

National Park Foundation 2014 Impact Grant

Great Egg Harbor National Scenic and Recreational River

Courtesy of Subaru of America

Final Report



August 10, 2015

**Evaluation of Fisheries Sustainability in the
Great Egg Harbor National Scenic and
Recreational River Estuary**

Final Report To:

**National Park Foundation
1110 Vermont Avenue, NW, Suite 200
Washington DC, 20005**

**National Park Service
Philadelphia Support Office
200 Chestnut Street, 3rd Floor
Philadelphia, PA. 19106**

By

**Fred Akers, Administrator
Great Egg Harbor River Council
Great Egg Harbor Watershed Association
P.O. Box 109
Newtonville, NJ 08346**

August 10, 2015

Cover Photo: Duke-O-Fluke ready to depart from Shady River Marina



The Great Egg Harbor Watershed Association & River Council

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August 10, 2015

Carolyn Hill

Director, Grants and Programs
National Park Foundation
1201 Eye Street NW, Suite 550B
Washington, DC 20005

RE: Great Egg Harbor 2014 Impact Grant Final Report

Dear Carolyn,

The Great Egg Harbor National Scenic and Recreational River National Park Foundation Impact Grant Project, "Evaluation of Fisheries Sustainability in the Great Egg Harbor Wild and Scenic River Estuary", has been successfully completed.

The Great Egg Harbor National Scenic and Recreational River Council sincerely thanks the National Park Foundation and Subaru of America for the very generous grant of \$22,600 to conduct conservation research and bring 240 youth visitors to the Great Egg Harbor River, which is both a Unit of the National Park System and a part of the National Wild and Scenic River System.

As a Unit of the National Park System with no federally owned lands and managed by local jurisdiction in partnership with the National Park Service, the Great Egg Harbor River Council receives a fluctuating and limited amount of federal funding from Congress through the National Park Service to annually implement the Comprehensive Management Plan for the long term protection of the Outstanding Resource Values for which the river was designated.

Because of the uncertainty of the level of federal operating funds that will be provided each year, it is difficult for the Great Egg Harbor River Council to plan, build, and maintain the capacity necessary to accomplish important conservation research, provide programs for the thousands of visitors who come to the river each year, and provide programs specifically for youth engagement on the Great Egg Harbor River.

Therefore this Impact Grant was a much needed and important opportunity to leverage additional non-federal funding to help achieve valuable conservation research and engage 240 7th grade students outdoors on the river.

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www.gehwa.org – The Official Website of the Great Egg Harbor Watershed Assoc.

This Final Report documents and describes the student trawl survey process, presents and analyzes the conservation research data collected, discusses the importance and value of public and youth engagement, acknowledges the leaders and supporters, provides photographic documentation for the project, and documents the press, a letter of appreciation and an award received.

We are also pleased to report that the capacity building and recognition provided by this National Park Foundation and Subaru of America grant for our Student Trawl Survey Program helped to facilitate an award of additional federal funding to enable 3 trips in June this year as part of Northeast Regional Director Mike Caldwell's Call to Action grant program, and 2 additional trips in June from local private and public funds.

This grant, which represented 19% of operational funding for the Great Egg Harbor River Council during the time period, made a huge positive impact for the long term protection and promotion of the Great Egg Harbor National Scenic and Recreational River.

The Great Egg Harbor National Scenic and Recreational River Council sincerely thanks the National Park Foundation and Subaru of America for their support for this opportunity to achieve important conservation research and bring youth to the Great Egg Harbor National Scenic and Recreational River.

Fred Akers

Fred Akers, Administrator



P1: Egg Harbor Township Fernwood School 7th Grade Students and Teachers Pose After Trip

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Acknowledgements

This project, “Evaluation of Fisheries Sustainability in the Great Egg Harbor Wild and Scenic River Estuary”, would not have been possible without the support of the National Park Foundation 2014 Impact Grant, Subaru of America, the National Park Service, the Great Egg Harbor River Council, and a number of other participants and supporters.

Special recognition and appreciation goes out to teachers Jim Thoms and Stephany Oster of the Fernwood Avenue Middle School in Egg Harbor Township. It takes a tremendous amount of extra effort for a teacher to integrate the outdoor classroom experience into the core curriculums, achieve administrative support to take their students out of school for a day, and plan, organize, and supervise the outing. These teachers are Champions for their students, and the river.

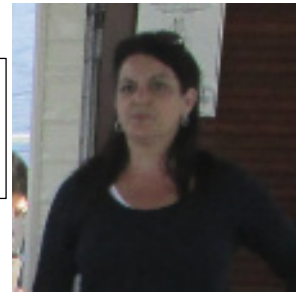
Teacher Jim Thoms and the Egg Harbor Township School System are the founders of the student trawl survey process and methods model that the Great Egg Harbor River Council rescued from funding cuts in 2010, and which has now evolved to the level of successful achievement of this project for 240 students and 8 trips in one year.

The Great Egg Harbor River Council would like express its sincere appreciation to the following participating partners and supporters of this project:

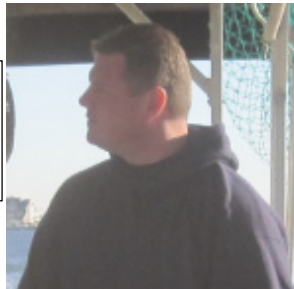
Jim Thoms
Fernwood School
Teacher



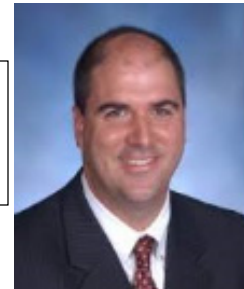
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Captain, Duke-O-
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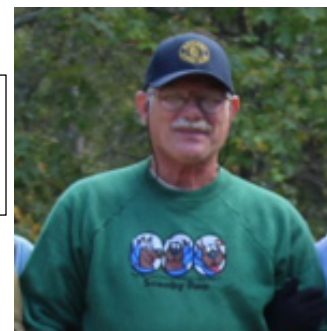
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Administrator



Executive Summary

129 miles, 17 tributaries, and the tidal estuary of the Great Egg Harbor National Scenic and Recreational River in the Pinelands Region of Southern New Jersey, became a Unit of the National Park System and part of the National Wild and Scenic River System in October 1992.

The historical abundance of the fisheries resources of the river, and in particular anadromous fish, were judged by the National Park Service during the designation study to be one of the Outstanding Resource Values for which the river was designated by Congress.

To try to establish a baseline for the rivers fisheries resources after the designation in 1992, the National Park Service commissioned the University of Maryland's Cooperative Fish and Wildlife Research Unit to conduct an **Evaluation of Fisheries Resources of the Great Egg Harbor River** by undertaking a 2-year, 3-season survey of the fish in the river in 1998 and 1999, which cost \$80,000 at that time.

The objectives of this study were to develop a list of fishes collected in the river system, document the presence of spawning runs of anadromous fish (alewife, blueback herring, and striped bass), and delineate potential spawning and rearing habitats. The results of this study were published in 2001, and have since been digitized and posted online at: www.gehwa.org

Collections were made by electroshocking and seining for this study for both adult and juvenile fishes. A significant species diversity list was established during this study. Spawning adults and juvenile alewife river herring were found, the presence of American eel was established, but there was no presence of blueback herring, and there was no presence of striped bass spawning or recruitment in the river.

Since the University of Maryland's fisheries study in 1998-1999, the Great Egg Harbor River Council and the National Park Service, now partners in long term river protection, have perceived a substantial reduction in breeding alewife river herring, and striped bass recruitment in the Great Egg Harbor River.

While federal and state fisheries management rules and regulations have brought back the striped bass to the Great Egg since 1998, the entire Atlantic Coastal river herring population has crashed since then, causing the listing of the river herring as a Species of Concern by the National Marine Fisheries Service in 2009, and a coast wide closing of the river herring fishery, including in New Jersey in 2012.

Since the 2009 Species of Concern listing, the Great Egg Harbor River Council and the National Park Service have been concerned about the disappearing river herring, and considered possible affordable actions to take to document their disappearance from the river and what can be done to bring them back.

However, since FY2009, the National Park Service has substantially cut the annual Cooperative Agreement funding for the Great Egg Harbor River, forcing the River Council to struggle to fund only basic public education and outreach programs, like connecting local middle school students to the

river through outdoor classroom boat trips. There has been no money for fisheries science projects like those in the past, which are usually very expensive.

Then in 2014, the National Park Foundation, with support from Subaru of America, offered their Impact Grant program to the Great Egg Harbor National Scenic and Recreational River. The Great Egg Harbor River Council and the National Park Service recognized that an Impact Grant could provide critical financial support to transform the already innovative outdoor student trawl survey program into a project that would combine scientific fisheries sampling and data collection with service-based student learning upriver to help determine if fisheries resources are adequate to provide a multiple species sustainable ecosystem.

With the Impact Grant award of \$22,600, the River Council conducted eight field sampling/trawling expeditions upriver with students in known anadromous fish habitat to collect fisheries data, water quality data, and avian species data.

240 different 7th Grade students, along with 62 adults, “found their park” in this Impact Grant project. For many of the students, it was the first time they had been in a boat on the Great Egg Harbor River National Scenic and Recreational River! A total of 41 tows of the 16 foot trawl net were made, a total of 2,502 marine creatures representing 30 species were caught, counted and released, and 26 different bird species were observed and identified.

While the scientific data collected were not nearly enough, and the implications of the data collected are not all that positive, this project not only advanced conservation research science, but it brought hundreds of new visitors to the river and provided a much needed public focus for fisheries conservation on the Great Egg Harbor River.

The following pages of this report will offer considerable explanation, details and analysis of the project results. As the Administrator for both the Great Egg Harbor River Council and the Great Egg Harbor Watershed Association, I offer our sincere thanks and gratitude for this much needed financial support through your National Park Foundation Impact Grant. It has made a very positive impact to the Great Egg Harbor National Scenic and Recreational River.

Fred Akers, Administrator, Great Egg Harbor River Council

P-2: Sunrise on the Great Egg Harbor Bay viewed from the Duke-O-Fluke docked in Somers Point 10/9/14



Student Trawl Survey Process and Methods

This project builds on an existing program of outdoor classroom trawl surveys being implemented with the Egg Harbor Township Schools since 2010 in the lower estuary. The trawl equipment and sampling methodology has been well established, and previously collected data have been provided to the NPS and NJ Division of Marine Fisheries. The methodology from this existing program was targeted at upstream reaches in search of River Herring and other migratory fish species like menhaden and perch at the bottom of the food chain for this project.

Prior to the trips, the Fernwood School 7th grade students were taught about the importance of good water quality in the river, what some of the stressors to water quality are, and the different ways to measure water quality. The River Administrator also made an in school presentation about the importance and value of the federal designation of 129 miles of the river in 1992.



The platform for the trawl surveys is a 45 foot pontoon boat, the Duke-O-Fluke, with a capacity for 38 people total. The thirty 7th grade students for each trip are divided into study teams before the trip, and provided with data sheets and water quality test kits. As they board the boat, they find places at the boat benches to organize their team and equipment.

After the First Mate gives the required Coast Guard safety briefing, an announcement is made welcoming the students to the Great Egg Harbor National Scenic and Recreational River, and recognizing the National Park Foundation and the River Council for providing funding for the trip. Then the boat casts off and travels to the first tow site, and the trawl net is deployed.

After the trawl net is deployed for a tow, water samples are then drawn into the boat, and each team grabs a water sample for testing and conducts water quality tests. The parameters for student water quality testing include temperature, pH, conductivity, salinity, dissolved oxygen, turbidity, dissolved carbon dioxide, nitrate, phosphate, sulfide, and alkalinity.



This boat is equipped with a small mesh scientific sampling trawl net with 1 ½” #9 mesh in the body, 1 ¼” #15 mesh in cod end, hung on Poly-Dacron rope with floats on the headrope, loop style chain on the footrope, otter style trawl doors, towlines, and a tail float.



The boat is operated in reverse at about 2 mph, and the trawl net is deployed into the water by hand from the front of the boat and towed across the bottom for a measured period of time, determined by conditions and location. Once the tow time is complete, the boat is slowed and the trawl net is pulled in by hand on to the front deck of the boat.

The cod end of the net is then untied, and the contents of the net are either placed in a holding tank for sorting, identification, and release, or placed on the edge of the deck for sorting, identification and release, depending on the total volume of the haul.

The students are then called to gather in view of the holding tank, and a bio-survey is conducted showing the students the different species in the catch. The different species are identified, counted, and then released. The students are then required to add the different fish species and count data to their data sheets.

Each of the eight individual trawl surveys were conducted in the vicinity of the historic sampling sites used in the 1998/1999 *Evaluation of Fisheries Resources* study undertaken by the University of Maryland Cooperative Fish and Wildlife Unit.



Multiple tows were undertaken during each of the 8 trips from June 2014, October 2014, and May 2015. A total of 42 tows of the 16 foot trawl net were made, and a total of 2,502 marine creatures representing 30 species were caught, counted and released. A two person boat crew, two staff from the Great Egg Harbor River Council, two teachers from the Fernwood School, and a scientist from Princeton Hydro were on board each trip to operate the boat and manage the trawl sampling, fish identification, and water quality sampling.

The upriver trawling was more difficult and time consuming than in the lower estuary. The student time window of 5 hours was not long enough to include the extra 3 hours of travel time required to get the boat up river to the historically prime river herring habitat at Gravelly Run and Mays Landing.

To solve the time problem, we obtained permission from the owners of an upriver marina with adequate docking and safe bus parking to use their marina for the boat to meet the students upriver. Keith and Savanna Squire, owners of the Shady River Marina, were very gracious to provide free use of their marina for 2 trips in October and 3 trips in May. Their support was critical to the success of the project.

Another problem was that there was considerably more large woody debris on the bottom of the river in the upriver reaches where we sampled. This caused 5 tows to be interrupted by snags, and it caused some damage to the net which we were able to repair in the field. We did have a backup trawl net, and we needed to use that for the last trip on May 7.

There was also a very significant abundance of white catfish in some upriver reaches, which caused hundreds of white catfish to be caught in a single tow of the net. Dumping and processing those catches on the edge of the deck was the only option for timely processing and releasing.



To try and prevent accumulating too many fish in the net per tow, the tow duration was shortened in reaches where white cat fish were abundant. The total catch of white catfish and brown bullheads was 1,758, which represents 70% of the catch in only two species.

In addition to fish and water quality data, wild birds were identified and listed continually throughout the trip. 26 different species of birds were identified for the project. Numbers of birds were not counted due to the difficulty in not counting the same bird twice.

Our goals for this project were to take the existing student trawl cruise program a great distance up the Great Egg Harbor River to hopefully find and document river herring and other migratory fish species that have been disappearing from the system, while at the same time bringing youth visitors to the Great Egg Harbor National Scenic and Recreational River.

We succeeded in bringing 240 different 7th grade students to an exciting and challenging outdoor program right on the Great Egg Harbor National Scenic and Recreational River with a series of 8 student cruises. We also succeeded in collecting important scientific data to advance conservation research as well.

Again we thank the National Park Foundation with support from Subaru of America for this Impact Grant that made a very positive impact on the Great Egg Harbor National Scenic and Recreational River!

Visitor and Youth Engagement Discussion

A serviced-based learning experience for approximately 240, 7th grade students was a primary component of the project. 30 students and two teachers participated in each of the eight trawling cruises as citizen scientists who assisted with the data collection under the supervision of two River Council staff and one scientist from Princeton Hydro, Inc.

Each trawl cruise was an outdoor classroom where the students and faculty learned firsthand about the Wild and Scenic Great Egg Harbor River and its fishery and bird resources. The implementation of this project brought 240 students out to the river, and it incorporated the river and its ecology into the curriculum of the students and teachers who participated.

Existing partnerships between the National Park Service, the Great Egg Harbor River Council, and the Egg Harbor Township School System were enhanced through this very successful ongoing outdoor classroom serviced-based learning program - using saltwater science cruises on the river. This project was also the start of a new partnership between the Great Egg River Council and Princeton Hydro Inc., New Jersey's premier environmental consulting firm.

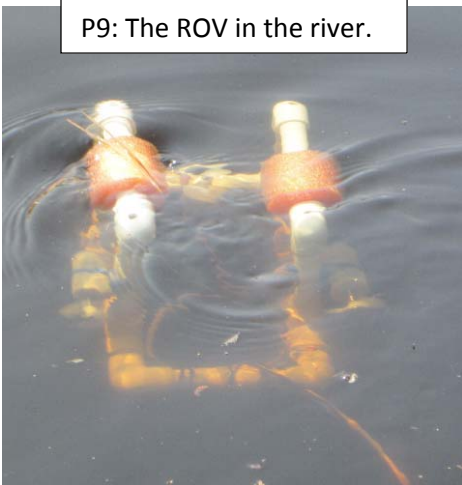
In addition to the use of scientific test kits, field observations, and data collection and reporting, this project also served as a platform for field checking the operation and performance of a remote operated vehicle (ROV) that was built as part of the Fernwood Schools Science, Technology, Engineering, and Math, or STEM curriculum.

The ROV was designed and built by the students to operate in the marine environment, and getting the students out on the water with the stable outdoor classroom pontoon boat the Duke-O-Fluke provided the perfect time and place to operate the ROV in the river marine environment with the students.

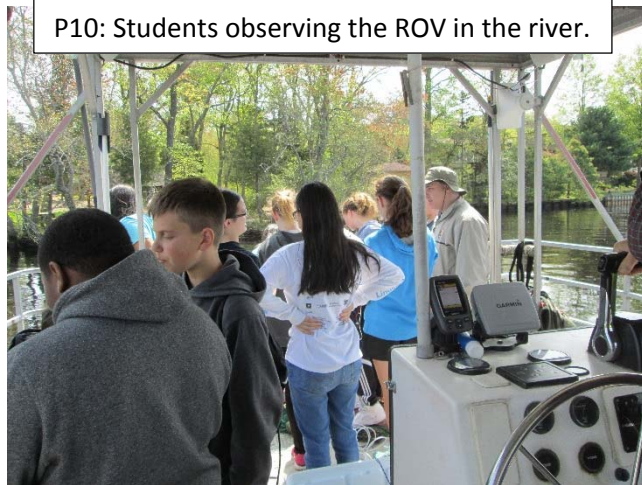
P8: Preparing to launch the ROV.



