undertaking more robust studies at the University level. I am encouraged by the increase of involvement through cooperative research at the university level, additional data collections by management agencies in order to aid future management decisions related to this resource and a continuation of the cooperative discussions related to the diadromous fisheries of Long Island organized by Seatuck Environmental.

In conclusion, we have seen positive results from the rock ramp fish pass at Grangabel Park. There is positive progress toward fish passage along the main stem of the Peconic River and at Woodhull dam on Little River. If we can continue this momentum we can look forward to future improvements to the alewife spawning run in the Peconic River. In addition, Alewife Creek in Southampton remains the lone example of a relatively un-impacted spawning run for Long Island. In additions, volunteers continue to document remnant spawning runs around Long Island continues adding new streams each year through Seatuck Environmental Association, The South Shore Estuary Reserve, the Long Island Sound Study and the Peconic Estuary Program. The Long Island Sound Sturdy program is looking to continue its efforts in Westchester County during 2019.

Acknowledgements:

This project has been a collaborative effort since its inception and continues with these data collection efforts. I wish is express my appreciation to the Peconic Estuary Staff for their continued support of this effort and for continuing to press forward on fish passage efforts in the Peconic River and throughout the Peconic Estuary. There is a long list of folks who have spent time assisting me with the collection and processing of Alewives at Woodhull dam since 2010. In particular I would like to thank Kyle Young for his help and interest in this effort. I do not have a complete list of folks who helped out with this effort but please understand that I

appreciated you assistance. Some folks would simply wander by while I was working up fish and kindly assist, others would come down in bigger groups to see the spawning run and learn about the efforts to improve alewife spawning runs around Long Island. I would like to thank everyone who shared some time helping over the course of this effort. The results presented in this report represent your interest and assistance.

Table 1. Alewife Spawning Streams on Long Island and New York City

South Shore	Stream/Pond Outlet	Town	Confirmed
1	Carlls River	Babylon	
2	Carmans River	Brookhaven	2000
3	Massapapequa Creek	Massapequa	2012
4	Swan River	Patchogue	2013
5	Champlin Creek	Islip	2016
6	Mill River	Rockville Center	2015
7	Bellmore Creek	Bellmore	2014
8	Orowoc Creek	Islip	2016
9	Mill River	Wantagh	2015
10	Hook Creek	Valley Stream	2017
11	Milburn Creek	Baldwin/Freeport	2017
12	Parsonage Creek	Baldwin	2017
13	Motts Creek/Doxey Pond	Woodmere/Valley Stream	2017
North Shore			
14	Fresh Pond/Baiting Hollow	Riverhead	2006
15	Mill River/Beaver Lake	Oyster Bay	2013
16	Sunken Meadow Creek	Smithtown	2011
17	Nissequogue River	Smithtown	2017
18	Setauket Mill Pond	Setauket	2015
19	Fresh Pond	Fort Salonga	2014
20	Stony Hollow	Centerport	
East End			
21	Peconic River	Riverhead/Southampton	prior to 1995
22	Alewife Creek	Southampton	prior to 1995
23	Ligonee Brook	Sag Harbor	2010*
24	Big Reed Pond	Montauk	Prior to 1995
25	Halsey Neck Pond	Southampton	2017
New York City			
26	Bronx River	New York City	2012

Table 2. Peconic River Sample Dates, 2010 to 2017

Year	Start Date	End Date	Days Sampled
2010	16-Mar	16-May	32
2011	2-Mar	15-May	34
2012	26-Feb	5-May	39
2013	5-Mar	3-May	37
2014	1-Mar	24-May	46
2015	27-Mar	19-May	22
2016	19-Feb	14-May	39
2017	25-Feb	18-May	31
2018	21-Feb	10-May	34

Table 3. Peconic River Alewife Presence/Absence Observations, Woodhull Dam, 2010 to 2017.

Date	2010	2011	2012	2013	2014	2015	2016	2017	2018
Jan. 1-31									
Feb. 1-28								P – 100	P - 7
Mar. 1-10		P – 5	P – 1	P – 2			P – 50	P – 50	
Mar. 11-20	P – 400	P – 25	P – 10000	P – 4000	P – 500		P – 750		P - 425
Mar. 21-31	P – 750	P – 3	P – 6000	P – 4000	P – 2000	P - 25	P – 5000	P – 250	P - 10000
Apr. 1 -10	P – 6000	P – 500	P – 7000	P – 10000	P - 2500	P – 500	P – 4500	P – 4500	P - 10000
Apr. 11-20	P – 6000	P – 500	P – 4000	P – 6000	P – 7000	P – 250	P – 7000	P – 10000	P - 2500
Apr. 21-30	P – 5000	P – 400		P – 2000	P – 5000	P – 7000	P – 4000	P – 6000	P - 10000
May 1-10	P – 1500			P – 50	P – 1500	P – 2000	P – 1000	P – 1000	P - 10000
May 11-20					P – 750	P - 200	P - 50	P - 50	
May 21-30					P – 100				

Table 4. Estimated Alewife Spawning Run Size, Rounded to the nearest Thousand.

Year	Estimated Minimum Spawning Population	Estimated Maximum Spawning Population
2010	25000	40000
2011	20000	35000
2012	50000	75000
2013	60000	80000
2014	50000	75000
2015	20000	35000
2016	40000	55000
2017	45000	60000
2018	50000	70000

Table 5. Mean Total Length for Spawning Peconic River Alewives, 2010 to present and 1995 and 1996.

