Warm Springs National Fish Hatchery

Annual Report FY-2016

U.S. Fish and Wildlife Service
5308 Spring Street
Warm Springs, GA 31830

_Carlos Echevarria_____ _1/30/17____
Project Leader Date

Gulf Coast Striped Bass Restoration

Warm Springs NFH distributed Gulf coast striped bass fingerlings in support of restoration objectives set for the species within several river basins in the Southeast. Gulf coast striped bass population had declined significantly due to loss of habitat, including blocked access to historical spawning areas and summer thermal refuges and to water quality degradation. As the need arose for conservation measures, agency directors and commissioners from Florida, Georgia, Alabama, and the U.S. Fish and Wildlife Service signed a Cooperative Agreement in 1987, to establish by mutual consensus the restoration of striped bass in the Apalachicola-Chattahoochee-Flint (ACF) river system. The goal of the agreement was "to restore a self-sustaining stock of striped bass to the maximum extent possible.

ACF Gulf Striped Bass. Credit: USFWS

Preparing for the striped bass season, Josh Simmons and Carlos Echevarria attended Georgia Department of Natural Resources' Warm Water Hatchery meeting February 1st, at the Go Fish Education Center, Perry, GA. They then attended the Southeastern states Morone meeting held at the same location on February 2nd and 3rd. The committee participants reviewed 2015 restoration efforts and set goals for the 2016 production cycle.

While production ponds were empty during the winter, they were seeded with rye grass. Air diffusers utilized to provide supplementary aeration during the culture season, were also cleaned, pressure washed and stored until they were reinstalled in the ponds. Ponds scheduled to produce fingerling striped bass were made ready in preparation for filling with water in early April. Sediment was removed from in and around harvesting basins of the 12 ponds typically used for producing striped bass.

Working in cooperation with our state and federal partners, fry were received, stocked into ponds, reared, harvested and distributed between April and May 2016. A combined total of 948,000 five to seven day old fry were received in good condition from Welaka NFH, FL and Marion State Fish Hatchery, AL on April 18 and April 21.

Twelve ponds totaling 6.7 surface acres were stocked at rates ranging from 100,000 to 180,000 fry per surface acre. Following 29 to 33 days of culture, all ponds were harvested and distributed. The average rate of return for the production ponds was 30%, equaling 41,066 fish per surface acre and 12.64 lbs. per acre. Striped bass are no longer marked with OTC for assessment purposes. However, genetic markers are now being used which eliminates handling stress, marking mortalities, and detection errors associated with the use of OTC. A total of 275,142 Gulf coast striped bass, weighing 84.7 pounds (average 3,248 fish per pound) were distributed to multiple Georgia reservoirs within the ACF river basin in support of the restoration objectives set for the species.

Date	Distribution Site	River Basin	Number	Weight (lbs.)
5/18/2016	Lake Seminole at Faceville Landing, GA	ACF Basin	106,711 fish	24.3
5/19/2016	Bartlett's Ferry / Lake Harding, GA	ACF Basin	58,500 fish	16.1
5/20/2016	Lake Blackshear at Veterans Park, GA	ACF Basin	15,850 fish	2.7
5/24/2016	Lake Oliver at Lake Oliver Landing, GA	ACF Basin	10,870 fish	1.9
5/24/2016	Goat Rock Reservoir at Goat Rock Landing, GA	ACF Basin	4,809 fish	7.2
5/25/2016	Lake Blackshear at Veterans Park, GA	ACF Basin	26,312 fish	10.4
5/25/2016	Lake Seminole at Faceville Landing, GA	ACF Basin	52,090 fish	22.1
		Totals	**275,142 fish**	**84.7 lbs.**

Lake Sturgeon Reintroduction and Restoration Program

Warm Springs NFH works cooperatively with numerous state and federal partners to rear and distribute lake sturgeon. The hatchery has been involved, since 1998, with lake sturgeon production to improve culture techniques, feeding, fish health, habitat assessment, and telemetry studies.