P9: The ROV in the river.



P10: Students observing the ROV in the river.



As the National Park Service and the Nation prepare to celebrate 100 years of the National Park System in 2016 and a new Century of Stewardship and Engagement, this 2014 National Park Foundation Impact Grant project was a model example of the “Find Your Park” Call to Action. With this project, the Great Egg Harbor River Council clearly demonstrated how to achieve the centennial goal to "connect with and create the next generation of park visitors, supporters, and advocates".

This project was innovative, it demonstrated clear outcomes, and it addressed the following specific Call to Action goals:

Action #2 - Step by Step: This project introduced 240 middle school children to their first park experience through an outdoor park education program that will be their first step in the pathway to diverse park experiences.

Action #5 – Parks for People: This project will enhance the connection of the Pinelands Regional Growth Area population to close-to-home outdoor recreational opportunities and natural resource conservation on the Great Egg Harbor National Scenic and Recreational River.

Action #7 – Next Generation Stewards: This project will help to create a new generation of citizen scientists and future stewards of our parks by conducting fun, engaging, and educational biodiversity discovery activities on the Great Egg Harbor National Scenic and Recreational River.

Northeast Regional Director Mike Caldwell has offered “Centennial Initiative Call 2 Action (C2A)” matching grants for FY2015 and FY2016 for project proposals that meet the “spirit” behind Call to Action. Given the momentum that this project achieved through the National Park Foundation 2014 Impact Grant, the Great Egg Harbor River Council has already been awarded a 50% matching grant of \$2,400 for 3 cruise trips in June 2015, that have already been completed with 90, 7th Grade students participating, and there is a matching grant proposal application submitted for \$7,350 for a \$14,700 project in FY2016 that would bring 240 more students to the Great Egg Harbor River to find their park.

In the final analysis, the National Park Foundation and Subaru, through their generous support of this project, have enabled the experience of a lifetime for 240, 7th Grade students. Many of these young citizens have never been on a boat, many have never touched a fish, and this experience may significantly influence their future. The National Park Foundation and Subaru have clearly made a great impact with their support.



P11: Students Touch a Fish.

Water Quality Results and Discussion

The Great Egg Harbor Watershed drainage area covers 627 square miles, 90% of which is in the federally designated Pinelands National Reserve. There is a 17 trillion gallon natural aquifer under the Pinelands National Reserve that is directly connected to surface water and base flow of many rivers and streams. One of the main motivations for designating the Pinelands the Nation's first National Reserve was to permanently protect the naturally pristine water quality of the Kirkwood Cohansey aquifer in the coastal plain of New Jersey.

Water quality is typically designated, measured, and assessed by physical, chemical, and biological parameters and standards. Under the federal Clean Water Act, the state of New Jersey is required to constantly measure and assess water quality, and then publish and report the results to the national Environmental Protection Agency once every 2 years.

The physical parameters of the Pinelands waters are characterized by very low natural pH and conductivity and significant "staining" of the waters from dissolved iron in the acidic soils and from tannin in the leaves absorbed like tea from tea leaves as rainfall and groundwater travel slowly through the ground in the flat coastal plain. The water color of the Great Egg Harbor River is typical.

The use of chemical parameters for measuring water quality are very important, but they represent only a short snapshot in time of existing conditions. Biological parameters are more useful in terms of the long term monitoring of water quality, and these are usually aquatic insects and other aquatic life, and fish.

While the Great Egg Harbor Watershed has very little legacy pollution from the Industrial Revolution, more recent urban development in the Pinelands has caused significant degradation of fresh water quality from non-point source pollution, particularly in terms of aquatic life impairment.

However, water quality in the "Saline Estuary" waters of the tidal Great Egg Harbor River, estuary, and bay has been good over all, and a sustainable level of good water quality continues to be maintained. Significant factors beneficial to this good water quality are large quantities of freshwater inputs from many different tributaries, much lower nutrient loads compared to other estuaries like Barnegat Bay, very robust tidal flushing from the ocean twice a day, and the continued viability of shell fishing in saline estuary waters.

The water quality monitoring for the National Park Foundation 2014 Impact Grant consisted mostly of chemical and physical testing by the students with low cost test kits and equipment. The students were divided into water quality testing teams. Each time the trawl net was deployed water samples were drawn, and each team grabbed a water sample and conducted water quality tests.

The parameters for student water quality testing included temperature, pH, conductivity, salinity, dissolved oxygen, turbidity, dissolved carbon dioxide, nitrate, phosphate, sulfide, and alkalinity. Testing these parameters for the first time was a daunting challenge to 12 and 13 year old citizens, and it was also the experience of a life time. While the work of teaching and doing this activity was far more valuable than the quality of the data achieved, the resulting data helps to assure that there were no serious chemical and physical water quality problems evident on these trips.

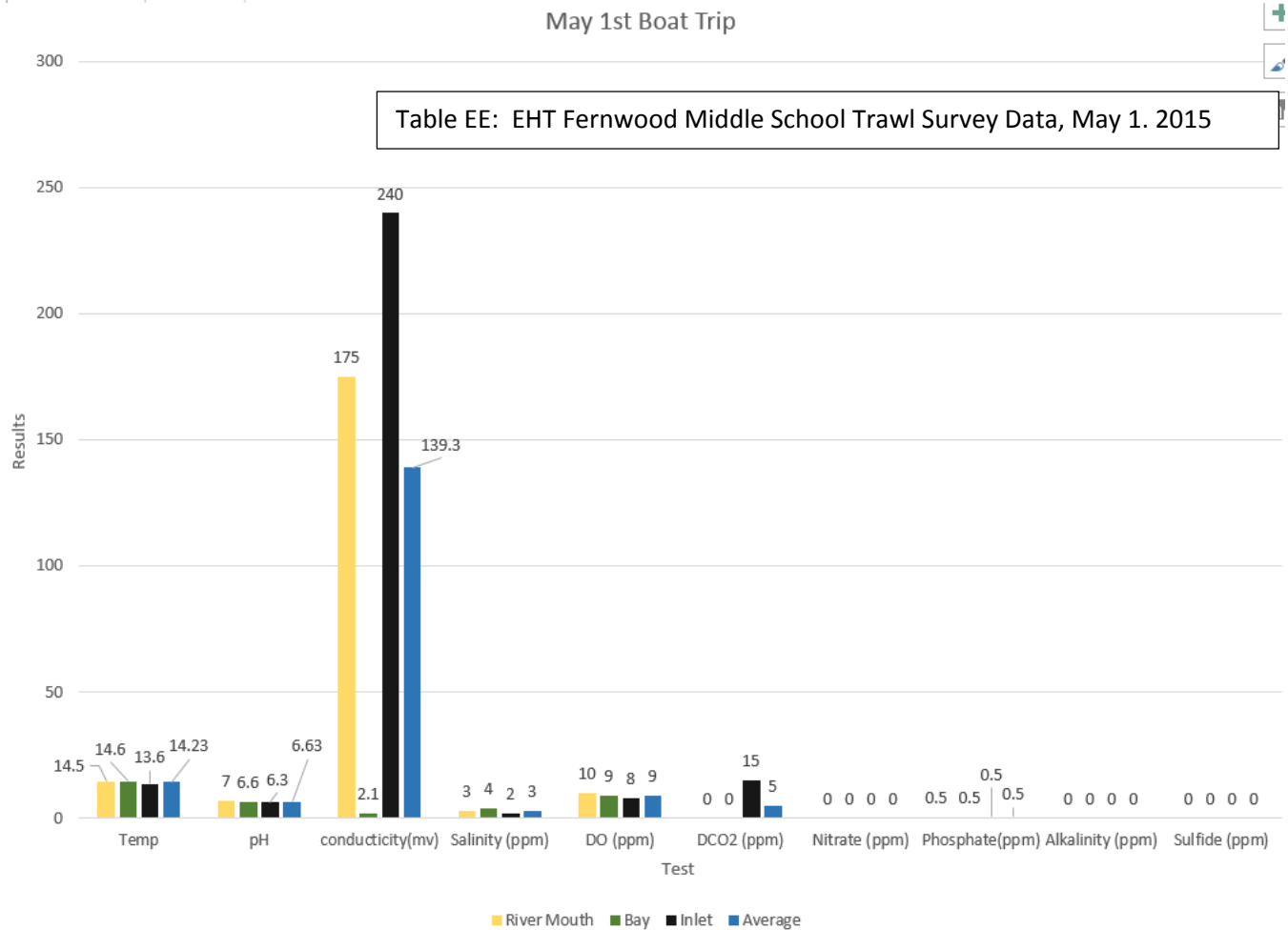
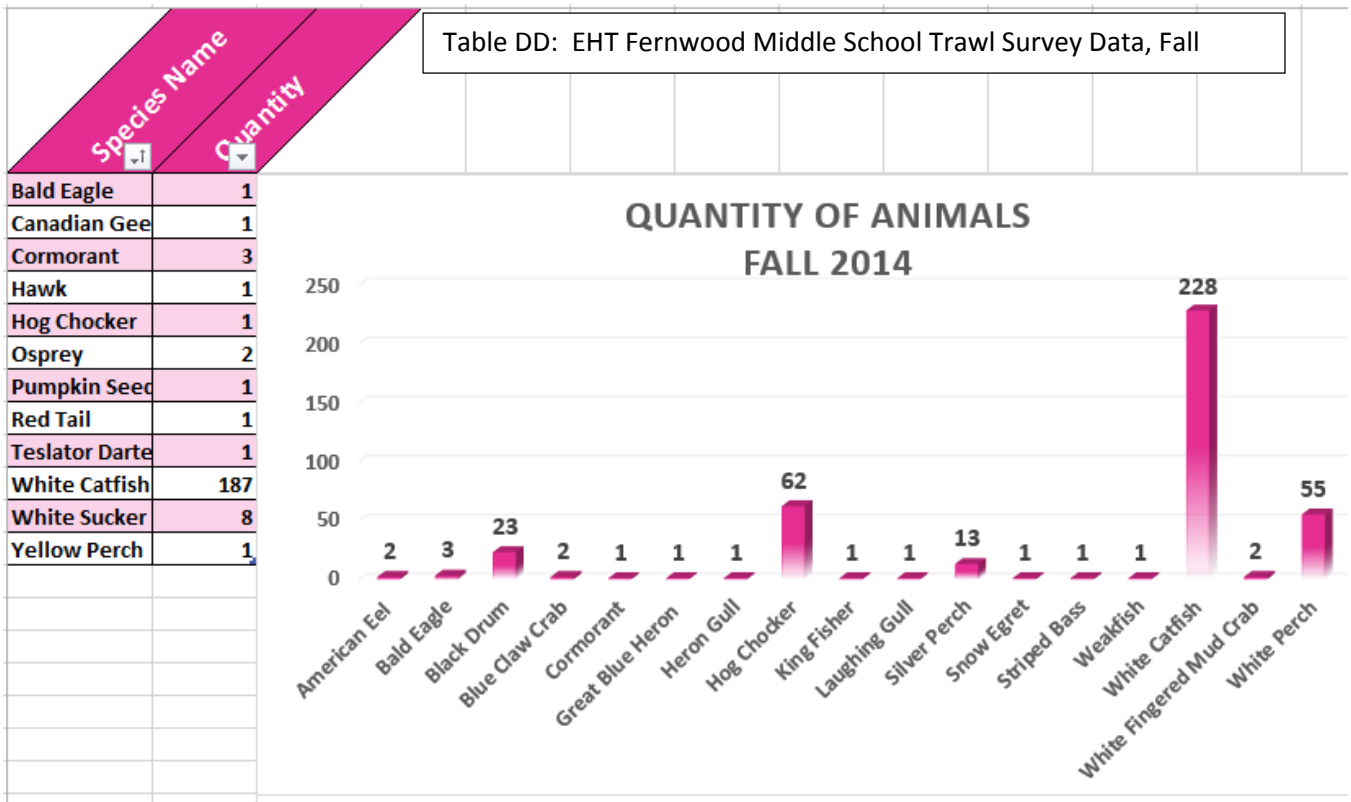
Many student data sheets were created over the 8 trawl trips. These data sheets were taken back into the classroom, where they were then reviewed, analyzed, and digitized as part of the teaching curriculum for science, math, and information technology. Windows Excel was one of the computer programs used to organize, display, and publish the data. The following tables are examples of the student outputs for this project.

Table CC: EHT Fernwood Middle School Trawl Survey Data, Fall 2014

WATER TEST	River Mouth	Bay	Ocean Inlet	AVERAGE				
Temp C	20.7	20.5	22.2	21.1				
pH	6.8	7.0	7.1	7.0				
Conductivity (mv)	136.0	180.0	199.0	171.7				
Salinity (ppm)	5.0	6.0	11.0	7.3				
DO (ppm)	6.0	8.0	8.0	7.3				
DCO2 (ppm)	0.0	0.0	10.0	3.3				
Nitrate (ppm)	0.0	0.0	0.0	0.0				
Phosphate (ppm)	0.0	0.0	0.0	0.0				
Alkanity (ppm)	15.0	11.0	11.0	12.3				
Sulfide (ppm)	0.0	0.0	0.0	0.0				

AVERAGE

■ Temp C ■ pH ■ Conductivity (mv) ■ Salinity (ppm)
 ■ DO (ppm) ■ DCO2 (ppm) ■ Nitrate (ppm) ■ Phosphate (ppm)
 ■ Alkanity (ppm) ■ Sulfide (ppm)



Avian Species Data Analysis and Discussion

The Great Egg Harbor Bay, Estuary, and River got its name from Dutch explorer Cornelius Jacobsen Mey. In 1614, Mey came upon the inlet to the Great Egg Harbor River. The meadows were so covered with shorebird and waterfowl eggs that he called it "Eyren Haven" (Egg Harbor).

378 years later, partly as the result of a National Park Service study determination that abundant undisturbed forests and wetlands were still serving as resting, feeding and breeding areas for many different species of birds, 129 miles of the Great Egg Harbor River, including the tidal estuary and 17 tributaries were designated as a Unit of the National Park System and part of the National Wild and Scenic River system in 1992.

Recognizing that avian species, in addition to fish, are another one of the Outstandingly Remarkable Resource Values for which the river was designated, the Great Egg Harbor River Council conducted over \$80,000 of avian conservation research over 10 years from 2003 to 2013 to document the species diversity and abundance of birds in the Great Egg Harbor Estuary and River.

The results of this extensive conservation work showed the presence and use of the Great Egg Harbor Estuary by numerous bird species, including an impressive list of threatened and endangered bird species topped by Bald Eagles and Osprey. Historic populations of Bald Eagles and Osprey drastically declined in the Great Egg Harbor system in the 1970s and 1980s in part due to the toxic effects of insecticides such as DDT on reproduction, but they have now been brought back to very significant recovery levels today through human intervention and conservation initiatives.



P12: Monitoring Osprey Nest on the Great Egg.



P13: Osprey Nest with White Perch.

To lead and assist with Osprey conservation at the state level, the Great Egg Harbor River Council has installed or replaced over 20 Osprey nesting platforms in the Great Egg Harbor Estuary since 2008, and annually monitors and maintains an Osprey Colony of 41 nesting platforms west of the Garden State Parkway within the federal Wild and Scenic River designation for the state of New Jersey's Endangered and Nongame Species Program.

The Osprey, sometimes known as the fish hawk or fish eagle, eats only fish, and is therefore totally

dependent on the sustainability of small forage or prey fish in the Great Egg Harbor River ecosystem to provide an adequate food supply to survive and raise its young. Given the collapse of the once abundant River Herring population, the critical ecosystem connection between the Osprey and fish abundance was one of the main motivations for the River Council to apply to the National Park Foundation for a 2014 Impact Grant to try to advance sustainable fish conservation on the Great Egg Harbor National Scenic and Recreational River.

2012-2013 Avian species data collected by the Great Egg Harbor River Council shows that there are at least 23 species of fish-eating birds present on the river. Table AA lists those species.

Table AA: Fishing Eating Bird Species Found in the Great Egg Harbor River and Estuary	
Osprey	Red-throated Loon
Bald Eagle	Common Loon
Golden Eagle	Pied-billed Grebe
Double-crested Cormorant	Horned Grebe
Great Blue Heron	Red-necked Grebe
Great Egret	Northern Gannett
Great Black-backed Gull	Snowy Egret
Herring Gull	Tri-colored Heron
Laughing Gull	Black-crowned night Heron
Forster's Tern	Yellow-crowned night Heron
Ring-billed Gull	Glossy ibis
Belted Kingfisher	

Table BB: Bird Species Observed on the Great Egg Harbor River	10/1/14	10/7/14	10/9/14	5/1/15	5/4/15	5/7/15
Fish Eating Birds						
Osprey			x	x	x	x
Bald Eagle	x	x	x	x	x	x
Double-crested Cormorant	x	x		x		
Great Blue Heron	x		x			x
Great Egret	x		x			x
Snowy Egret			x		x	
Great Black-backed Gull	x		x			x
Herring Gull	x	x	x			
Laughing Gull	x	x	x	x	x	x
Forster's Tern	x		x		x	x
Common Loon						x
Belted Kingfisher		x	x			
Non-fish Eating Birds						
Peregrine Falcon	x		x			
Northern Harrier	x		x	x		
Turkey Vulture	x	x	x	x	x	
Canada Goose		x	x	x	x	
Red-winged Blackbird		x				
Mallard			x			
Red-tailed Hawk			x	x		
Black Scoter			x			
Rock Doves			x			
Barn Swallow				x	x	x
Tree Swallow					x	
Purple Martin					x	x
Brant						x
Willet						x

During the trawl survey trips, binoculars were furnished to the students, and the sky and river habitat were constantly being scanned throughout each trip for the presence of birds. Any birds seen were identified to species, and the species seen were recorded on data sheets. Counting for species abundance is not considered on these trips that move up and down the river, because it is impossible to prevent counting the same bird twice.

The total of different bird species seen for the project was 26, and 12 of those were fish eating birds. Table BB lists the bird species observed for the National Park Foundation 2014 Impact Grant Project.