Year	Number of Males	Mean Total Length	Standard Deviation	Range	Number of Females	Mean total Length	Standard Deviation	Range
1995	20	257.3	13.91	238-282	40	264.6	11.61	235-288
1996	85	266.2	14.09	234-283	78	279.9	11.13	249-308
2010	356	263.1	11.49	235-300	256	273.2	11.67	243-313
2011	252	260.5	10.12	232-289	158	272.2	10.85	234-298
2012	694	257.7	14.06	224-305	413	277.2	14.44	241-325
2013	515	268.8	8.63	236-304	320	281.0	9.66	256-318
2014	580	276.6	12.68	216-307	501	289.0	12.22	252-325
2015	410	275.3	14.58	232-317	307	287.5	13.20	246-324
2016	539	268.5	15.08	227-320	423	283.1	14.63	248-327
2017	447	259.7	12.02	228-294	295	273.5	13.04	235-318
2018	536	267.5	10.18	232-295	400	276.8	10.92	235-316

Table 6. Mean Total Length for Spawning Alewife Creek Alewives, 2013, 2014 and 2017.

Year	Number of Males	Mean Total Length	Standard Deviation	Range	Number of Females	Mean Total Length	Standard Deviation	Range
2013	36	265.9	7.47	252-285	38	289.1	13.31	264-315
2014	66	267.9	8.89	252-290	62	279.2	11.02	253-302
2017	25	261.1	16.97	236-277	17	275.7	8.49	258-288

Table 7. Mean Total Length for Spawning Massapequa Creek and Mill River Alewives, 2017.

Water Body	Number of Males	Mean Total Length	Standard Deviation	Range	Number of Females	Mean Total Length	Standard Deviation	Range
Massapequa Creek								
2017	30	253.9	28.28	224-282	31	276.1	2.12	246-299
2018	11	262.0	9.89	239-279	16	273.5	9.48	264-300
Mill River								
2017	50	257.0	21.21	226-301	15	266.5	20.51	240-289
2018	38	263.3	8.90	229-276	19	270.9	9.46	258-286

Table 8. Peconic River Alewife Sex Ratio, 2010 to 2014.

Year	Number of Males	Number of Females	Sex Ratio Male to Female
2010	356	255	1.4:1
2011	252	158	1.6:1
2012	654	413	1.6:1
2013	515	320	1.6:1
2014	580	501	1.2:1
2015	410	307	1.3:1
2016	539	423	1.3:1
2017	447	295	1.5:1
2018	536	400	1.3:1
Total	4289	3072	1.4:1

Table 9. Age Structure for Peconic River Male Alewives by Total Length, 2011 to 2013.

Total Length	2	3	4	5	6	7	8
220		2	1				
230		4	7	2			
240		2	11				
250			17	6	1		
260		1	11	14	2		
270			3	16	5		
280			5	7	7	2	
290				1	2	2	
300					2		
310							
320							

Table 10. Age Structure for Peconic River Female Alewives by Total Length, 2011 to 2013.

Total Length	2	3	4	5	6	7	8
220							
230	1						
240			1				
250		3	8	1			
260			7	8			
270		1	6	14	5		
280			6	16	6		
290			1	9	10	1	
300				1	10	4	
310					2	6	1
320					1		1

Figure 1. The Peconic Estuary.

Figure 2. Sampling Location on the Peconic River.

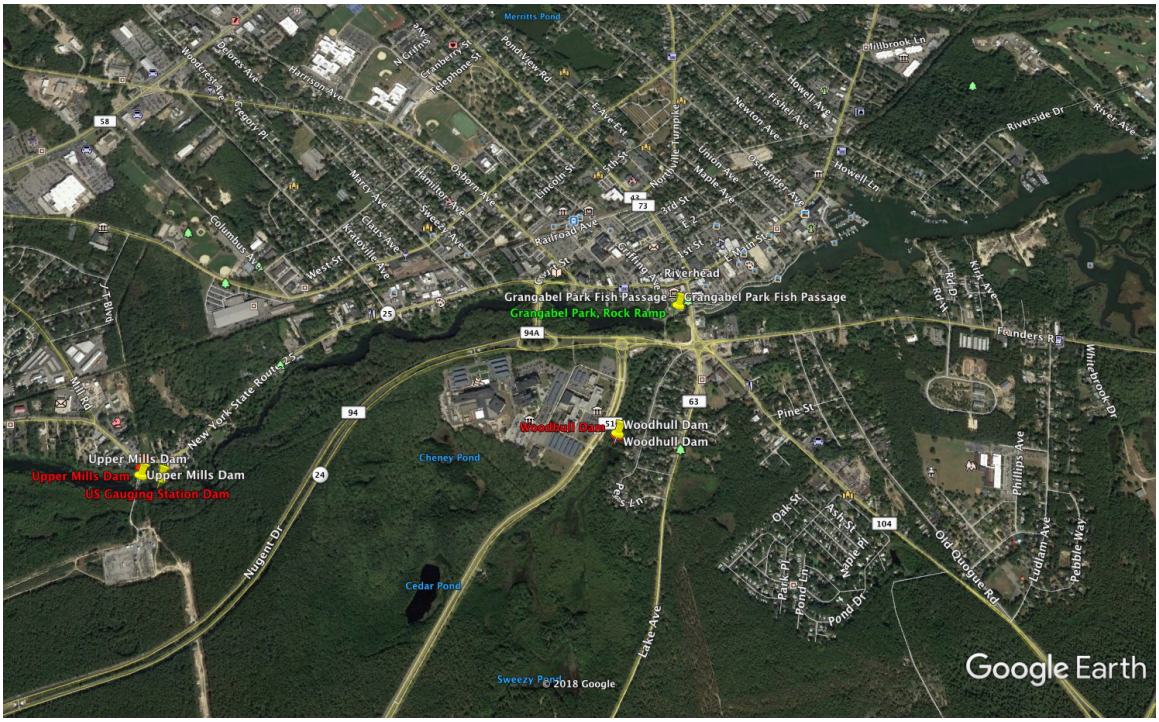


Figure 3. Observation sites on alewife Creek and Big Fresh Pond.