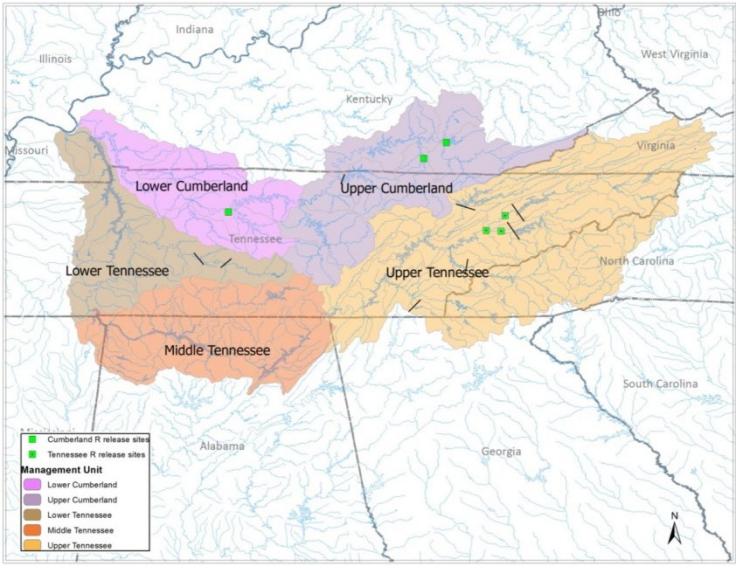
In 2001, the hatchery joined several partners with the purpose of reintroducing lake sturgeon in the Upper Tennessee River. The partners included: Tennessee Wildlife Resources Agency; Tennessee Valley Authority; Tennessee Aquarium, Chattanooga, TN; Georgia Department of Natural Resources (GDNR); and two other federal facilities, Pvt. John Allen NFH, Tupelo, MS, and Mammoth Springs NFH, Mammoth Springs, AR. In 2007, Orangeburg NFH, Orangeburg, SC joined the stocking effort. In 2014, one FWS hatchery (Edenton NFH, Edenton, NC) and two state

hatcheries (Marion and Eastaboga State Fish Hatchery, Alabama Department of Natural Resources) joined the effort to raise lake sturgeon to be stocked in the Tennessee and the Coosa rivers.

In 2004, a new agreement was initiated with Georgia DNR to reintroduce lake sturgeon in the Coosa River basin. Due to the success of our program in 2006 in the upper Tennessee and Coosa rivers, the states of Kentucky and Tennessee agreed on reintroducing lake sturgeon in their native habitat in the Cumberland River, located in the western portion of Tennessee. In 2013, the state of North Carolina expressed interest in expanding reintroduction of lake sturgeon to their native waters within the state, and joined the Lake Sturgeon Working Group. Due to the successful reintroduction efforts of lake sturgeon in the Tennessee River and the cooperative efforts from many different states along the basin, the working group decided to change its name to the Southeastern Lake Sturgeon Working Group.

Working at the southern end of the historical range for lake sturgeon, Warm Springs NFH produces lake sturgeon for distribution into headwaters of the Tennessee River, typically near the confluence of the Lower French Broad River and Holston River. In addition, Warm Springs NFH produces eggs and fish for use by Georgia DNR, for a lake sturgeon fishery on the Coosa River of Georgia and Alabama. Propagation and care of lake sturgeon follows genetic management and quarantine protocols established for the species.

Warm Springs NFH staff also conducts habitat and population surveys on sections of the Lower French Broad River and Holston River in Tennessee to assess effectiveness of the stocking program. Thirteen out of fifteen year classes have already been identified by genetic examination of collected tissue from brooders and re-captured fish, not including our next assessment in November 2016. We mapped and range tested 23 sonic receivers at selected locations around known concentration of lake sturgeon at lock and dams, and along tributary streams in East Tennessee. The data from these receivers is offloaded regularly to identify daily, seasonal, and annual movements of sturgeon along the upper Tennessee River. Assessment work also continued for a fourth year on sections of the Coosa River, assisting with surveys for lake sturgeon stocked by Georgia Department of Natural Resources.