Today, the National Park Service considers the Great Egg Harbor National Scenic and Recreational River one of the top 10 places in North America for birding. Hopefully, the current level of fisheries resources will continue to sustain the current diversity and abundance of birds on the Great Egg Harbor River well into the future.

Fisheries Data Analysis and Discussion

Total Catch

Including all 41 net tows, a total of 2,502 marine creatures representing 30 species were caught, counted and released. Table 1 summarizes the species and abundance data collected on all 8 trips:

Table 1 Great Egg Harbor River Impact Grant Fish Trawl Survey Final Data Summary										
8 Trawl Trips, 240 Youth, 62 Adults		6/3/14	10/1/15	10/3/15	10/7/15	10/9/15	5/1/15	5/4/15	5/7/15	
Sites		TR12	GER15	TR11	GER	GER	GER	GER	GER	Totals
Taxonomic Name	Common Name	Qty	Qty	Qty	Qty	Qty				Qty
Fishes (vertebrates)										
<i>Alosa pseudoharengus</i>	Alewife				1					1
<i>Morone saxatilis</i>	Striped bass					1			2	3
<i>Morone americana</i>	White perch	10	34	3	119	79	4	5	4	258
<i>Perca flavescens</i>	Yellow perch				3		1			4
<i>Bairdiella chrysoura</i>	American silver perch			3		13				16
<i>Alosa sapidissima</i>	American shad									0
<i>Dorosoma cepedianum</i>	Gizzard shad									0
<i>Anguilla rostrata</i>	American eel					3				3
<i>Pomatomus saltatrix</i>	Bluefish									0
<i>Cynoscion regalis</i>	Weakfish					1				1
<i>Trinectes maculatus</i>	Hogchoker	50	117	1	12	74	1	1		256
<i>Paralichthys dentatus</i>	Summer Flounder									0
<i>Opsanus tau</i>	Oyster toadfish	1								1
<i>Urophycis regia</i>	Spotted codling	3								3
<i>Brevoortia tyrannus</i>	Atlantic menhaden		1		1					2
<i>Micropogonias undulatus</i>	Atlantic Croaker		4							4
<i>Fundulus heteroclitus</i>	Mummichog									0
<i>Anchoa mitchelli</i>	Bay anchovy									0
<i>Menidia menidia</i>	Atlantic silverside									0
<i>Menidia peninsulae</i>	Tidewater silverside									0
<i>Fundulus diaphanus</i>	Banded killifish									0
<i>Farfantepenaeus duorarum</i>	Northern pink shrimp									0
<i>Ameiurus nebulosus</i>	Brown bullhead	6	91	3	260			2	1	363
<i>Ameiurus calus</i>	White catfish				254	678	220	179	70	1401
<i>Ictalurus punctatus</i>	Channel catfish									0
<i>Micropterus salmoides</i>	Largemouth bass									0
<i>Pomoxis nigromaculatus</i>	Black crappie				3				1	4
<i>Esox niger</i>	Chain pickerel									0
<i>Lepomis gibbosus</i>	Pumpkinseed				1		1	1		3
<i>Lepomis macrochirus</i>	Bluegill							1		1
<i>Catostomus commersoni</i>	White sucker						8	2		10
<i>Notemigonus crysoleucas</i>	Golden shiner									0
<i>Etheostoma olmstedii</i>	Tessellated darter						1			1
<i>Caranx hippos</i>	Crevalle jack									0
<i>Syngnathus fuscus</i>	Northern Pipefish									0
<i>Pogonias cromis</i>	Black Drum			1		23				24
Crabs & Shrimp (Arthropod Invertebrates)										
<i>Callinectes sapidus</i>	Blue crab	10	10	5		2				27
<i>Menippe mercenaria</i>	Florida Stone Crab	1		12						13
<i>Carcinus maenas</i>	Green Crab	3								3
<i>Rhithropanopeus harrisii</i>	White fingered mud crab			50		3				53
<i>Paleomonetes vulgaris</i>	Grass shrimp	1								1
<i>Farfantepenaeus duorarum</i>	Northern pink shrimp		26							26
	Common Shore Shrimp			7						7
Other Invertebrates										
<i>Ascidacea</i>	Sea squirt			7						7
	aquatic worms			2						2
	Marine Macroinvertebrates			4						4
										2502

The vertebrate fishes caught represent 94% of the total catch with 20 species. Of the 2,359 fishes caught, 1,764, or 75%, were either White catfish or Brown bullheads. White perch and Hogchokers were the next significantly abundant species caught at 258 and 256 representing 10% each for fishes caught respectively, and the remaining 15 species caught were 1% or less each of the total abundance caught. Table 2 below summarizes the total fishes caught:

GEHR Impact Grant Fish Trawl Survey Final Data Summary			
Table 2		Totals	% of
Taxonomic Name	Common Name	Qty	Catch
Fishes (vertebrates)			
<i>Alosa pseudoharengus</i>	Alewife	1	0.043
<i>Morone saxatilis</i>	Striped bass	3	0.127
<i>Morone americana</i>	White perch	258	10.937
<i>Percaflavescens</i>	Yellow perch	4	0.170
<i>Bairdiella chrysoura</i>	American silver perch	16	0.678
<i>Anguilla rostrata</i>	American eel	3	0.127
<i>Cynoscion regalis</i>	Weakfish	1	0.043
<i>Trinectes maculatus</i>	Hogchoker	256	10.852
<i>Opsanus tau</i>	Oyster toadfish	1	0.043
<i>Urophycis regia</i>	Spotted codling	3	0.127
<i>Brevoortia tyrannus</i>	Atlantic menhaden	2	0.085
<i>Micropogonias undulatus</i>	Atlantic Croaker	4	0.170
<i>Ameiurus nebulosus</i>	Brown bullhead	363	15.387
<i>Ameiurus calus</i>	White catfish	1401	59.389
<i>Pomoxis nigromaculatus</i>	Black crappie	4	0.170
<i>Lepomis gibbosus</i>	Pumpkinseed	3	0.127
<i>Lepomis macrochirus</i>	Bluegill	1	0.043
<i>Catostomus commersoni</i>	White sucker	10	0.424
<i>Etheostoma olmstedii</i>	Tessellated darter	1	0.043
<i>Pogonias cromis</i>	Black Drum	24	1.017
Total Individuals Caught =		2,359	100.000

143 Crabs, shrimp, and other invertebrates including 10 species were also caught in the trawl net. Crabs, shrimp, and other invertebrates represented 6% of the total catch, and the following Table 3 documents their abundance and composition:

GEHR Impact Grant Fish Trawl Survey Final Data Summary			
Table 3		Totals	% of
Taxonomic Name	Common Name	Qty	Catch
Crabs & Shrimp (Arthropod Invertebrates)			
<i>Callinectes sapidus</i>	Blue crab	27	18.89
<i>Menippe mercenaria</i>	Florida Stone Crab	13	9.09
<i>Carcinus maenas</i>	Green Crab	3	2.10
<i>Rhithropanopeus harrisii</i>	White fingered mud crab	53	37.06
<i>Paleomonetes vulgaris</i>	Grass shrimp	1	0.7
<i>Farfantepenaeus duorarum</i>	Northern pink shrimp	26	18.18
	Common Shore Shrimp	7	4.89
Other Invertebrates			
<i>Ascidacea</i>	Sea squirt	7	4.89
	aquatic worms	2	1.40
	Marine Macroinvertebrates	4	2.80
Total Individuals Caught =		143	100

Spatial Analysis

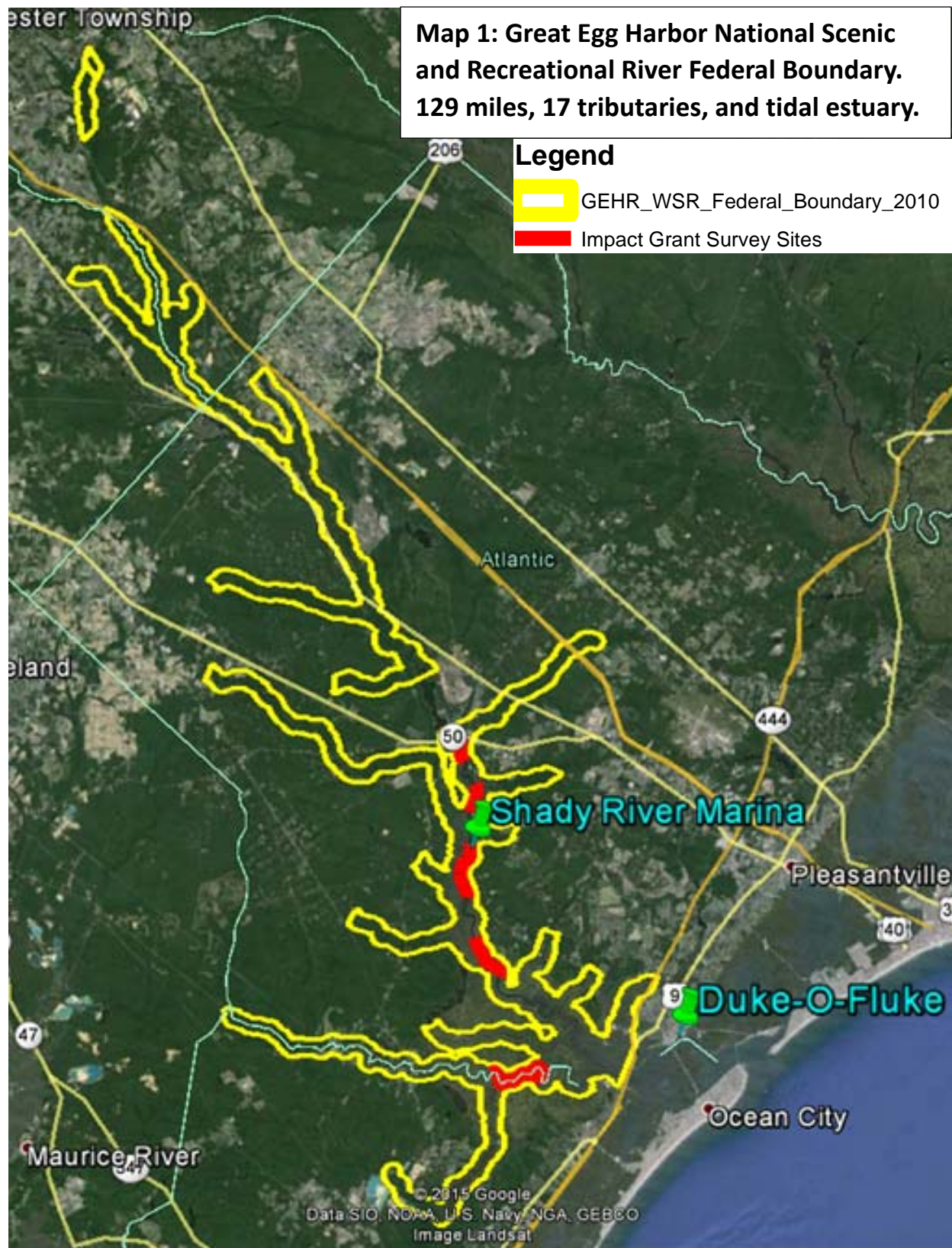
The project undertook 6 fisheries trawl surveys with 32 net tows on the upper tidal Great Egg Harbor River, and 2 fisheries trawl surveys with 8 net tows on the upper tidal Tuckahoe River. The locations for all the tows were coordinated with the historic sites of the 1998-1999 University of Maryland Study.

Since the data from the 1998-1999 survey were categorized by sites, it was determined that the data for this project should also be collected by site. While the individual trawl trips sampled in multiple sites on some of the 8 trips, the data for each individual tow were collected by tows per site.

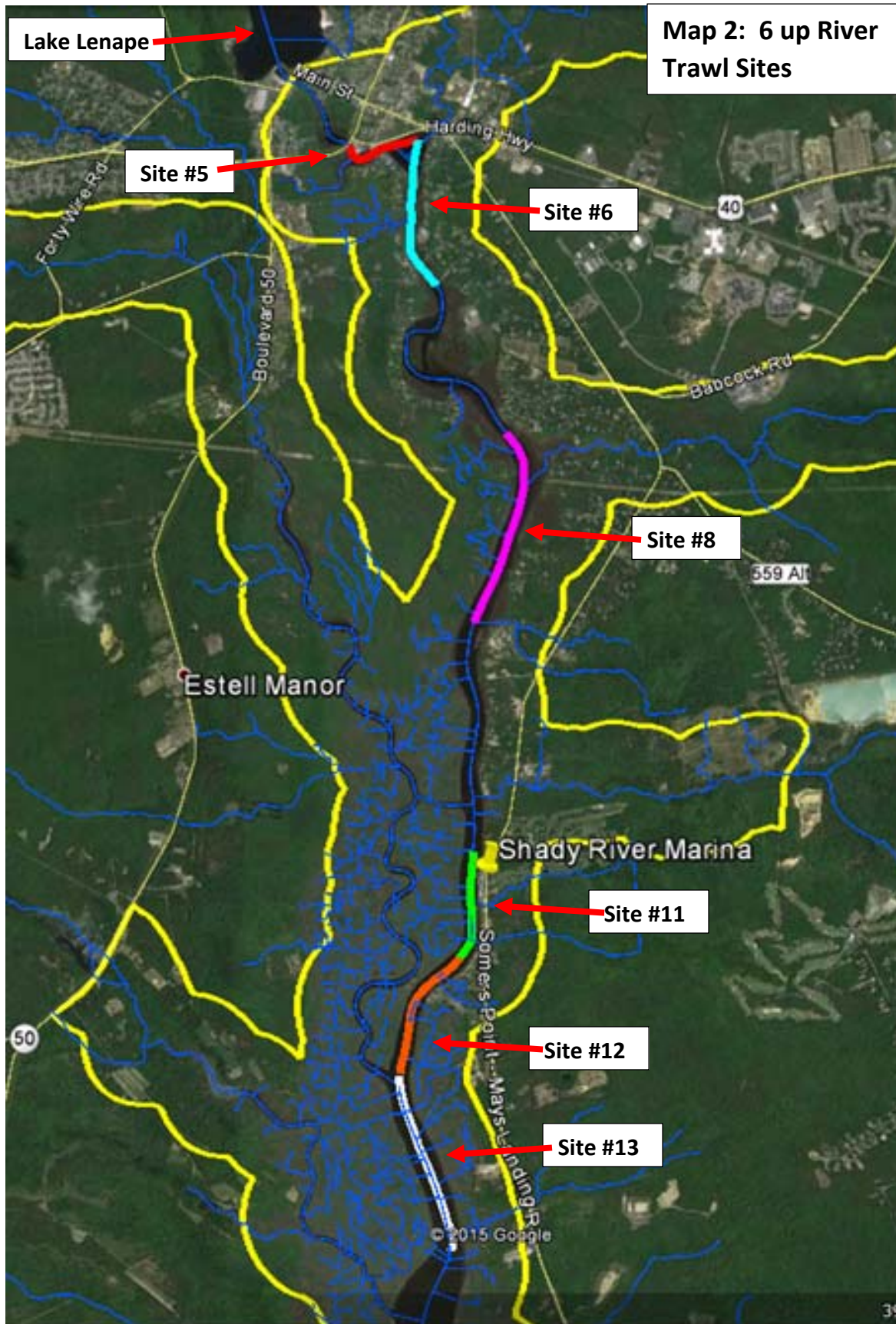
As part of this project, the sampling sites/reaches from the 1998-1999 survey documented on paper maps were recreated into ArcGIS polyline files so that they could be mapped in ArcMap and overlaid on existing mapping projects of the river. Then the 8 ArcGis site files that were targeted for this project were converted into Garmin MapSource files, and loaded into a hand held GPS unit for field navigation and documentation at each respective site.

The travel time and the student trip time turned out to be significant constraints to get to the upriver sites where lower salinities favored river herring breeding grounds. Three of the trips went up and back from Somers Point which limited the distance traveled and the number of tows at the sites covered by those trips. The other 5 trips were successful in more tows per trip in the historically prime river herring breeding grounds on the Great Egg Harbor River main stem by having the boat meet the students upriver to separate the travel time from the trawling time.

The ArcGIS site files for the project sites visited were also converted to Google Earth files to enable a broader and more current base map view of the spatial relationships between the sampling sites and the entire 129 mile designation of the river, the tributaries, and the tidal estuary. See Map 1.



The 6 upstream trawl sampling sites accessed from Shady River Marina are shown on Map 2.



The 3 downstream trawl sampling sites accessed from Somers Point are shown on Map 3.