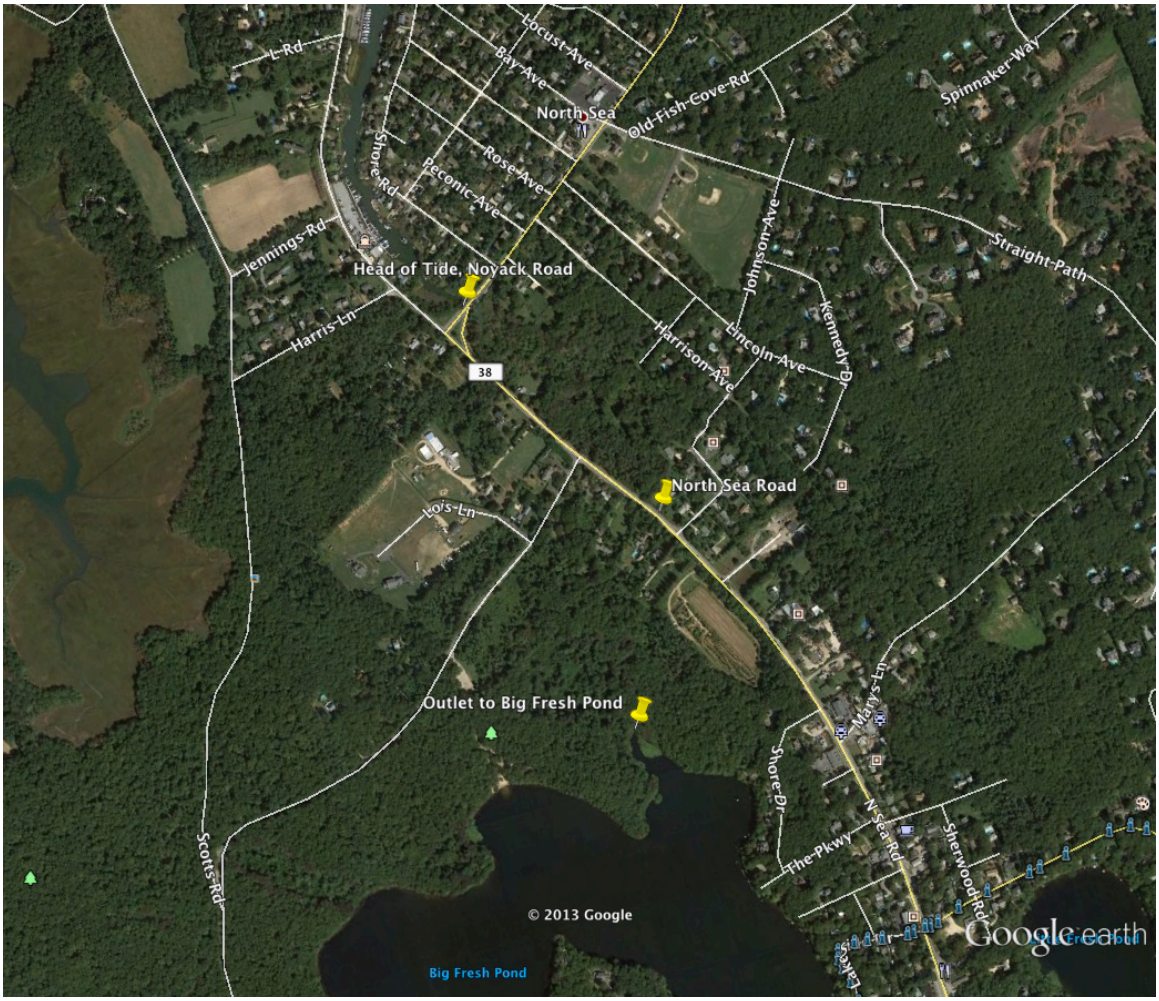
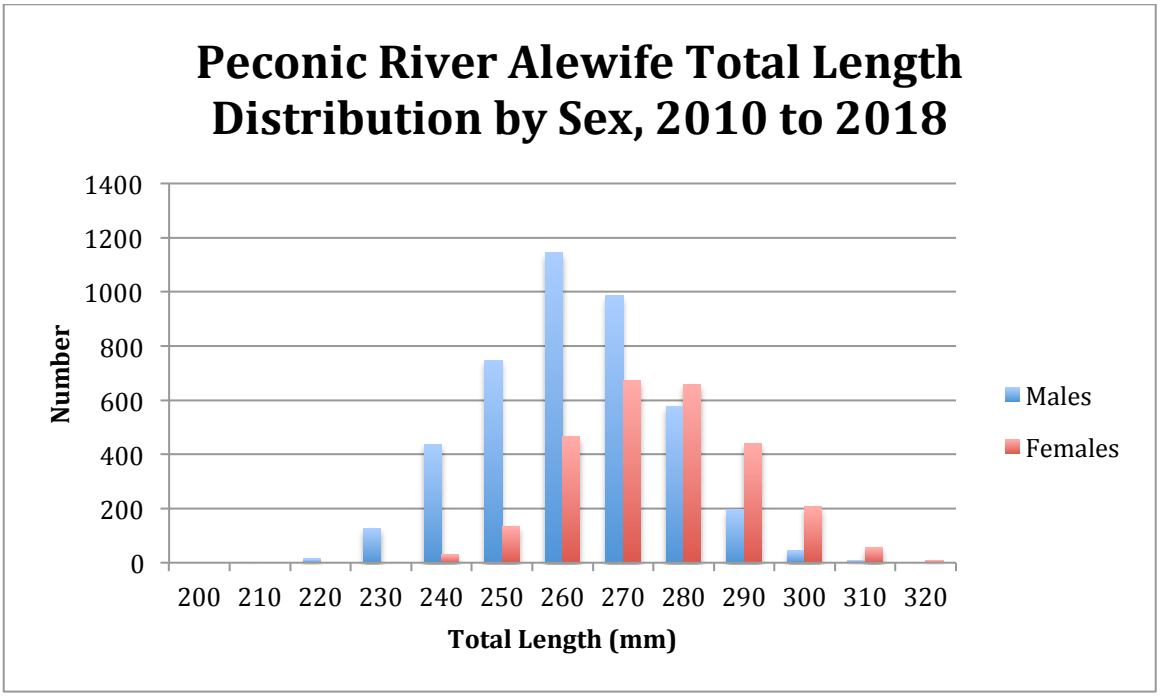