Units of management and stocking sites within the Tennessee and Cumberland river basins. Credit: USFWS

Propagation, Culture, and Stocking Activities:

The last of the FY 2015 year class lake sturgeon were distributed at Seven Islands Refuge Landing on the Lower French Broad River on October 17th, 2015. A total of 1,978 fish (163.24 lbs total weight, average length 8.5 inches) and marked by removing the 5th and 6th scutes from the left side of the body were distributed. Chad Shirey transported and stocked the fish this year in conjunction with the annual Lake Sturgeon Festival outreach

event sponsored by the Tennessee Clean Water Network (TCWN). The purpose of this event is to educate the public on our expanding efforts in the region, and to promote the cooperative restoration efforts underway for lake sturgeon in the Upper Tennessee River. Josh Simmons transported an additional 200 marked sturgeon October 22nd, transferring the fish to Tennessee Wildlife Resource Agency for research purposes.
Carlos Echevarria and Chad Shirey traveled to Wisconsin this year in mid-April to spawn lake sturgeon and transport fertilized eggs back to the hatchery. Bill Wayman, Fish Technology Center Director, also traveled with us to conduct some cryopreservation work and to provide assistance with our hectic spawning work. Lake sturgeon broodfish were collected from the Wolf River at Shawano Dam and spawned on April 20th, 2016 with assistance of WIDNR biologists. A total of 119,005 green eggs were collected for use at Warm Springs. An additional 60,270 eggs were collected for immediate transfer to GADNR's Summerville Hatchery and Go Fish Education Center for the Coosa River restoration program.

Collecting site below Shawano Dam on the Wolf River, WI. Credit: Jeremy Monroe jeremy@freshwatersillustrated.org

Carlos Echevarria explaining lake sturgeon egg collection & fertilization to visitors.
Credit: Jeremy Monroe jeremy@freshwatersillustrated.org

Bill Wayman and Chad Shirey fertilizing eggs.
Credit: Jeremy Monroe jeremy@freshwatersillustrated.org

The lake sturgeon from FY2016 were held through May at the hatchery and were transferred after one month of quarantine to participating FWS hatcheries, state, and university partners during the first week of June for continued culture. Participating hatcheries received a total of 33,604 30 day-old fingerlings for the Tennessee River basin. Warm Springs NFH retained 4,908 fingerlings for continued culture and eventual distribution into the Tennessee River basin later this year. At the end of June WSNFH inventoried 4,799 lake sturgeon on station.

Date	Location	Number	Length	Weight (lbs.)	
April 20, 2016	Summerville SFH, GA		30,270	Eggs	N/A
April 21, 2016	Go Fish Center SFH, GA		30,000	Eggs	N/A
June 2nd, 2016	Eastaboga SFH, AL		2,508	1.37”	0.98
June 2nd, 2016	Marion SFH, AL		2,026	1.43”	0.76
June 2nd, 2016	TN Aquarium		2,400	1.36”	0.95
June 3rd, 2016	Table Rock SFH, NC		2,508	1.36”	0.82
June 3rd, 2016	Summerville SFH, AL		2,327	1.40”	1.20
June 2nd, 2016	Orangeburg NFH		4,988	1.36”	2.03
June 2nd, 2016	Edenton NFH		6,114	1.45”	2.49
June 3rd, 2016	Private John Allen NFH		6,101	1.45”	2.49
June 7th, 2016	Mammoth Springs NFH		4,632	1.41”	2.37
Totals:			**33,604 fish**		**14.09 lbs.**

During the culture period, lake sturgeon were fed multiple times daily with a combination of high energy soft-moist commercial diet and natural feeds such as frozen krill and midge larvae (bloodworms). The fish were also provided the soft-moist commercial feed at night through the use of automatic belt feeders. The rearing tanks had supplemental oxygen. Water temperatures were optimized for rapid growth. The lake sturgeon fingerlings were continually graded to reduce competition and maintain uniform growth.

Josh Simmons caring for lake sturgeon at Warm Springs. Credit: USFWS

On September 14th, Chad Shirey distributed 1,230 tagged lake sturgeon (8.03” average length, weight of 96.76 lbs.) to the Seven Islands Access on the French Broad River, TN. These fish were marked the previous day by removing their left side 1st and 2nd scutes. WSNFH staff continued culture of an additional 3,393 lake sturgeon averaging 6” to 8” in length through the end of September for later marking and distribution in FY 2017.

Staff and volunteers surgically removing 2 scutes on anesthetized lake sturgeon. Credit: USFWS

Lake Sturgeon Habitat & Population Assessment Work:

Lake sturgeon sampling and habitat assessment was conducted in the Upper Tennessee River during November and the Coosa River in December.