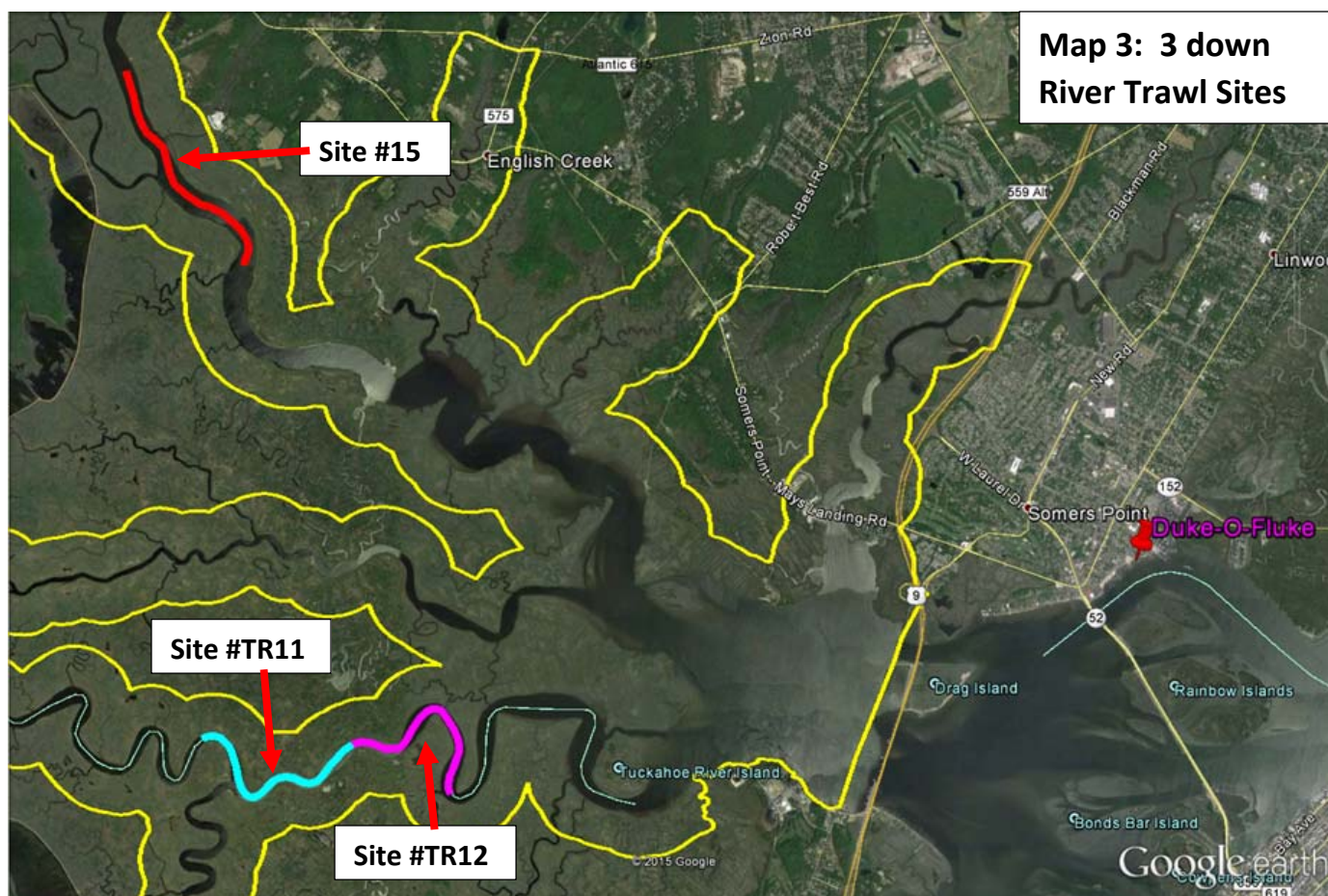


Table 4 lists the 9 sites sampled during the 8 trawl trips, and documents the number of tows per site

Table 4: 2014 GEHR Impact Grant Fish Sampling Sites	
Sites Great Egg Harbor River	No. of Tows
#5 Mays Landing	13 Tows
#6 Watering Race Branch	3 Tows
#8 Gravelly Run	8 Tows
#11 Green Tree Golf course	3 Tows
#12 Dead Horse Run	2 Tows
#13 South River East	2 Tows
#15 Gibson Creek	3 Tows
Sites Tuckahoe River	
#TR 11 Cedar Swamp Creek	3 Tows
#TR 12	4 Tows
Total Sites = 9	Total Tows = 41

Methods Comparison between 1998-1999 and 2014-2015 Fisheries Resource Survey Projects

Electroshocking

The 1998-1999 Great Egg Harbor River fisheries survey by the University of Maryland employed electroshocking and seining to collect fish. Collections were made by electroshocking in low-salinity, navigable areas below dams or other blockages to upstream navigation and seining in high-salinity areas or areas above dams or blockages.

Electroshocking shocks or stuns the fish, and the fish are then caught in dip nets from a boat that maneuvers around to net the stunned fish seen floating on the surface as quickly as possible before they recover and swim away.

Electroshocking can be done in varying water depths and in confined and unconfined stream segments. The netting of the fish takes place at the surface, so any fish with a swim bladder within complex bottom structures such as woody debris, aquatic vegetation, rocks, and snags can be shocked and counted when it floats to the surface and gets netted. Fish without swim bladders will not float to the surface and are therefore not caught and counted.

Any size fish can be electroshocked. With a fine mesh in the dip nets, it is possible to shock and capture a full range of fish sizes in various life stages from very small juveniles to very large adults.

Electroshocking does not work well in salty water. According to the 1998-1999 report, both the Great Egg Harbor and Tuckahoe Rivers became more saline as the season progressed, making it difficult to effectively electroshock. However, electroshocking has low impacts on aquatic habitat.

Seining

A seine is a fishing net that hangs vertically in the water with its bottom edge held down by weights and its top edge buoyed by floats. Seine nets can be deployed from the shore as a beach seine, or from a boat. While the seining techniques were neither specified nor described in the 1998-1999 report, we will assume that beach seining was the principal technique.

Typically seine nets have a fine mesh which is capable of capturing a full range of fish sizes in various life stages from very small juveniles to very large adults. Seine nets also come in variable sizes from 10 ft. to well over 100 ft., and the larger the net, the greater the effort required.

Beach seining is usually limited to shallow shoreline habitats to depths of 4 or 5 feet. Beach seines are usually pulled through the water by two people who walk on the bottom while simultaneously pulling the net. Sites for beach seining need to have a firm enough bottom to walk and pull the net, and a minimum of underwater snags to allow uninterrupted sweeps of the net.

Pulling a beach seine through shallow shoreline habitats is an activity that can be seen and felt by fish in the water, and most fish will attempt to avoid and swim away from beach seines. Once a sweep with a beach seine is completed, it is necessary to prevent any fish caught from escaping when collecting fish from the seine.

Shallow shoreline habitats in tidal waters are greatly variable between high and low tides, and tide ranges are variable as well depending on location and moon phase. Seining at high tide versus low

tide can produce widely variable results, and any sample design for seining in tidal waters should consider the effect of tides.

Bottom Trawling

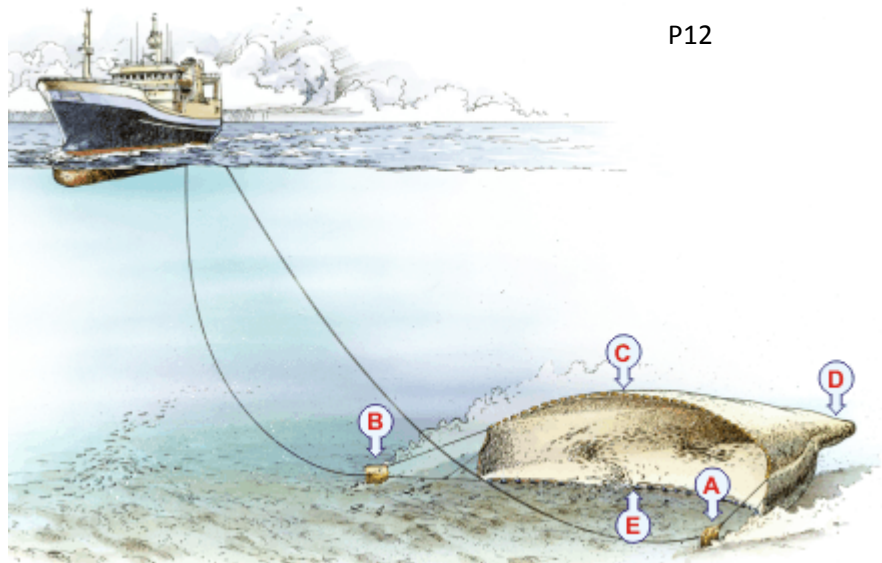
The 2014-2015 Great Egg Harbor River 2014 National Park Foundation Impact Grant fisheries survey by the Great Egg Harbor River Council employed a 16 foot otter bottom trawl net to collect fish. Bottom trawling is towing a trawl net along or close to the bottom or “bed” of the river, and bottom trawling targets both bottom-living fish and semi-pelagic fish in moderate to deep water.

Trawls are funnel-shaped nets that have a closed-off tail or “cod end” in the back where the fish are collected, and an open mouth in the front where the fish are caught and pushed to the back. The vertical opening of the mouth is created using flotation on the upper edge or “floatline”, and a chain for weight on the lower edge or “footrope”.

The horizontal spread of the net is provided by trawl doors or "otter boards". These doors essentially act as wings and weights, using a hydrodynamic shape to provide horizontal spread and keeping contact with the bottom. The towing vessel must maintain a speed generally in the range of 2.5–4.0 knots for the doors to remain standing and functional.

The following parts of a typical bottom trawl are shown in Illustration P12:

- A – Port trawl door
- B – Starboard trawl door
- C – Floatline
- D – Tail or cod end
- E – Footrope



P12

The size selectivity of bottom trawls is controlled by the mesh size of the "cod-end"—the part of the trawl where fish are retained. The trawl net for this project had 1½" #9 mesh in the body, and 1¼ #15 mesh in the cod end. This mesh is typically used to catch shrimp, but it may not be small enough to catch very small juvenile fish.

Water salinity is not an issue with trawl nets, but navigability is. Adequate depth and room to maneuver are required, and large woody debris, other debris, and snags can interrupt the trawl and damage the net. Also, dragging the net on the bottom can physically damage bottom habitat.

Data Comparison, Discussion, and Recommendations

Species Diversity Comparisons

While the time, costs, and methods differed, a close comparison of the data collected from the 1998-1999 and 2014-2015 fisheries surveys reveals substantial information regarding the present and future sustainability of the fisheries resources of the Great Egg Harbor River, particularly in regards to anadromous fish.

The salinity gradients in the Great Egg Harbor tidal estuary are one of the keys to species diversity, and the ability to sample across these gradients is key to documenting fish species diversity. Some fish are predominantly fresh water fish, some are predominantly salt water fish, and some, like the anadromous and catadromous fishes, have evolved to transition through a great range of salinity during their life cycle.

The 1998-99 survey documented 24 species, and the 2014-15 survey documented 20 species. However, only 13 species were common to both projects, while the 1998-99 survey found 11 different species, and the 2014-15 survey found 7 different species, for a total of 31 different species combined. (See Table 5)

1998-99 and 2014-15 Fisheries Species Data		1998-99	2015
Taxonomic Name	Common Name	Species	Species
Table 5		Fishes (vertebrates)	
<i>Alosa pseudoharengus</i>	Alewife	Yes	Yes
<i>Morone saxatilis</i>	Striped bass	Yes	Yes
<i>Morone americana</i>	White perch	Yes	Yes
<i>Perca flavescens</i>	Yellow perch	Yes	Yes
<i>Bairdiella chrysoura</i>	American silver perch	No	Yes
<i>Anguilla rostrata</i>	American eel	Yes	Yes
<i>Cynoscion regalis</i>	Weakfish	No	Yes
<i>Trinectes maculatus</i>	Hogchoker	No	Yes
<i>Opsanus tau</i>	Oyster toadfish	No	Yes
<i>Urophycis regia</i>	Spotted codling	No	Yes
<i>Brevoortia tyrannus</i>	Atlantic menhaden	Yes	Yes
<i>Micropogonias undulatus</i>	Atlantic Croaker	No	Yes
<i>Ameiurus nebulosus</i>	Brown bullhead	Yes	Yes
<i>Ameiurus calus</i>	White catfish	Yes	Yes
<i>Pomoxis nigromaculatus</i>	Black crappie	Yes	Yes
<i>Lepomis gibbosus</i>	Pumpkinseed	Yes	Yes
<i>Lepomis macrochirus</i>	Bluegill	Yes	Yes
<i>Catostomus commersoni</i>	White sucker	Yes	Yes
<i>Etheostoma olmstedii</i>	Tessellated darter	Yes	Yes
<i>Pogonias cromis</i>	Black Drum	No	Yes
<i>Micropterus salmoides</i>	Large Mouth Bass	Yes	No
<i>Esox niger</i>	Chain pickerel	Yes	No
<i>Fundulus heteroclitus</i>	Mummichog	Yes	No
<i>Dorosoma cepedianum</i>	Gizzard shad	Yes	No
<i>Notemigonus crysoleucas</i>	Golden shiner	Yes	No
<i>Anchoa mitchelli</i>	Bay anchovy	Yes	No
<i>Fundulus diaphanus</i>	Banded killifish	Yes	No
<i>Menidia menidia</i>	Atlantic silverside	Yes	No
<i>Menidia peninsulae</i>	Tidewater silverside	Yes	No
<i>Caranx hippos</i>	Crevalle jack	Yes	No
<i>Alosa sapidissima</i>	American shad	Yes	No
Total Different Species =		24	20

Most of these species differences can be related to the more freshwater focus of the 1998-99 study and the more saltwater focus of the 2014-15 study, and the greater selectivity for smaller fish species with the electroshocking and seining compared to the trawl netting.

However, a few of the species found in one survey and not found in the other may be related to sustainability and climate change, and we offer the following summary analysis for those:

Weakfish – Found in 2014-15 but not in 1998-99. This species is currently a conservation concern for sustainability, and finding them in 2015 may be a positive sign. However, the data collected in 2015 does not reflect abundance.

Hogchoker – Found in 2014-15 but not in 1998-99. Based on the abundance found and the fact that hogchokers don't have a swim bladder, it is likely that electroshocking didn't catch these.

Atlantic croaker – Found in 2014-15 but not in 1998-99. While a more saline species, the increased presence of this fish being reported by others in the Great Egg Harbor River may be an indication of climate induced northward expansion of this species.

Black drum – Found in 2014-15 but not in 1998-99. Also a more saline species. All of the black drum caught were juveniles, and the increased presence of this fish in the Great Egg Harbor River may be an indication of climate induced northward expansion of this species.

American Shad – Found in 1998-99 but not in 2014-15. Today this is a species of conservation concern, and all waters except the Delaware River were closed to fishing for this species in 2012.

Anadromous Fish and Species Abundance Comparison by Site

Given that the concern for the disappearance of the River Herring was a primary motivation for this project, this anadromous fish comparison is of great importance to the outcome. And since the main focus of the 1998-99 study was on the tidal freshwater habitat for river herring, this analysis will focus on data comparisons for Site #5, Site #6, and Site #8, Site #11, Site #12, and Site #15.

For site #5, the 1998-99 survey found some adult River Herring in April and May for both years, and some juvenile River Herring in July of 1998 and September of 1999, for a total of 64 River Herring through the time series. (See Table 6)

1998-1999 University of Maryland Study Results											
Table 6: Site #5, Mays Landing		4/98	5/98	7/98	9/98	10/98	4/99	5/99	9/99	10/99	
Taxonomic Name	Common Name	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Total
Fishes (vertebrates)											
<i>Alosa pseudoharengus</i>	Alewife	2	8	6			13	9	26		64
<i>Morone saxatilis</i>	Striped bass	1					2	1			4
<i>Morone americana</i>	White perch	2	5	1			1	25	26		60
<i>Perca flavescens</i>	Yellow perch	2	7		5		2	13	4		33
<i>Anguilla rostrata</i>	American eel				1						1
<i>Brevoortia tyrannus</i>	Atlantic menhaden									26	26
<i>Ameiurus nebulosus</i>	Brown bullhead								1		1
<i>Ameiurus calus</i>	White catfish										0
<i>Pomoxis nigromaculatus</i>	Black crappie										0
<i>Lepomis gibbosus</i>	Pumpkinseed				2		1	1			4
<i>Lepomis macrochirus</i>	Bluegill				13						13
<i>Catostomus commersoni</i>	White sucker	3				1	1	1			6
<i>Dorosoma cepedianum</i>	Gizzard Shad		1					3	1		5
<i>Notemigonus crysoleucas</i>	Golden Shiner			2	9		4	1			16
<i>Mictropterus salmoides</i>	Large Mouth Bass				1						1
<i>Menidia peninsulae</i>	Tidewater Silverside									5	5
14 Species, Total Abundance =											175

The 2014-15 survey found 1 juvenile River Herring in October 2014 at Site #5, and no adult River Herring in May 2015. This was the furthest upstream site that could be accessed for the trawl survey, and since it was a historic spawning area for River Herring, 11 tows were conducted at site #5 on 3 different dates in May 2015 searching for adult River Herring, with none caught. (See Table 7)

GEHR 2014-15 Impact Grant Fish Trawl Survey Final Data Summary						
Table 7: Site #5, Mays Landing, 13 Tows		10/7/14	5/1/15	5/4/15	5/7/15	
Taxonomic Name	Common Name	Qty 2T	Qty 2T	Qty 4T	Qty 5T	Total
Fishes (vertebrates)						
<i>Alosa pseudoharengus</i>	Alewife	1				1
<i>Morone saxatilis</i>	Striped bass				2	2
<i>Morone americana</i>	White perch	24	2	4	4	34
<i>Percaflavescens</i>	Yellow perch	2				2
<i>Anguilla rostrata</i>	American eel					0
<i>Brevoortia tyrannus</i>	Atlantic menhaden					0
<i>Ameiurus nebulosus</i>	Brown bullhead				1	1
<i>Ameiurus calus</i>	White catfish	3	5	26	68	102
<i>Pomoxis nigromaculatus</i>	Black crappie	3			1	4
<i>Lepomis gibbosus</i>	Pumpkinseed	1		1		2
<i>Lepomis macrochirus</i>	Bluegill			1		1
<i>Catostomus commersoni</i>	White sucker		3	2		5
10 Species, Total Abundance =						154
	pH		5.74	5.38	5.67	
	Conductivity		108.9	109.7	127.8	
	Temperature		14.6	12.8	20.7	
	Salinity					

Regarding other species of potential concern for site #5, White and Yellow perch were significantly more abundant in 1999, and a school of Atlantic menhaden were caught in October 1999. It should also be noted that while no White catfish were caught across the entire time series of the 1998-99 survey, White catfish were abundant at this site in 2015.

For site #6, adult River Herring were caught in April and May in both 1998 and 1999, with a greater abundance in May 1999, and juvenile River Herring were caught in July 1998, and August, September, and October 1999.

Here too White and Yellow perch were abundant in 1998-99, and a school of Atlantic menhaden were caught in October 1999. It should also be noted that only 1 White catfish and no Brown bullheads were caught across the entire time series of the 1998-99 survey, while White catfish and Brown bullheads were abundant at this site in 2015. (See Tables 8 and 9).