Figure 5. Daily Water Temperatures from Grangabel Park (Series 1&2); Woodhull Dam (Series 3); and Upper Mills Dam (Series 4) during 2011.

Figure 4. Peconic River Male and Female Alewife length frequency distribution, 2010 to 2018.



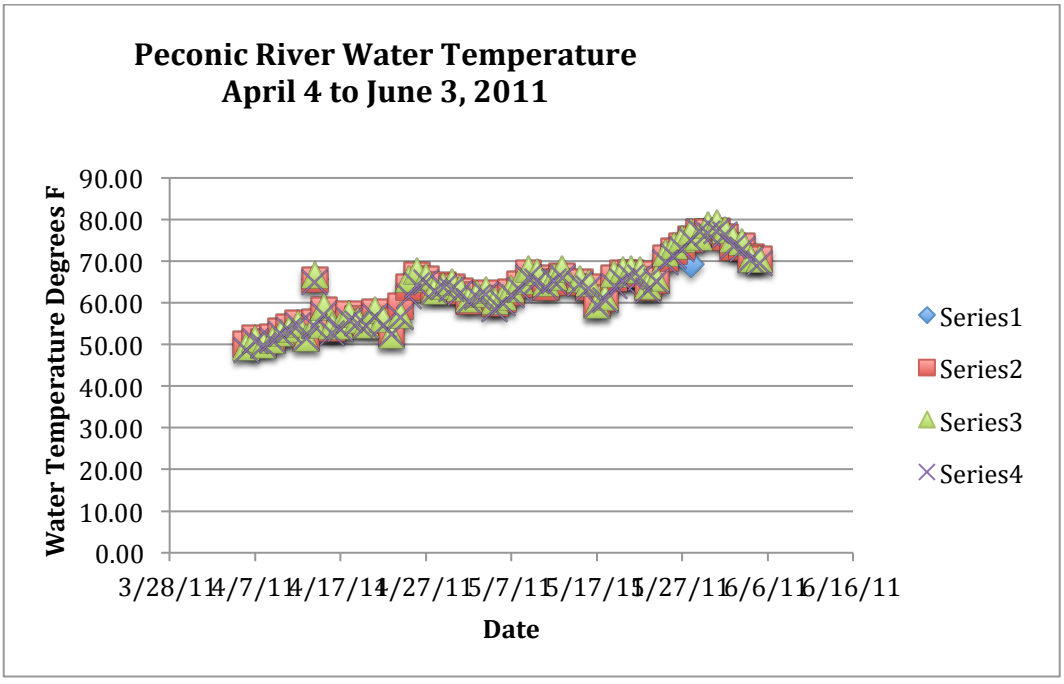


Figure 6. Mean Daily Water Temperature from Woodhull Dam and Alewife Creek, 2012.