Chad Shirey and Carlos Echevarria worked with other boat crews during annual sampling efforts undertaken along the Upper Tennessee River, November 16th through the 20th. Boat crews on the Tennessee River consisted of staff and volunteers from Tennessee Wildlife Resource Agency (TWRA), Tennessee Valley Authority (TVA), University of Tennessee (UT), Tennessee Technological University, and FWS personnel from Warm Springs NFH, Panama City FWCO, Erwin NFH and Warm Springs Fish Health Center. Data collected during the sampling included substrate and habitat information at the collection sites. Tissue samples for genetic analyses were collected and all fish were scanned for or implanted with Passive Integrated Transponders (PIT) tags. A total of 79 lake sturgeon were collected by the seven boat crews sampling this year. Twelve of these lake sturgeon were also implanted with acoustic transmitters for continued tracking and habitat selection studies.

Brian Hickson and Carlos facilitated an ongoing study of lake sturgeon diet, prey availability and foraging habits, supplying equipment needed to conduct gastric lavage on captured lake sturgeon. This method of sampling stomach contents is non-lethal, cost effective, quick, and relatively safe for use on sturgeon species.

Trotline sampling is effective in deeper waters utilized by lake sturgeon along the TN River. Credit: Laurel Barnhill, USFWS

Deploying trotline sampling gear. Credit: Laurel Barnhill, USFWS

Captured lake sturgeon and surgery to tag with acoustic transmitters on the Upper TN River. Credit: USFWS

Haile Macurdy obtained scientific collecting permits allowing Warm Springs NFH staff to assist with sampling or collection of lake sturgeon in Alabama during 2015-2016.

On November 30th through December 4th, Chad, Josh and Carlos traveled to the Coosa River, GA and Lake Weiss, AL to conduct annual sampling of lake sturgeon in cooperation with GADNR staff John Damer and Mark Bowen. Brian Rhinehard, Hatchery Manager of Eastaboga State Hatchery, Alabama Department of Natural Resources, assisted us for a day collecting fish in Lake Weiss. Heavy rain events within the upper watershed resulted in several days of high discharge rates from upstream dams, contributing to a reduced capacity to collect lake sturgeon using trotlines. This year, three lake sturgeon were collected during the one week effort.

Josh Simmons in-between rain storms on the Coosa River. Credit: USFWS

The latest update to the Tennessee Lake Sturgeon Management Plan was received for review. Other work underway for lake sturgeon included data analysis and updates to the annual production report.

Hatchery Manager Carlos Echevarria participated in the 2015 Annual Meeting of North American Sturgeon and Paddlefish Society (NASPS) at Oshkosh WI, October 18th – October 22nd. Sturgeon and paddlefish researches and managers got together to discuss new and emerging work geared toward restoration and management. He also participated in a one day workshop entitled "Techniques to Determine Sex and Stage of Maturity in Sturgeons and Paddlefish". The workshop introduced participants to ultrasound, endoscopy, plasma sex steroid concentrations, and minor biopsy techniques.

The annual Southeastern Lake Sturgeon Working Group meeting was held March 8th-10th, 2016in Knoxville, TN at the Tennessee Valley Authority tower. Carlos Echevarria participated, providing input on 2015 hatchery production data and also discussed goals for 2016. A record total of 28,735 lake sturgeon were distributed by all participating stations during 2015.

Lake sturgeon recapture data from sampling efforts during 2015 in Alabama waters was submitted to the State's online database.

Habitat work by other members of the conservation group is noted in a recently published article in North American Journal of Fisheries Management by Daniel J. Walker and J. Brian Alford, titled: *Mapping Lake Sturgeon Spawning Habitat in the Upper Tennessee River using Side-Scan Sonar.* The article provides information on key lake sturgeon habitat. This article can be found at: http://www.tandfonline.com/doi/full/10.1080/02755947.2016.1198289