1998-1999 University of Maryland Study Results

Table 8: Site #6, Watering Race		4/98	5/98	7/98	4/99	5/99	8/99	9/99	10/99	
Taxonomic Name	Common Name	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Qty	Total
Fishes (vertebrates)										
<i>Alosa pseudoharengus</i>	Alewife	6	5	6	29	4	25	26	5	106
<i>Morone saxatilis</i>	Striped bass	1							1	2
<i>Morone americana</i>	White perch		1	3	8	4	26	1	20	63
<i>Perca flavescens</i>	Yellow perch	3	14	26	1		20			64
<i>Anguilla rostrata</i>	American eel			1					1	2
<i>Trinectes maculatus</i>	Hogchoker									0
<i>Brevoortia tyrannus</i>	Atlantic menhaden								28	28
<i>Ameiurus nebulosus</i>	Brown bullhead									0
<i>Ameiurus calus</i>	White catfish			1						1
<i>Lepomis gibbosus</i>	Pumpkinseed			2						2
<i>Lepomis macrochirus</i>	Bluegill			1						1
<i>Catostomus commersoni</i>	White sucker	1		1			2			4
<i>Esox niger</i>	Chain Pickerel			2						2
<i>Dorosoma cepedianum</i>	Gizzard Shad				1					1
<i>Notemigonus crysoleucas</i>	Golden Shiner					1	16			17
<i>Etheostoma olmstedii</i>	Tessellated Darter						12			12
14 species, Total Abundance =										305

GEHR 2014-15 Impact Grant Fish Trawl Survey Final Data Summary

Table 9: Site #6, Watering Race 3 Tows		10/7/14	5/1/15	
Taxonomic Name		Qty 1T	Qty 2T	Total
Fishes (vertebrates)				
<i>Alosa pseudoharengus</i>	Alewife			0
<i>Morone saxatilis</i>	Striped bass			0
<i>Morone americana</i>	White perch		1	1
<i>Perca flavescens</i>	Yellow perch		1	1
<i>Anguilla rostrata</i>	American eel			0
<i>Trinectes maculatus</i>	Hogchoker	2		2
<i>Brevoortia tyrannus</i>	Atlantic menhaden	2		2
<i>Ameiurus nebulosus</i>	Brown bullhead	60		60
<i>Ameiurus calus</i>	White catfish	15	1	16
<i>Lepomis gibbosus</i>	Pumpkinseed		1	1
<i>Lepomis macrochirus</i>	Bluegill			0
<i>Catostomus commersoni</i>	White sucker		5	5
8 Species, Total Abundance =				88

For site #8, there was only 1 adult River Herring caught in April 1999 and none in 2015, White perch were about equal, and Yellow perch were caught in 1999 but not in 2015. No White catfish or Brown bullheads were caught in 1998-99, but 100's were caught in 2014-15. (See Tables 10 & 11).

1998-1999 University of Maryland Study Results						
Table 10: Site #8, Gravelly Run		5/98	4/99	5/99	9/99	
Taxonomic Name	Common Name	Qty	Qty	Qty	Qty	Total
Fishes (vertebrates)						
<i>Alosa pseudoharengus</i>	Alewife		1			1
<i>Morone americana</i>	White perch		4	3		7
<i>Percaflavescens</i>	Yellow perch		1	4	3	8
<i>Anguilla rostrata</i>	American eel	1		1		2
<i>Trinectes maculatus</i>	Hogchoker					0
<i>Ameiurus nebulosus</i>	Brown bullhead					0
<i>Ameiurus calus</i>	White catfish					0
<i>Lepomis gibbosus</i>	Pumpkinseed	1		2		3
<i>Catostomus commersoni</i>	White sucker	1				1
<i>Esox niger</i>	Chain Pickerel	1		1		2
<i>Dorosoma cepedianum</i>	Gizzard Shad			1		1
<i>Notemigonus crysoleucas</i>	Golden Shiner			1		1
<i>Micropterus salmoides</i>	Large Mouth Bass				1	1
10 Species, Total Abundance =						26

GEHR 2014-15 Impact Grant Fish Trawl Survey Final Data Summary						
Site #8, Gravelly Run, 8 Tows		10/7/14	5/1/15	5/4/15	5/7/15	
Taxonomic Name	Common Name	Qty 1T	Qty 3T	Qty 3T	Qty 1T	Total
Table 11 Fishes (vertebrates)						
<i>Alosa pseudoharengus</i>	Alewife					0
<i>Morone americana</i>	White perch	9	1	1		11
<i>Percaflavescens</i>	Yellow perch					0
<i>Anguilla rostrata</i>	American eel					0
<i>Trinectes maculatus</i>	Hogchoker	10	1	1		12
<i>Ameiurus nebulosus</i>	Brown bullhead	200		2		202
<i>Ameiurus calus</i>	White catfish	210	214	110	2	536
<i>Lepomis gibbosus</i>	Pumpkinseed					0
<i>Catostomus commersoni</i>	White sucker					0
4 Species, Total Abundance =						761
	pH			5.62	5.94	
	Conductivity			256	180	
	Temperature			18.9	21.1	

For site #11, there were 20 adult River Herring caught in April 1999 and none in 2015, there was an abundance of White perch in 2014-15, and 100's of White catfish were caught in 2015, but only 1 in 1999. (See Tables 12 & 13).

1998-1999 University of Maryland Study Results				
Site #11, Green Tree Golf Course		4/99	5/99	
Taxonomic Name	Common Name	Qty	Qty	Total
Table 12: Fishes (vertebrates)				
<i>Alosa pseudoharengus</i>	Alewife	20		20
<i>Morone saxatilis</i>	Striped bass		1	1
<i>Morone americana</i>	White perch	1	1	2
<i>Percaflavescens</i>	Yellow perch	3		3
<i>Anguilla rostrata</i>	American eel			0
<i>Trinectes maculatus</i>	Hogchoker			0
<i>Ameiurus calus</i>	White catfish		1	1
<i>Esox niger</i>	Chain Pickerel	1		1
<i>Dorosoma cepedianum</i>	Gizzard Shad		1	1
7 Species, Total Abundance =				29

GEHR 2014-15 Impact Grant Fish Trawl Survey Final Data Summary					
Site #11, Green Tree Golf Course, 3 Tows		10/7/14	10/9/15	5/4/15	
Taxonomic Name	Common Name	Qty 1T	Qty 1T	Qty 1T	Total
Table 13: Fishes (vertebrates)					
<i>Alosa pseudoharengus</i>	Alewife				0
<i>Morone saxatilis</i>	Striped bass				0
<i>Morone americana</i>	White perch	86	24		110
<i>Percaflavescens</i>	Yellow perch	1			1
<i>Anguilla rostrata</i>	American eel		1		1
<i>Trinectes maculatus</i>	Hogchoker		12		12
<i>Ameiurus calus</i>	White catfish	27	450	43	520
5 Species, Total Abundance =					644

For site #12, the 1999 sampling was done in April and May, and the 2014 sampling was done in October. There were 7 adult River Herring caught in April 1999, White perch were about equal, and 165 White catfish were caught in 2014, but none in 1999. A school of Atlantic menhaden was present at Site #12 in May 1999, and 16 Gizzard shad were caught in May 1999. 21 juvenile Black drum were caught at this site in October 2014. (See Tables 14 & 15).

1998-1999 University of Maryland Study Results				
Site #12, Dead Horse Run		4/99	5/99	
Taxonomic Name	Common Name	Qty	Qty	Total
Table 14: Fishes (vertebrates)				
<i>Alosa pseudoharengus</i>	Alewife	7		7
<i>Morone saxatilis</i>	Striped bass	1		1
<i>Morone americana</i>	White perch	5	17	22
<i>Percaflavescens</i>	Yellow perch		1	1
<i>Brevoortia tyrannus</i>	Atlantic menhaden		25	25
<i>Ameiurus calus</i>	White catfish			0
<i>Catostomus commersoni</i>	White sucker		1	1
<i>Pogonias cromis</i>	Black Drum			0
<i>Dorosoma cepedianum</i>	Gizzard Shad	13	3	16
<i>Notemigonus crysoleucas</i>	Golden shiner		1	1
8 Species, Total Abundance =				67

GEHR 2014-15 Impact Grant Fish Survey Final Data		
Site #12, Dead Horse Run, 2 Tows		10/9/14
Taxonomic Name	Common Name	Qty 2T
Table 15: Fishes (vertebrates)		
<i>Alosa pseudoharengus</i>	Alewife	0
<i>Morone saxatilis</i>	Striped bass	0
<i>Morone americana</i>	White perch	34
<i>Percaflavescens</i>	Yellow perch	0
<i>Brevoortia tyrannus</i>	Atlantic menhaden	0
<i>Ameiurus calus</i>	White catfish	165
<i>Catostomus commersoni</i>	White sucker	0
<i>Pogonias cromis</i>	Black Drum	21
3 Species, Total Abundance =		220

For site #13, the 1999 sampling was done in April, and the 2014 sampling was done in October. There were 9 adult River Herring caught in April 1999, 21 White perch were caught in October 2015, but none in 1999. 63 White catfish were caught in 2015, but none in 1999. (See Tables 16 & 17).

1998-1999 University of Maryland Study Results		
Site #13, South River East		4/99
Taxonomic Name	Common Name	Qty
Table 16: Fishes (vertebrates)		
<i>Alosa pseudoharengus</i>	Alewife	9
<i>Morone saxatilis</i>	Striped bass	2
<i>Morone americana</i>	White perch	
<i>Percaflavescens</i>	Yellow perch	1
<i>Bairdiella chrysoura</i>	American silver perch	
<i>Anguilla rostrata</i>	American eel	
<i>Trinectes maculatus</i>	Hogchoker	
<i>Ameiurus calus</i>	White catfish	
<i>Catostomus commersoni</i>	White sucker	1
<i>Pogonias cromis</i>	Black Drum	
4 Species, Total Abundance =		13

GEHR 2014-15 Impact Grant Fish Survey Final Data		
Site #13, South River East, 2 Tows		10/9/14
Taxonomic Name	Common Name	Qty 2T
Table 17: Fishes (vertebrates)		
<i>Alosa pseudoharengus</i>	Alewife	
<i>Morone saxatilis</i>	Striped bass	1
<i>Morone americana</i>	White perch	21
<i>Percaflavescens</i>	Yellow perch	
<i>Bairdiella chrysoura</i>	American silver perch	3
<i>Anguilla rostrata</i>	American eel	2
<i>Trinectes maculatus</i>	Hogchoker	7
<i>Ameiurus calus</i>	White catfish	63
<i>Catostomus commersoni</i>	White sucker	
<i>Pogonias cromis</i>	Black Drum	2
7 Species, Total Abundance =		99

For site #15, the 1999 sampling was done in April, and the 2014 sampling was done in October. There were 2 adult River Herring caught in April 1999, 34 White perch were caught in October 2015, but only 1 in 1999. 117 Hogchokers were caught in 2014. 91 Brown bullhead were caught at site #15 in 2015, but none in 1999. (See Tables 18 & 19).

1998-1999 University of Maryland Study Results		
Site #15, Gibson Creek		4/99
Taxonomic Name	Common Name	Qty
Table 18: Fishes (vertebrates)		
<i>Alosa pseudoharengus</i>	Alewife	2
<i>Morone americana</i>	White perch	1
<i>Percaflavescens</i>	Yellow perch	1
<i>Trinectes maculatus</i>	Hogchoker	
<i>Brevoortia tyrannus</i>	Atlantic menhaden	
<i>Ameiurus nebulosus</i>	Brown bullhead	1
<i>Dorosoma cepedianum</i>	Gizzard Shad	1
5 Species, Total Abundance =		6

GEHR 2014-15 Impact Grant Fish Survey Final Data		
Site #15, Gibson Creek, 3 Tows		10/1/14
Taxonomic Name	Common Name	Qty 3T
Table 19: Fishes (vertebrates)		
<i>Alosa pseudoharengus</i>	Alewife	
<i>Morone americana</i>	White perch	34
<i>Percaflavescens</i>	Yellow perch	
<i>Trinectes maculatus</i>	Hogchoker	117
<i>Brevoortia tyrannus</i>	Atlantic menhaden	1
<i>Ameiurus nebulosus</i>	Brown bullhead	91
5 Species, Total Abundance =		243

In summary for the River Herring, the 2014-15 fisheries trawl survey, including 41 net tows at 9 sites over 8 days, only 1 juvenile River Herring was caught. For the University of Maryland 1998-99 fisheries resource survey which conducted 28 surveys of 168 sites over 2 years, 437 adult River Herring, and 633 juvenile River Herring were caught, measured, and released. The final data for River Herring in the 1998-99 survey is shown in Table 20.

Total Abundance of Alewife collected in the Great Egg Harbor and Tuckahoe Rivers by Month in 1998 and 1999							
Table 20	April	May	June	July	Aug	Sept	Oct
1998 Adults	133	26					
1998 Juveniles			26	71	52	31	106
1999 Adults	188	90					
1999 Juveniles			26	70	92	131	28
Totals	321	116	52	141	144	162	134
437 Adult River Herring				633 Juvenile River Herring			

New Older Data Recently Found

One of the goals of this project was to collect new fisheries data to compare to the 1998-1999 survey data as a baseline from 15 years ago. In addition, outreach to the New Jersey Bureau of Marine Fisheries triggered by this project resulted in the sharing of scanned historical fisheries collection data from 1970 through 1976 archived at the Bureau's office.

In 1970 and 1971 in response to the "Commercial Fisheries Research and Development Act", significant fisheries data were collected and published by NJDEP. The final report was entitled ***"Studies of the Great Egg Harbor River and Bay"***, by John F. McLain, Jr. For this 2 year 3 season survey, 197 trawls were conducted, and 115 seine hauls were conducted, collecting a total of 33,531 specimens representing 67 species.

Then from June 1972 to December 1976, more fisheries data including the Great Egg Harbor River were collected and published by NJDEP. This final report was entitled ***"New Jersey Anadromous Fish Inventory, The Collection of Existing Information and Field Investigation of Anadromous Clupeid Spawning in New Jersey"***, by H.E. Zich.

This 1972-76 project confirmed 133 anadromous clupeid spawning runs in NJ including 14 in the Great Egg Harbor River and its tributaries, and it also confirmed that 28 anadromous clupeid spawning runs in NJ had become extinct by 1976, including 2 shad runs in the Great Egg, 1 in Cedar Swamp Creek and 1 in the Great Egg Harbor River main stem.

Then in 1982-83, NJDEP conducted a search of the Great Egg Harbor River for striped bass production and other fisheries data. The report for this project was entitled, ***"Spring Ichthyoplankton in the Raritan/South and the Great Egg Harbor Rivers, New Jersey"***, by Peter J. Himchak.

Finally in March 2005, NJDEP published a report, ***“Locations of Anadromous American Shad and River Herring During Their Spawning Period in New Jersey’s Freshwaters Including Known Migratory Impediments and Fish Ladders”***, with no author listed. This report listed 23 confirmed spawning runs in the Great Egg Harbor River and its tributaries 10 years ago.

Final Discussions and Conclusions

River Herring Discussion

The 1998-99 survey caught 437 adult and 633 juvenile River Herring compared to 1 juvenile in 2014-15. The data for this survey indicates that there are very few River Herring in the Great Egg Harbor River today. This is far beyond unsustainable. This is the collapse of a species population.

The River Herring fishery is one of the oldest documented fisheries in North America, dating back over 350 years in some areas. Until the late 1960’s, it was exclusively a US inshore fishery. Then in the late 1960’s, distant-water fleets began fishing for River Herring off the Mid-Atlantic coast. The record of commercial fishing landings for River Herring went from an all-time high in the 1970’s to an all-time low in the mid-90’s.

The National Marine Fisheries Service under the Department of Commerce published a Fact Sheet in 2009 designating the River Herring as a federal Species of Concern. Many states completely closed their River Herring fisheries in state waters around that time as they documented crashing populations in many rivers. New Jersey was not one of these states.

In 2009, the Atlantic States Marine Fisheries Commission (ASMFC), a compact of all 15 Atlantic coastal states, implemented an Amendment to the Interstate Fishery Management Plan for Shad and River Herring. The plan requires states to submit fishery management plans that demonstrate the sustainability of River herring runs in order for fisheries on River herring to continue in state waters, or else a moratorium on the harvest of all River herring fisheries in state waters will be imposed effective January 1, 2012.

So on January 1, 2012, the ASMFC made the state of New Jersey close its River Herring and Shad fisheries in state waters because there was no proof of sustainability. It is important to note that New Jersey prosecuted the River Herring fishery for years with no proof of sustainability. It is also important to note that while NJ completely closed the River Herring fishery in state waters, they still left open a 5% River Herring bycatch cap for NJ commercial fishing interests in federal waters.

The following is a list of well-known threats to River Herring: 1-habitat loss due to dam construction and insufficient fish passage opportunities to their spawning grounds, 2-habitat and water quality degradation in critical spawning and nursery habitat, 3-overfishing, 4-significant by-catch/discard mortality in other commercial fisheries, and predation.

Habit loss due to dam construction, insufficient fish passage, and habitat and water quality degradation were not and are not significant adverse impactors to historic River Herring populations on the Great Egg Harbor River. Of the 23 confirmed spawning runs in NJDEP’s 2005 report, 7 have no dam or significant restrictions, and the other 16 have very old dams that were in existence when the river herring runs were large and most of the historical breeding was successful below those dams.

The threat of predation for the River Herring is at the heart of the adverse impacts to the ecosystem from the River Herring's population collapse. The River Herring is a "forage fish", and a keystone species at the bottom of the food chain that needs to be there to be eaten.

According to U.S Fish and Wildlife literature <http://www.fws.gov/northeast/cnefro/herring.html>, a River Herring can produce 45,000-350,000 eggs per season, and River Herring suffer relatively high rates of mortality throughout their life cycles. Less than 1% of the eggs survive early life stages to migrate to the sea as juveniles. Total annual mortality of adults is about 70%. As many as 90% of all adults die annually during, or after, spawning migrations and reproduction.

Not unlike the horseshoe crab that provides an overabundance of its eggs to feed other creatures in the ecosystem, healthy, abundant populations of River Herring were also historically able to provide an overabundance of eggs, juvenile fish, and adults to support a host of other species, and especially birds, on the Great Egg Harbor River.