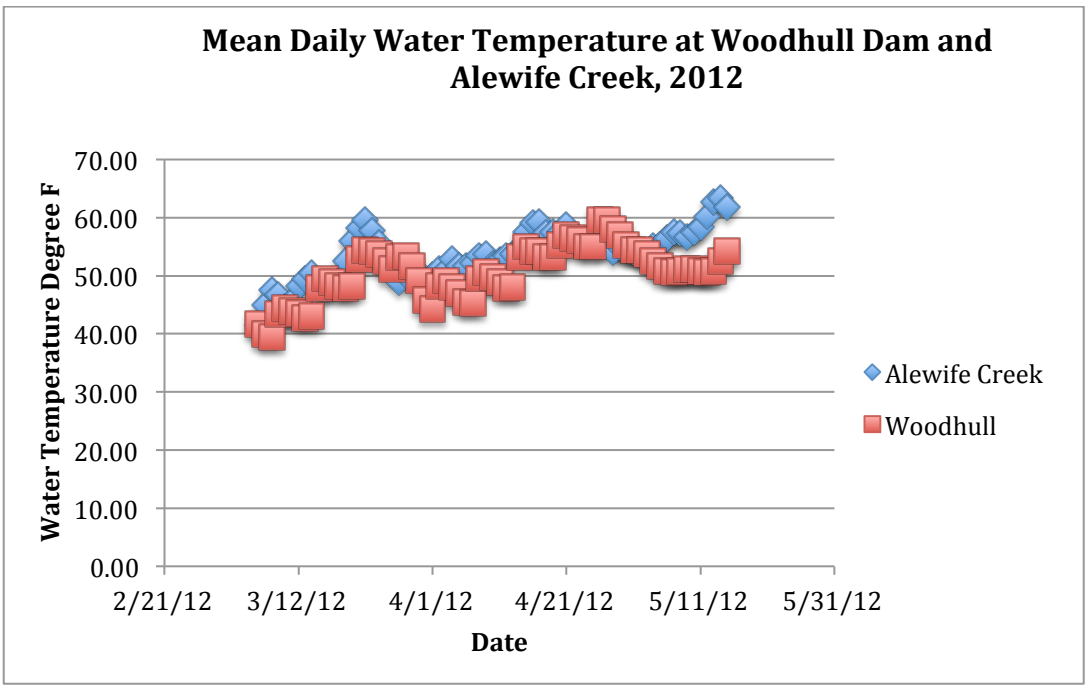


Figure 7. Mean Daily Water Temperature for the Peconic River and Alewife Creek, 2013.

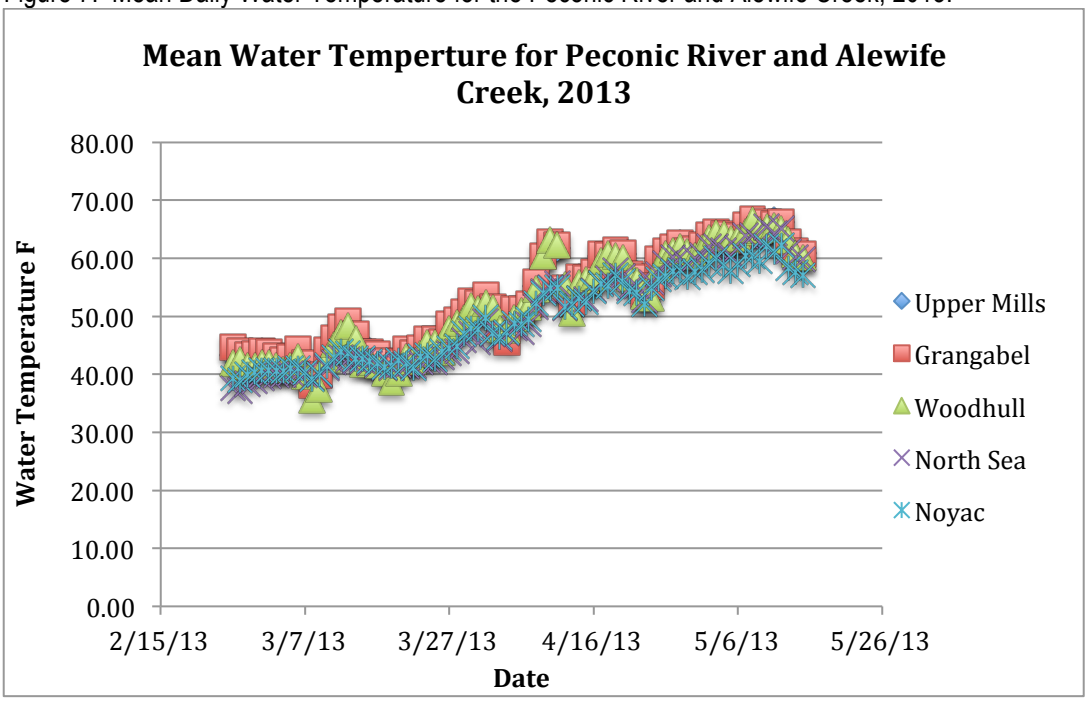


Figure 8. Peconic River Water Temperature data from USGS Route 105 monitoring Station, 2013

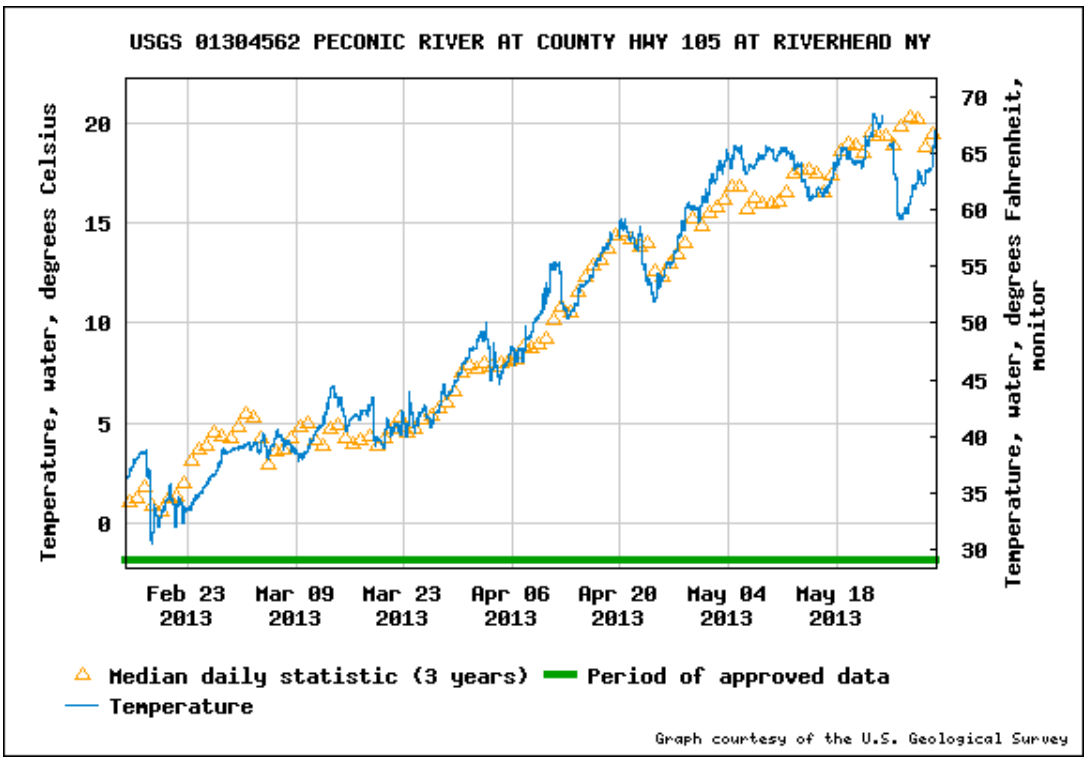


Figure 9. Peconic River Water Temperature Data from the Route 105 Bridge Monitoring Station, 2014.

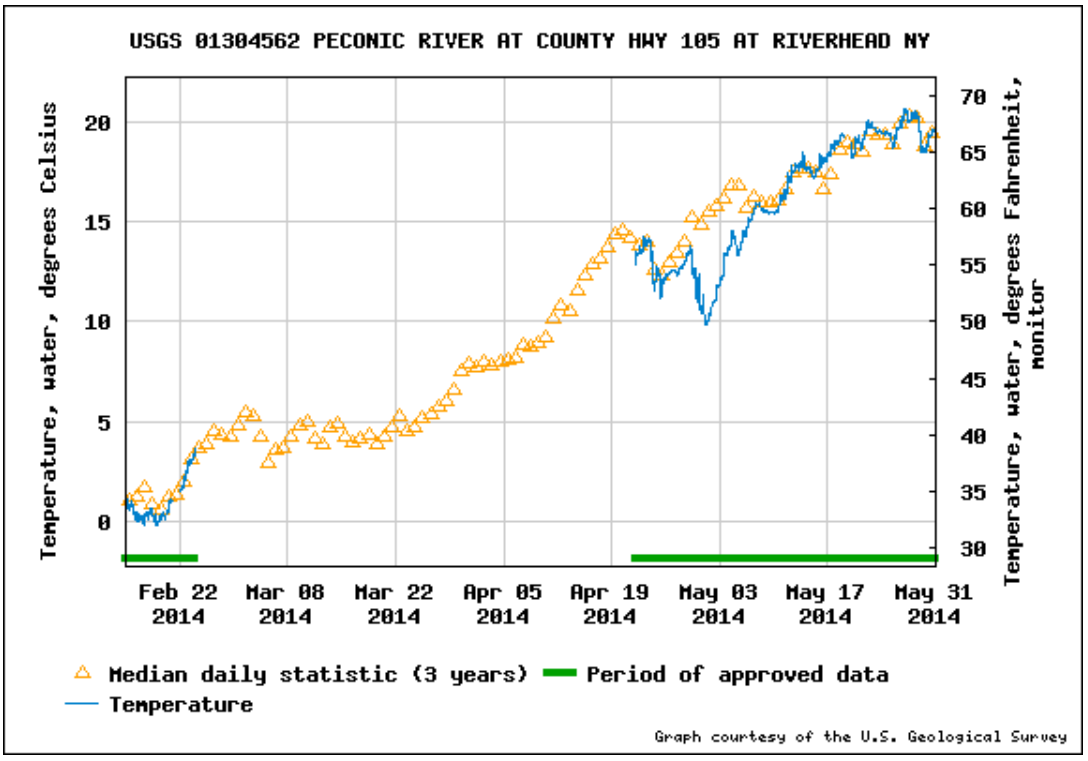


Figure 10. Peconic River Water Temperature Data from the Route 105 Bridge Monitoring Station, 2015.