The disappearance of this abundance of biomass and forage historically provided by the River Herring has left a hole in the ecosystem, and the real cost of this loss to the ecology of the system may never be fully understood. And other species are now required to fill this hole.

In addition to the economic and ecological losses from the collapse of the River Herring populations, there is also a social and cultural loss. Since part of this collapse has occurred within the last 30 years, there are still river and watershed residents who saw and remember their past abundance. But maybe not so in another 30 years.

Several Members of the current Great Egg Harbor River Council have recounted their remembrances of the River Herring at some of the meetings where this issue has been discussed and what actions to take have been considered. One Member recalled as a youth that the River Herring were so abundant that he could go into a river with a pillow case and scoop them up. Another told about going out with his father on his April 16 birthdays and chasing River Herring into trash cans on Gravelly Run.

Other river residents have told similar stories about foul hooking River Herring and White Suckers in South River at 11th St., catching river herring in trash cans, and, as youth, catching river herring and selling them to local hotels and restaurants to be pickled and sold. And there has been a long tradition of catching River Herring by hook and line in the Great Egg Harbor River, and then using them as bait to catch the elusive striped bass, which is not permitted today.

Now that the River Herring population has collapsed and the River Herring fishery is totally closed in state waters due to unsustainable fishing, the question becomes, "How can the River Herring be brought back to their historical role in the ecosystem?" While this does seem like an impossible task given the current state of the fishery, the following actions are already, or need to be, taken:

1. Continue the commercial fishing moratorium for River Herring in state waters indefinitely.
2. Stop the commercial bi-catch of River Herring in federal waters.
3. The National Marine Fisheries Service should list the River Herring as a Threatened Species under the Endangered Species Act to trigger additional protections.

4. The River Herring should be designated by the National Marine Fisheries Service and other fisheries managers as its own stock in the fisheries so that it can have its own management plan and stock assessments.
5. All state and federal fisheries managers need to adopt ecosystem management for all fish species instead of single species management.
6. Provide additional scientific studies to better understand the biology and ecology of River Herring.
7. Invest more funding into habitat protection, water quality protection, fish passage, and dam removal.
8. Designate the River Herring as a priority species in the State Wildlife Action Plan Marine Zone to promote state conservation efforts.

American Shad Discussion

In the 1998-99 survey, 3 American shad appeared in the data tables, and none were collected in 2014-15. As reported earlier in the H.E. Zich 1977 report, previously documented spawning runs of American Shad in Cedar Swamp Creek and the Great Egg Harbor River were determined to be extinct at that time.

It is interesting to note that Zich found documentation that 250,000 shad fry were planted at Mays Landing in the Great Egg Harbor River in 1912 by the U.S. Fish Commission. This data indicates that there once was an American shad run in the Great Egg Harbor River that was attempted to be restored back in 1912 with no success.

This is an example of the past decline of a spawning anadromous fish in the Great Egg Harbor River that happened so long ago that most people alive today know nothing about it.

Spawning populations of American Shad still exist in the Delaware River today, and in 2012 the state closed the American shad fishery everywhere in the state except for the Delaware River.

Atlantic Striped Bass Discussion

6 striped bass were caught in 1998-99, and 3 juvenile striped bass were caught in 2014-15. The presence of striped bass in the system is significant. Atlantic striped bass are anadromous, large, highly sought after game fish and table fish. Atlantic striped bass have been unsustainably overfished, but successful conservation management has brought their populations back. And here in NJ the State Legislature passed a law to prevent commercial fishing of striped bass.

Striped bass have formed the basis of one of the most important fisheries on the Atlantic coast for centuries. Early records recount their abundance as being so great at one time they were used to fertilize fields. However, overfishing and poor environmental conditions lead to the collapse of the fishery in the 1980s. Through the hardship and dedication of both commercial and recreational fishermen, the stock was rebuilt and today's anglers again harvest striped bass in great number.

In the early 1980's, the New Jersey Bureau of Marine Fisheries made substantial contributions to the science and recovery of the striped bass. In 1982-83, NJDEP conducted a search of the Great Egg Harbor River for striped bass production, and determined then that the Chesapeake Bay and the

Delaware and Hudson Rivers are the major spawning grounds for the coastal migratory populations of striped bass, and no spawning was occurring on the Great Egg. This finding was also echoed in the 1998-99 survey.

So in light of the collapse of the River Herring population, the fact that the striped bass recovered from a similar collapse is heartening. However, the recovery of the striped bass is a somewhat fragile one with uncertain sustainability, as there was a call for a 25% decrease in catch this year over last year by ASMFC, because striped bass stocks are not continuing to grow and are declining slightly.

American Eel Discussion

3 American eels were caught in this project, which is unusual given the mesh size of the trawl net and the ability of the eel to squeeze through. However, the American Eel is another important forage fish to the ecology of the Great Egg Harbor River that is at risk of unsustainable fishing practices. American Eels are a unique catadromous fish that lives in fresh water, but breeds in the sea.

Eels are a forage or “prey” fish in the Great Egg Harbor River because predators that eat eels include larger fish like striped bass, gulls, eagles, herons, and osprey. And as a forage fish, robust American eel populations can help fill the ecological void of the River Herring.

According to the International Union for Conservation of Nature (IUCN), the American eel is at very high risk of extinction in the wild. The world population of American eel has dropped 50% in the past several decades, and Asian market demands are sky-high because the 2011 tsunami in Japan wiped out eel stocks and Europe banned eel exports a year later. Consequently there is a big shift from the European eel to the American eel to meet demand in Asia. Fortunately New Jersey moved to protect the export of American eels to Asia years ago by establishing a 9 inch size limit for recreational and commercial take, which protects the smaller younger “elvers” in NJ from being caught and exported to Asia.

But overall conservation efforts will need to be extraordinary to bring the global eel population back to health. The American eel faces many threats—fishing, dams, water pollution, parasites, and climate change makes the picture even more complicated since it could alter ocean currents. The American eel depends on consistent currents to carry its young from birthing grounds in the Sargasso Sea to inland freshwater habitats like the Great Egg Harbor River where eels mature. Scientists have little idea what might happen to the eel when ocean currents change.

The current fishing rules for American eel in NJ and the Great Egg Harbor River for recreational fishing are a 9 inch size limit, a 25 fish daily creel limit, and the use of two miniature fykes or pots without a commercial permit. For commercial eel harvest, there is a 9 inch size restriction, but the creel limit is unspecified with a miniature fyke/pot license.

Given the past unsustainable overfishing of River Herring, striped bass and other fish because there was no requirement for a sustainable fisheries management plan to prevent over fishing, NJDEP should move to adopt a sustainable ecosystem fisheries management plan for the American eel as a forage fish. If there is insufficient data and information to guarantee sustainability for the American eel in NJ, then the American eel fishery should be closed in state waters like the River Herring fishery.

As an alternative action plan to protect the fisheries forage base of the Great Egg Harbor River, its distinction as a federally designated Wild and Scenic river could promote it to the list of rivers for which the sale of eels taken from is prohibited. And at the very least, the daily creel limit could be significantly reduced to further protect the long term sustainability of the American eel.

Catfish Discussion

75% of all finfish caught in this 2014-15 project were catfish. 1,401 White Catfish were caught, and 363 Brown Bullheads were caught. In comparison, the 1998-99 survey caught 11 brown bullheads, and 60 white catfish. Given negligible catch disparity due to different collection methods (catfish have swim bladders, so would have been successfully caught through electroshocking) the difference in the catfish caught between the two surveys is extraordinary.

Based on the numbers, it seems that the catfish - the white catfish in particular, which are more freshwater oriented - have moved into the ecological hole left by the collapse of the River Herring population over the last 15 years. While this hypothesis may or may not have any validity, catfish are considered both prey and predators in the aquatic ecosystem, and can function as forage or prey for birds, fish, and other wildlife. And they are very abundant in the Great Egg Harbor River now.

Given the potential value of catfish in the Great Egg Harbor River to the food chain and the ecosystem, the continued sustainability of their populations may be more important to the ecology of the river than previously considered. Protective fishing rules and regulations should be reevaluated.

Currently for recreational fishing rules, catfish are lumped into a category called "Sunfish and all other species with no specified creel limits", and the take is 25 per day combined with a number of other species with no minimum size statewide. There are no size or bag limits for commercial fishing of catfish, and the only reference to catfish taking is in the miniature fyke/pot license and parallel net license. While there may be no large or even small commercial market demands for catfish from the Great Egg Harbor River today, there are currently no protective regulations in place to prevent the future unsustainable fishing of catfish in NJ.

White and Yellow Perch Discussion

The 1998-99 survey caught 817 white perch and 339 yellow perch, and the 2014-15 survey caught 258 white perch and 4 yellow perch. While both species were present, there were far more perch 15 years ago than today through this data comparison.

Like the River Herring fishery used to be before it was closed, perch fishing is open to potentially unsustainable fisheries management rules and regulations. Like the catfish and all other species with no creel limits under the recreational regulations, there are no size limits on perch and there is only a combined creel limit of 25 fish per day.

The only reference to perch in the commercial regulations is under the Limited Entry Programs, where it specifies a Gill Net Mesh Exemption Permit is available to allow fishermen to pursue their small mesh traditional fishery for white perch and other species at a time when larger mesh gill nets are required to protect weakfish stocks. So it appears from the 2015 Commercial Fishing Regulations for New Jersey that there are no size or creel limits for the commercial take of perch in state waters.

Observations from the Great Egg Harbor River Council's 41 platform Osprey colony regarding fish use by Osprey, perch and catfish appear to be the main forage fish used now. Given that perch are a forage fish, and that River Herring are no longer available as a forage fish on the Great Egg Harbor River, the NJ Bureau of Fisheries Management should create sustainable fishing specifications for all forage species in state waters.

Final Conclusions

The goal of the 2014 National Park Foundation Impact Grant project was to conduct scientific fisheries sampling and data collection combined with service-based student learning to help determine if fisheries resources in the Great Egg Harbor River and Estuary, a designated unit of the National Park System and a component of the Wild and Scenic River System, are adequate to provide a multiple-species, sustainable ecosystem. The simple answer is no, they are not.

The significant absence of River Herring, and current conservation concerns for River Herring and other species like striped bass, American eel, catfish and perch, are all cause for serious concerns about the sustainability of the Great Egg Harbor River ecosystem for fish, birds, and other wildlife.

Historically, fish species have been managed on a single species basis, and the interdependence and connection of these single species to the surrounding ecosystem has not been considered. Also historically, ecosystem values for forage species like River Herring, American eel, catfish, and perch have been substantially disregarded or ignored, and these species have not been protected for either their own sustainability or ecosystem sustainability.

Given all the ecosystem threats today, including climate change, state and federal fisheries managers need to be far more protective of natural resources, and adopt ecosystem management for all fish species instead of single species management. The long term sustainability of existing ecosystems needs to be the focus.

This year the Mid-Atlantic Fishery Management Council accepted a Forage Fish White Paper with a comprehensive list of forage fish species that could possibly be exploited in the future, and took action to close all potential new fisheries for commercial exploitation until sustainable fisheries management plans were developed first to enable adequate controls.

Based on the example of the unsustainable rules and regulations for River Herring and the subsequent collapse of that fishery, The NJ Bureau of Fisheries Management should consider a more proactive approach for the protection of all species in state waters with no specified creel limits by creating sustainable specifications for all forage species in state waters.

Thank you again to the National Park Foundation and Subaru of America for their support to enable the Great Egg Harbor River Council to collect this important data and put it to work to better protect the Outstandingly Remarkable Values of the Great Egg Harbor National Scenic and Recreational River.

Press Release, Press Articles, Awards and Correspondence

The Great Egg Harbor River Council sent a formal press release about the Impact Grant Project to several news agencies, including to 3 different reporters at the Press of Atlantic City.

While it was difficult to get the press interested in this “good news” project grant for the area, we were able to get press coverage for two of the 8 trips.

On October 10, 2014, Captain Koenke was able to get the Press of AC fish reporter Mike Shepherd from “Shep on Fishing” to accompany us for a full 8 hour trip up the river and back from Somers Point. Shep not only wrote a great story published on October 10, 2014 about the project, but he also published one of our pictures, and invited the River Administrator and River Council President Greg Gregory to appear on his early morning radio show on November 1, 2014 to talk about the project and the river.

Then Reporter Laura Stetser from The Current came to interview the return of the May 7, 2015 expedition at Shady River Marina. She conducted a number of separate interviews, took a group picture, and then did considerable research of the fisheries issues and published a very comprehensive story about the project on May 14, 2015.

Later on June 9, 2015, the River Administrator was invited to a Great Egg Harbor Township School Board meeting where he was presented with a plaque recognizing that 1,000 students have participated in the outdoor classroom program on the river since the Great Egg Harbor River Council rescued the project from funding cuts in 2010.

Finally, the Great Egg Harbor Schools Superintendent Dr. Scott McCartney sent a letter on July 16, 2015, recognizing and thanking the National Park Foundation, Subaru, the National Park Service, and the Great Egg Harbor River Council for the \$22,600 2014 Impact Grant.

The following documents are attached for review:

September 29, 2014	The Great Egg Harbor River Impact Grant Press Release
October 10, 2014	“Seventh-graders and columnist spend a day learning on the river”
May 14, 2015	“Floating classroom program buoyed by community support”
June 9, 2015	“Fernwood Avenue Middle School Recognizes Watershed Fred”
July 16, 2015	Letter of Appreciation from Egg Harbor Schools Superintendent



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FOR IMMEDIATE RELEASE

The Great Egg Harbor National Scenic and Recreational River Receives \$22,600 2014 Impact Grant from the National Park Foundation

Newtonville, NJ (September 29, 2014) – The Great Egg Harbor National Scenic and Recreational River is one of 23 national parks selected to receive a 2014 [Impact Grant](#) from the [National Park Foundation](#), the official charity of America's national parks. The project will conduct scientific fisheries sampling and data collection combined with service-based student learning to help determine if fisheries resources in the Great Egg Harbor River and Estuary, a designated unit of the NPS, are adequate to provide a multiple-species, sustainable ecosystem.

Now in its seventh year, the Impact Grants program provides national parks with the critical financial support they need to transform innovative, yet underfunded, ideas into successful in-park programs and initiatives.

"Through our Impact Grants, we will help make a profound difference in our national parks by providing much-needed funding for projects that support habitat restoration, wildlife protection, and conservation research," said Neil Mulholland, President and CEO of the National Park Foundation.

This project will conduct eight scientific fisheries resources trawl surveys within the Great Egg Harbor Estuary by collecting fish species and abundance data, as well as new water quality data. After the collection of this new data, it will be compared to historic fisheries data collected in 1998 and 1999, historic bird species data collected for 10 years from 2004 to 2013, and Egg Harbor Township Schools trawl survey data collected since 2010. Then a final report offering a comparison and evaluation of future ecosystem sustainability for birds and fish in the Great Egg Harbor River estuary will be published, presented, and distributed. A primary component of the project will be a serviced-based learning experience for approximately 240 7th grade students. 30 students and three teachers will participate in each of the eight trawling cruises as citizen scientists who will assist with the data collection under the supervision of two River Council staff and one scientist from Princeton Hydro, Inc.

"This National Park Foundation Grant will help the Great Egg Harbor River Council build on an existing education and outreach program to not only educate and bring more visitors to the Wild and Scenic Great Egg, but also to investigate the health of the fisheries resources, one of the outstanding National resources values that motivated Congress to designate 129 miles into the National Wild and Scenic River System in 1992," said Fred Akers, Great Egg Harbor River Administrator.

The 2014 Impact Grants recipients are:

- Bryce Canyon National Park (UT)
- Capitol Reef National Park (UT)
- Congaree National Park (SC)
- Coronado National Memorial (AZ)
- Crater Lake National Park (OR)
- Cumberland Gap National Historical Park (KY,TN,VA)
- Dinosaur National Monument (CO,UT)
- El Malpais & El Morro National Monuments (NM)
- Fire Island National Seashore (NY)
- Gateway National Recreation Area (NY, NJ)
- George Washington Birthplace National Monument (VA)
- Great Egg Harbor National Scenic & Recreational River (NJ)
- Great Smoky Mountains National Park (NC,TN)
- Guadalupe Mountains National Park (TX)
- Hagerman Fossil Beds National Monument (ID)
- Hawai'i Volcanoes National Park (HI)
- Little River Canyon National Preserve (AL)
- Mammoth Cave National Park (KY)
- Manassas National Battlefield Park (VA)
- National Park Service RTCA Florida Field Office (FL)
- Rocky Mountain National Park (CO)
- Wupatki National Monument (AZ)
- Yosemite National Park (CA)

The 2014 Impact Grants were made possible, in large part, through the support of Disney and [Subaru of America](#).

A listing of these parks and their Impact Grants project descriptions can be found on the National Park Foundation [website](#).

For more information on the National Park Foundation and how to support and protect America's national parks, please visit www.nationalparks.org. For more information on the National Park Service, please visit www.nps.gov.

ABOUT THE NATIONAL PARK SERVICE

More than 20,000 National Park Service employees care for America's 401 national parks and work with communities across the nation to help preserve local history and create close-to-home recreational opportunities. Learn more at: www.nps.gov.

ABOUT THE NATIONAL PARK FOUNDATION

The National Park Foundation is the official charity of America's national parks and nonprofit partner to the National Park Service. Chartered by Congress in 1967, the National Park Foundation raises private funds to help PROTECT more than 84 million acres of national parks through critical conservation and preservation efforts, CONNECT all Americans with their incomparable natural landscapes, vibrant culture and rich history, and INSPIRE the next generation of park stewards. Find out more and become a part of the national park community at www.nationalparks.org.

Seventh-graders (and columnist) spend a day learning on the river

http://www.pressofatlanticcity.com/shorecast/shep-on-fishing-seventh-graders-and-columnist-spend-a-day/article_6014a0a4-4b17-5e16-93da-1a3717dbf646.html

Posted: Friday, October 10, 2014

By Mike Shepherd

"Can we go again?"

That was what one of the students from Fernwood Avenue Middle School in Egg Harbor Township said near the end of the science class hands-on trawl that captured hundreds of fish living in Great Egg Harbor River.