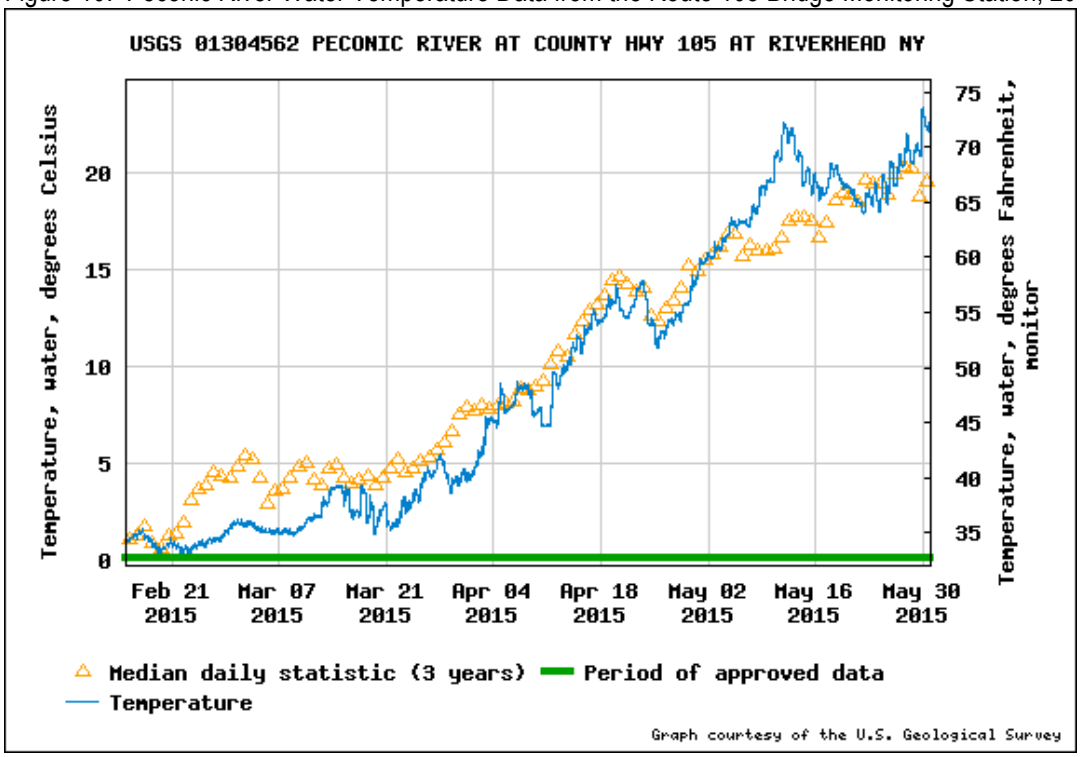


Figure 11. Peconic River Water Temperature Data from the Route 105 Bridge Monitoring Station, 2016.

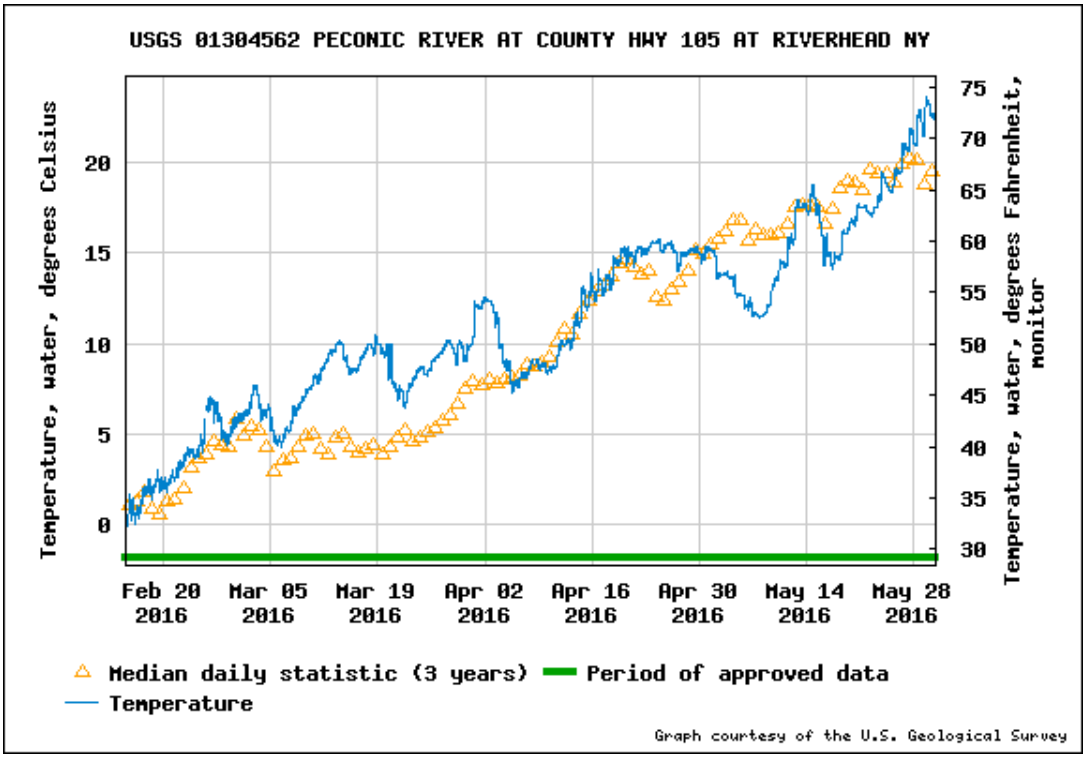


Figure 12. Peconic River Water Temperature Data from the Route 105 Bridge Monitoring Station, 2017.

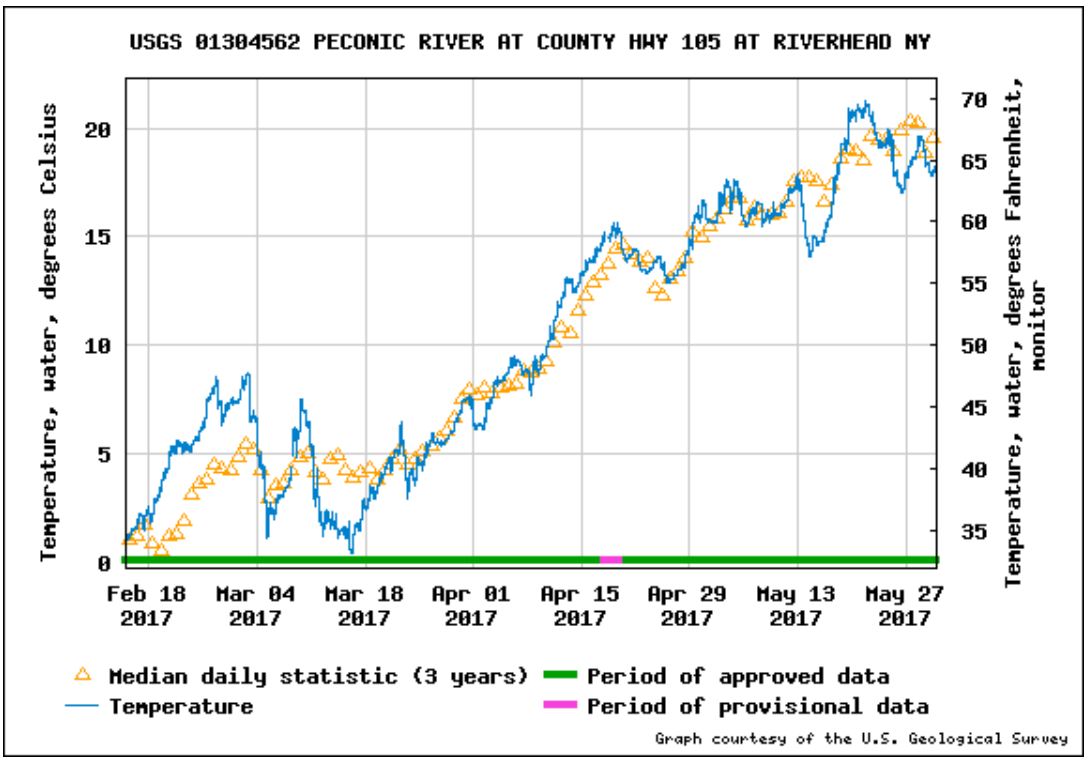


Figure 13. Peconic River Water Temperature Data from the Route 105 Bridge Monitoring Station, 2018.

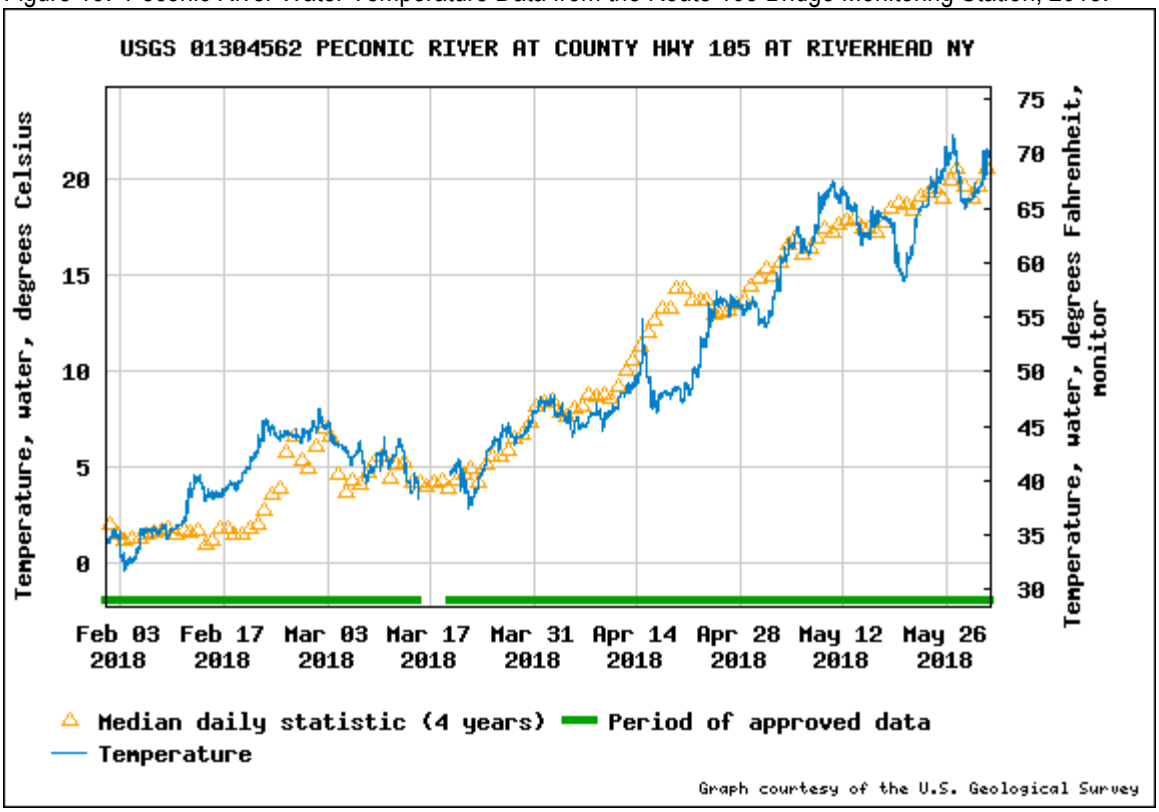


Figure 14. Stream Flow Conditions at the USGS Gauging Station, 2010 to Present.