The trip involved 30 seventh-graders under the able guidance of teachers **Jim Thoms** and **Stephanie Oster**. All of the young people on board the Duke-O-Fluke pontoon party boat Thursday with Capt. **Brook Koeneke** were excited to see what the trawls revealed when the net was hauled on board.

Capt. Brook trailed the net off the bow of the boat while running the boat in reverse. He's done it numerous times with a mate. They made five hauls.

Each time, the kids crowded around to see what the net brought on board. The first one revealed 131 white catfish of varying sizes, 49 hogchokers, 15 small black drumfish, 14 white perch and one blueclaw crab.

Thoms described each of the species for the students and another fascinated observer getting an education, Hogchokers are a small flatfish similar to flounder. Those captured Thursday were a few inches long.

The trawls were taken at different locations from just downriver of Shady River Marina, not far from Mays Landing to the power lines. Each one had a species that added to the variety. Two eels, a baby striped bass and a minuscule white-fingered crab joined the club in the second haul with 17 white perch, 23 white catfish and seven hogchokers. Three silver perch showed up in the third haul, along with four white perch, 40 white catfish and two baby black drum. The fourth gathering contributed a baby weakfish to list with 20 white perch, 10 silver perch, six black drum, 24 white catfish and a sizeable blueclaw.

When the final haul emerged from the water, somebody yelled "whoa!" because it had the most fish of the day, including probably a hundred white catfish.

All were returned to the water alive and swimming.

River herring

The purpose of these outings is to monitor the presence of river herring and water quality as part of the National Park Foundation/Subaru grant received this year. There were none Thursday, but Thoms said the last trip on the Duke captured river herring. The program involves eight hauls, four in the spring and four in October, and will get about 300 seventh-grade students at Fernwood out on the river throughout the year. Thoms has been guiding these eco-tours since 2005.

Just as interesting to some was identifying 14 bird species, including at least a dozen bald eagles. And the indications from the data the kids were compiling is that the water quality of the Great Egg Harbor River is very healthy.

The kids seemed to appreciate the experience, and not just because they got out of class. They were focused and intense, enjoying a gorgeous day on the river. The interaction among them while compiling and comparing the data was great.

Student **Gabe Soper** said he thought it was great "seeing something we don't usually see." He is aware of pollution. The young man said 3 percent of the world's water can be used for consumption. "I pay attention in science class," he said.

Eva Lee Migliore liked testing the water with samples taken at different locations on the river. "Really cool," she said.

Burak Cimen appreciated the trip. "It was out of the ordinary. We can't go on a boat every day for science."

And, he said, "I never saw a catfish with my own eyes."

The students arrived at Shady River Marina by bus at 9 a.m. and were headed back to school by 1:30 p.m.

The 12- and 13-year-old students compiled data while aboard the Duke listing the different species of wildlife, water quality, water temperatures and weather conditions. This information will be collected by students back in the classroom and compared to other trawls that are part of the Catawba Program at the school.

The Catawba Program was founded in 2000 by **Dave Crawford** as the Adopt-a-Stream Program, Thoms said. It is administered by the Great Egg Harbor River Council. Administrator **Fred Akers** and **Lynn Maun**, education and outreach coordinator, were on board representing the Council, which has 12 towns participating.

'Floating classroom' program buoyed by community support

http://www.shorennews today.com/egg_harbor_township/floating-classroom-program-buoyed-by-community-support/article_d5108598-fa3e-11e4-aa8e-73d21e09c044.html

Posted on May 14, 2015 by [Laura Stetser](#)

EGG HARBOR TOWNSHIP – The Fernwood Avenue Middle School students were turned into real scientists on Thursday, May 7 as they embarked on a five-hour ecological investigation



Fernwood Avenue seventh-grade students gather at the conclusion of their five-hour trip on the Great Egg Harbor River.

along the Great Egg Harbor River, stopping to make observations, document aquatic life and measure water quality.

The trip, made possible through a Great Egg Harbor 2014 Impact Grant, obtained by the Great Egg Harbor Watershed Association and the Great Egg Harbor Scenic and Recreational River Council, was designed to put classroom lessons to work as well as to collect usable data on the health of the waterway.

The 30 seventh-grade students aboard were charged with measuring water quality, counting fish and invertebrates as well as trying to locate river herring, a species of concern.

Oliva Shafer, 13, said she was hoping to find more diversity in the fish they picked up in the trawl net dragged behind the boat, but she reported seeing mostly catfish.

“There’s not a lot diversity right now,” Shafer said.

The state banned the catch and sale of river herring, which is used mostly as bait, in 2012 after it failed to provide proof that fishery operations for the species were sustainable.

The regulations were put in place due to concerns about the significant decline of the river herring, which travels upstream to spawn in freshwater. The exact cause for the declines remains uncertain, but according to the New Jersey Department of Environmental Protection, Division of Fish and Wildlife, numerous factors such as loss of spawning habitat, impediments to fish passage, water quality degradation and fishing all likely played a role.

Shafer was also part of a group of students who tested for the presence of the pollutant phosphate of which there was none.

Her classmate Malini Gulati, age 12, was charged with testing for nitrates in the water, which are left from fertilizers mixing into the waterways.

“We didn’t find any in the water samples, so that was really good news,” Gulati said.

The data collected will be sent to the New Jersey Bureau of Marine Fisheries, according to Fred Akers, the administrator of the watershed association that funds the trip.

“The data sent to the state makes this a ‘service based learning’ experience for the students and the school,” Akers said.

The five-hour trip takes the students up the Great Egg Harbor River aboard the Duke O’ Fluke pontoon boat, which has been routinely commissioned for the trip since 2007.

Brook Koeneké of North Wildwood, the owner of Duke o’ Fluke, said he takes other local schools on fishing trips and ecological tours, but this is the only one of its kind in which the students take an active role in researching and collecting data on the health of the waterway.

“This is a very worthwhile program,” Koeneké said. “The kids get a lot out of it and I think it is very important. This program does not deserve to be swept under the rug. This is a quality program.”

The boat typically docks in Somers Point, and trips in previous years took the students around

the bay. But Akers said this year the mission was to collect information from the river, which presented both time and money challenges.

“We found that it would take an additional three hours added to the five-hour trawl survey time to work the trawl surveys way up the river in the freshwater tidal habitats,” he explained, adding that the additional distance would have added 50 percent to the cost.

The Shady River Marina on the river just on the boarder of Egg Harbor and Hamilton townships was identified as the solution. Akers said the marina had what it needed, a good location, adequate docking for the boat, parking spaces for the school bus and a willing owner.

Its new owner, Keith Squire, who purchased the marina last year, said he was happy to support the program by offering its use at no charge.

“These kids are making memories out there. We were happy to help. For some of them, it’s their first boat trip. We like to be part of that,” Squire said. “It’s important that they get to see that work can be fulfilling if you do what you love.”

Fernwood Avenue Middle School science teacher Jim Thoms said the community support is instrumental in keeping this program afloat year after year, even in years of budget shortfalls. His class was joined by teacher Stephanie Oster’s class for the trip.

“This is truly a community project,” Thoms said. “Brook works with us to make sure it happens each year. He’s not making a ton of money on it, but he makes sure the kids get out there.”

A total of 300 students have been able to take part in the waterway lessons through a series of 10 trips planned from October through June.

“It combines ecology, environmental science and STEM,” which stands for science, technology, engineering and math, Thoms said.

These trips allow the students to put what they learn from the classroom into real-life work, he said, adding that the trip on May 7 enabled the students to test out their SeaPerch vehicle, a remotely operated underwater submersible that was outfitted with a camera.

For some students, like Timothy Medina, 13, the trip marked their very first time on a boat.

“At first, I was a bit worrisome, but after about 10 minutes I felt great,” Medina said, adding that the hands-on learning helped take his mind off of his nervousness. “The environmental activities we did were great. We got to see all of the organisms in the water, and I really enjoyed myself.”

laura.stetser@catamaranmedia.com

FERNWOOD AVENUE
MIDDLE SCHOOL

Recognizes

Fred Akers - *Watershed Fred*



The thousand students from Fernwood Avenue
Middle School that have participated and
experienced first hand your hard work and effort
would like to extend a grateful and appreciative

Thank You

for your endless support in helping create
and sustain our outdoor classroom on the water

~ 2015 ~

Egg Harbor Township Schools

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July 16, 2015

Mr. Gregory Gregory, Chairman, Great Egg Harbor National Scenic and Recreational River Council
Mr. Fred Akers, Administrator, Great Egg Harbor National Scenic and Recreational River Council
Mr. Richard Coe, Great Egg Harbor National Scenic and Recreational River Council
Mr. Paul Kenney, National Park Service
C/o Great Egg Harbor National Scenic and Recreational River Council
PO Box 109
Newtonville, NJ 08346

Dear Mr. Gregory, Mr. Akers, Mr. Coe, Mr. Kenney, and Members of the River Council:

On behalf of the Egg Harbor Township School District, I want to express my sincere appreciation for the very generous Impact Grant of \$22,600 from the National Park Foundation and Subaru to the Great Egg Harbor River Council for our Fernwood Avenue Middle School *Saltwater Expeditions* program.

This donation made a huge impact on 240 Egg Harbor Township youth by enabling them to experience first-hand the natural wonder of the Great Egg Harbor National and Scenic Recreational River aboard the Duke O' Fluke eco-tour and fishing vessel.

The Great Egg Harbor River is not only our namesake, it is the jewel of Egg Harbor Township and the pride of our community! Since 2007, Fernwood Avenue Middle School Teacher Jim Thoms and his students have been addressing the critical needs of the 'Great Egg' by testing the water's quality and clarity, oxygen levels, temperature changes, pH levels and conductivity. During the expeditions, students also collect surface and bottom samples, bio-survey sea-life organisms caught using seine nets, create service-learning lesson plans, and report their findings to the Marine Fisheries Administration Offices, Division of Fish and Wildlife in Trenton.

Thank you for your generosity, the confidence you have continued to show for Mr. Thoms and the Egg Harbor Township School District as a whole, and for seeing the incredible value of these *Saltwater Expeditions*. In this time of fiscal crisis in public education, it is only through the generosity of organizations like yours that our students are able to continue to experience unique outdoor learning adventures.

Very truly yours,


Scott McCartney, Ed.D.
Superintendent of Schools

Believe and Achieve!

New Jersey Department of Education Star Schools: Swift Elementary School 2000 and Eagle Academy 2003
New Jersey Department of Education Best Practices:
High School 1993, Middle School 2002, Davenport School 2001 & 2003, and Swift School 2005
Alder Avenue Middle School, New Jersey and United States Department of Education Green Ribbon Award, 2012

National Park Foundation 2014 Impact Grant

Great Egg Harbor National Scenic and Recreational River

Courtesy of Subaru America

Final Report Photo Gallery

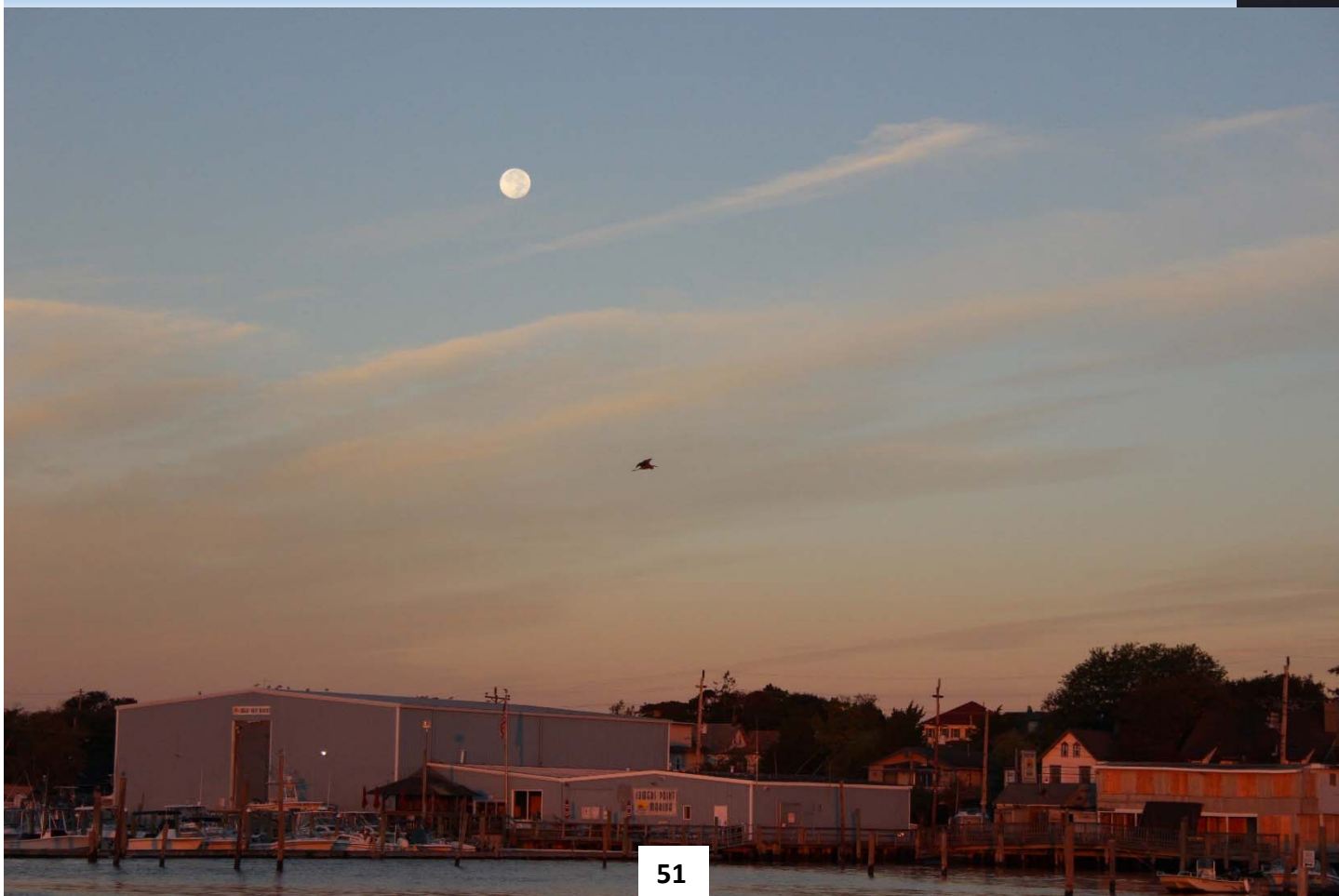


P13: Boarding Duke-O-Fluke at Shady River Marina 5/1/15



P14: Sun rising from Duke-O-Fluke docked in Somers Point 10/9/14

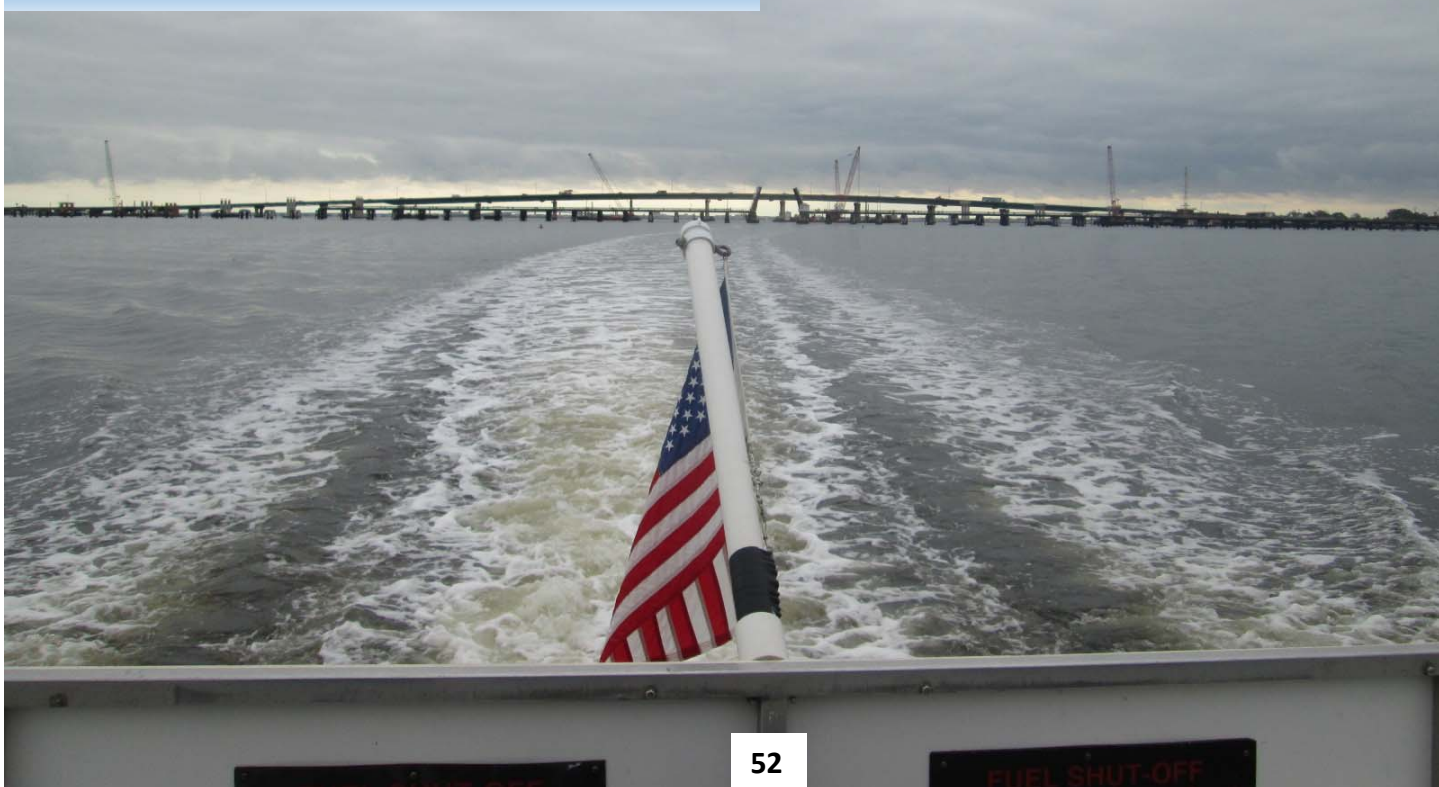
P15: Moon setting from Duke-O-Fluke docked in Somers Point with Great Blue Heron 10/9/14





P16: Duke-O-Fluke in Somers Point getting ready to depart 10/3/14

P17: Heading up river on the Duke-O-Fluke 10/3/14





P18: Bald Eagle near Thompson Marine 10/1/14

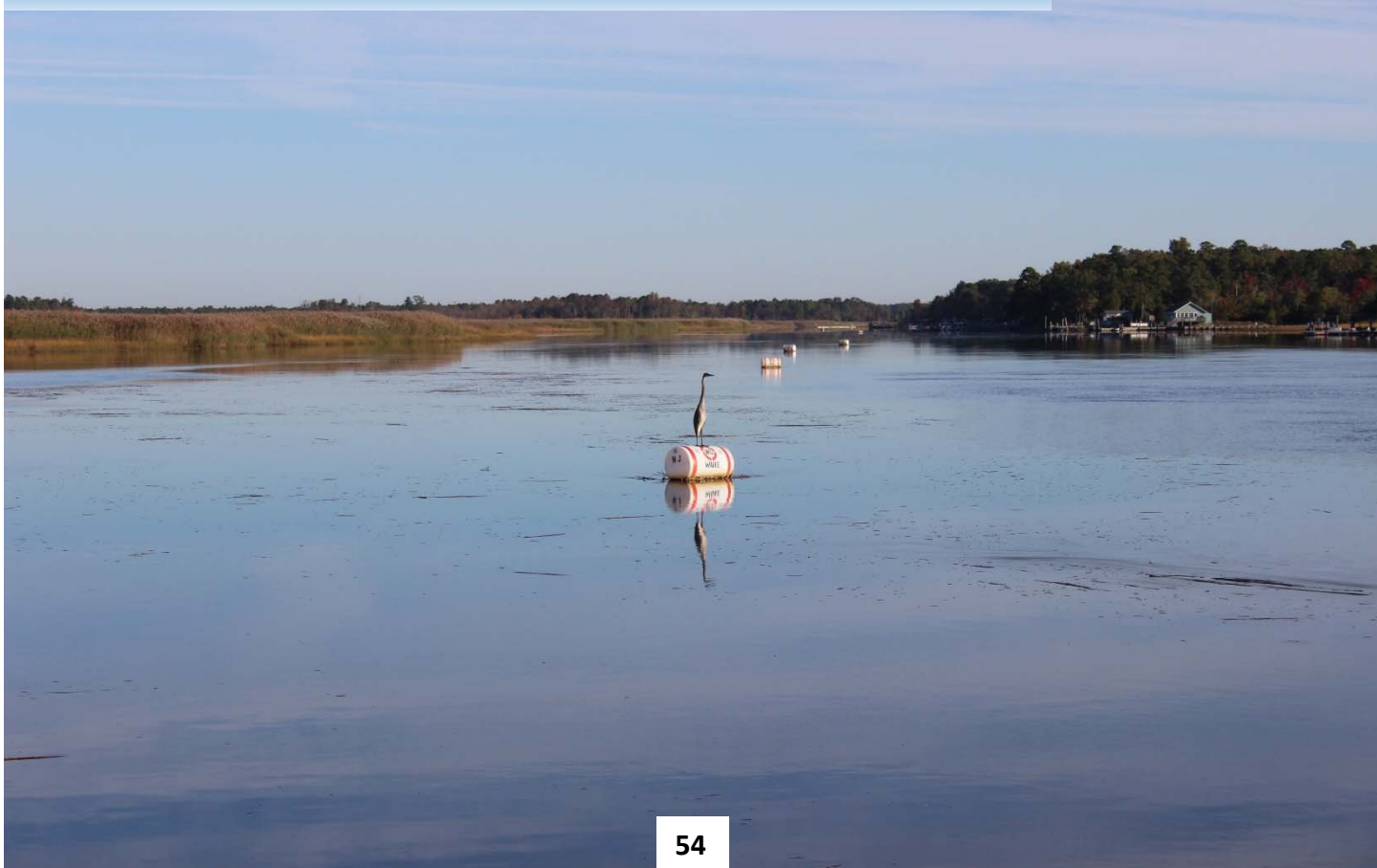
P19: Bald Eagle in bankside maritime forest 10/1/14





P20: Approaching Shady River Marina upriver 10/9/14

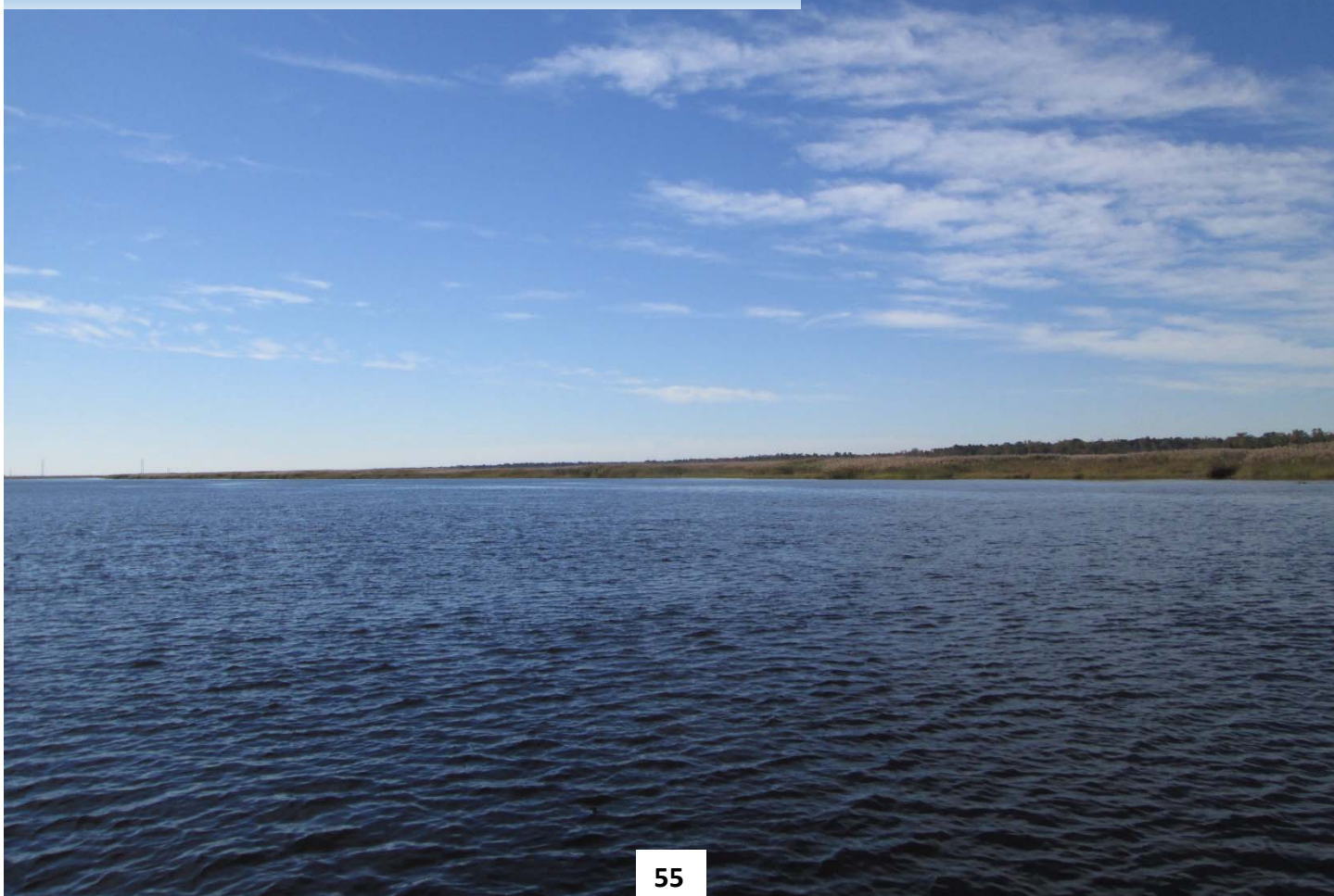
P21: Looking upstream of Shady River Marina and Great Blue Heron 10/9/14

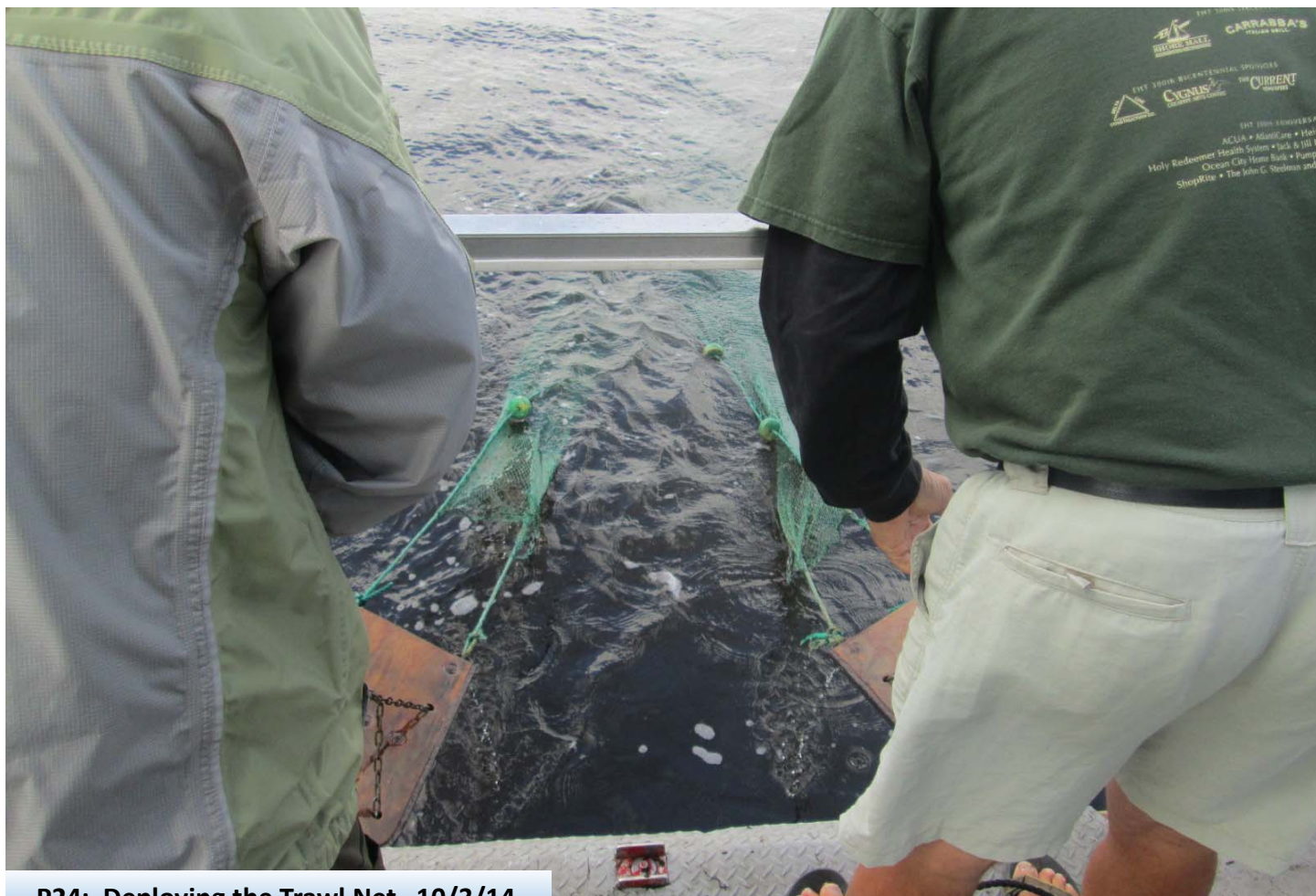




P22: Osprey near Lakes Creek 5/7/15

P23: Scenic Expanse of Great Egg Harbor Estuary 10/9/14







P26: Retrieving the Trawl Net 10/9/14

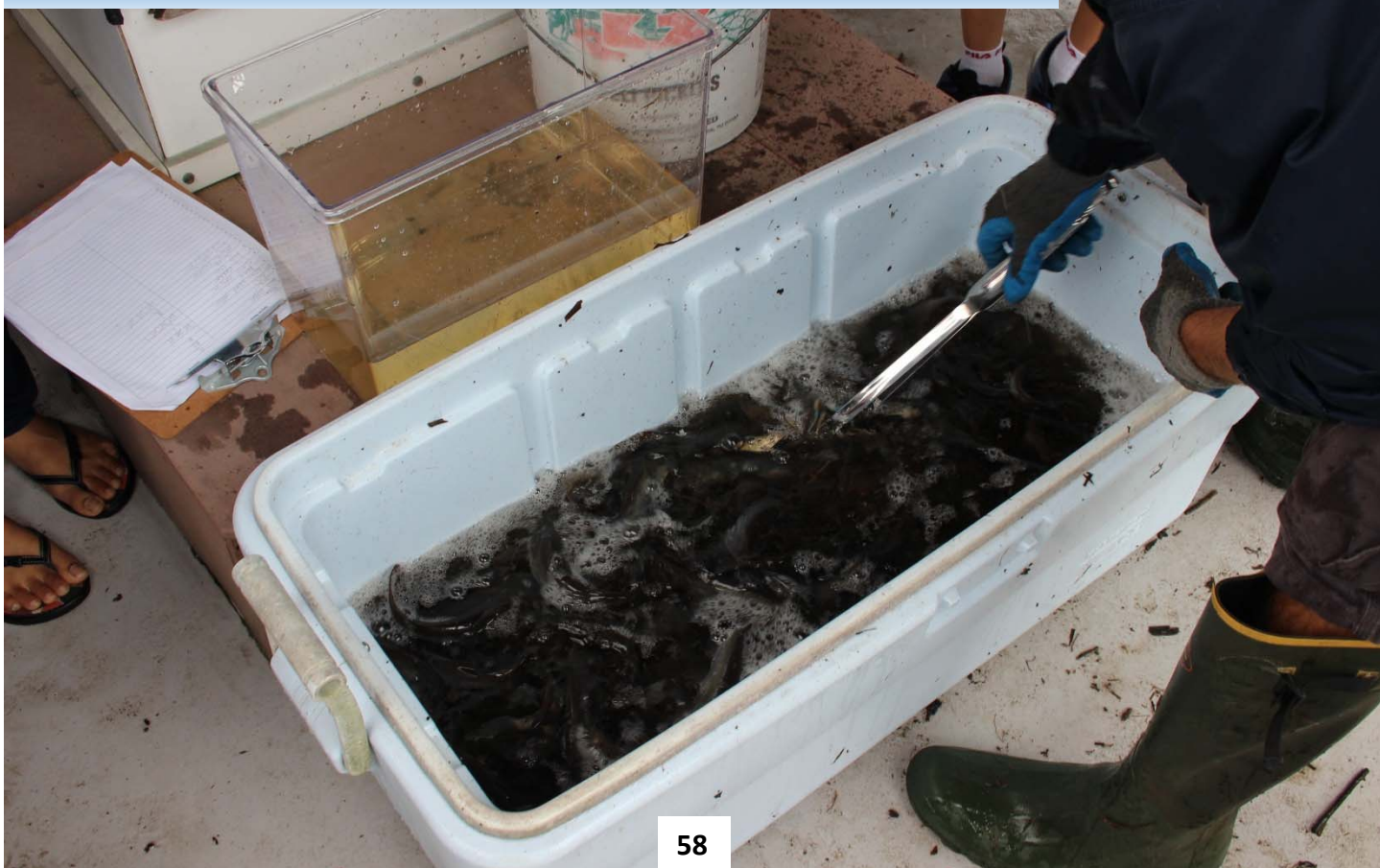
P27: Landing a Big Catch 10/9/14





P28: Sorting, Counting, and Releasing a Very Big Catch on the Deck 10/9/14

P29 Sorting and Counting a Big Catch in the Holding Tank 10/9/14





P30 Youth Engaged in Viewing the Catch 10/1/14

P31 Youth Engaged in Viewing the Catch 10/3/14





P32 Youth Engaged in Viewing the Catch 10/9/14

P33 Youth Engaged in Viewing the Catch 10/9/14





P34 Youth Touching a Fish 10/9/14

P35 Youth Touching a Fish 10/7/14





P36 Jim Thoms from Fernwood Middle School Holding Large White Cat Fish 10/9/14

P37 Clay Emerson from Princeton Hydro Holding Large White Cat Fish 10/7/14





P38 Only 1 River Herring Caught 10/7/14

P39 River Herring in Observation Tank 10/7/14





P40 American Eel and Catfish in Holding Tank 10/9/14

P41 Pumpkin Seed 10/7/14





P42 Hog Choker 6/3/14

P43 Shrimp 10/1/14





P44 White Perch 10/3/14



P45 Black Drum 10/3/14



P46 White Sucker 5/1/15

P47 Black Crappie 5/7/15





P48 Fernwood School Students Getting Off Bus at Shady River Marina 5/4/15

P49 Fernwood School Students Pose at Shady River Marina 5/7/15



Video Clips Great Egg Harbor 2014 Impact Grant

- 1 Fernwood Students Boarding the Duke 10-1-14 – 1:12 minutes.**
- 2 Hauling in the trawl net 10-3-14 – 2:32 minutes.**
- 3 Presenting a Blue Claw Crab 10-1-14 – 0:39 minutes.**
- 4 Checking the Catch 10-1-14 – 0:13 minutes.**
- 5 Recording the Catch 10-3-14 – 0:32 minutes.**
- 6 Recording Data 10-3-14 – 1:21 minutes.**
- 7 Touching a Shrimp 10-3-14 – 0:31 minutes.**
- 8 Hauling the Net 10-9-14 – 1:34 minutes.**
- 9 Sorting, Counting, and Releasing the Catch 10-7-14 – 0:44 minutes.**
- 10 Trawl Net Marine Debris 10-3-14 – 2:26 minutes.**
- 11 Bald Eagle 10-9-14 – 0:11 minutes.**