Alligator Gar Restoration Program

Warm Springs NFH participates in the alligator gar restoration program covering the Mobile River basin in Alabama and the Mississippi River basin in Tennessee. We are helping to achieve management objectives for this top-level predator working in cooperation with Private John Allen NFH, along with other State and Federal agencies. Alligator gar are a valued sport fish, the second largest freshwater species in the USA, and a top level predator, capable of consuming non-native species such as Asian carp. The following link provides some background on alligator gar conservation work on-going in tributaries along the Mississippi River. http://ualrpublicradio.org/post/return-gar

All of the culture work of alligator gar at Warm Springs falls within the Gulf Coastal Plains & Ozarks Landscape Conservation Cooperative Region. The Gulf Coastal Plains & Ozarks LCC continues to work on alligator gar as a priority tool – a model to identify areas within the Mississippi Alluvial Valley that are suitable for alligator gar. This project is an important tool in assessing spatial data related to the extent of inundation and environmental characteristics of flooding at known river stages on the lower Mississippi River corridor through analysis of remotely sensed satellite imagery. This data will allow fisheries management teams to evaluate habitat needs for Alligator Gar.

In early spring 2016, staff setup forage production ponds and purchased commercial feeds for the culture of alligator gar. The four ponds setup for forage fish production was started later than in 2015 in order to produce smaller-sized forage fish. This was accomplished in part by double cropping the forage production ponds. Warm Springs NFH was asked by GADNR to assist this year producing forage fish for their trophy bass program. Their hatcheries temporarily lacked space and would otherwise not be able to produce fish for their program this year. Warm Springs NFH put into production four ponds for eventual harvest and transfer of forage fish to GADNR in late May. Afterwards, the same ponds were restarted to produce forage in order to condition gar to natural prey prior to their distribution in August of 2016.

This year, the hatchery cultured Mississippi River basin fish, obtained as fry from Private John Allen NFH. On May 2nd a total of 6,000 five day-old fry were transferred to Warm Springs followed by another 2,250 eight day-old fry on May 5th. A total of 8,250 fry were received this year. Through the end of June, approximately 4,400 fish were on hand, (800 more than at the same time in 2015) ranging between 4.5 and 6.3 inches in length. Most mortality occurred early on in the program. Once the gar were fully trained to take commercial rations, they grew uniformly and with good survival. Otohime brand feeds were initially used with the fry and fingerlings. As the gar grew they were transitioned to floating Silver Cup steelhead diets. Scheduled feedings and use of 24-hour automatic feeders also helped ensure continued good growth and survival through the end of the culture period.

In July, forage ponds were harvested to ensure alligator gar were acclimated to a natural diet and to produce rapid growth during the final weeks of culture. Goldfish were harvested, graded and then used to supplement the commercial Silver Cup steelhead ration in use.

After approximately 96 to 100 days of culture at Warm Springs, a total of 4,148 fish (average length of 9.67" and total weight of 678.92 lbs.) were released. Volunteers Cassie Bates, Steven Schultz and WSFTC's Jaci Zelko assisted WSNFH staff with the all-day tagging operation on August 9th. On August 10th and 11th, Chad Shirey distributed juvenile alligator gar to the Hatchie River, a tributary of the Mississippi River in Tennessee at access ramps adjacent to the Highway 51 and 54 bridges.

For further information on alligator gar, visit the website: *http://www.sdafs.org/alligar/index.html*

Volunteer Steven Schultz monitoring water temperatures and oxygen levels. Credit: USFWS

Alligator gar can grow rapidly in culture prior to their release. Credit: USFWS

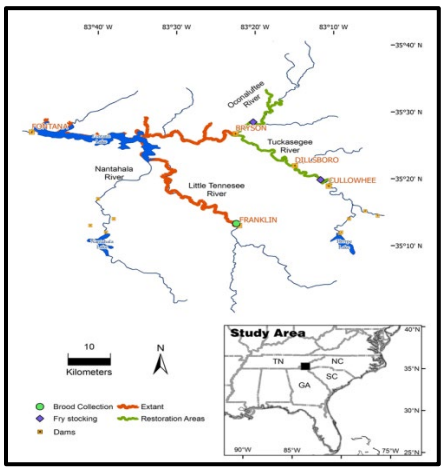
Staff and volunteers are tagging alligator gar with coded wire tags prior to distribution. Credit: USFWS

Sicklefin Redhorse Restoration Program

Our work with sicklefin redhorse represents a cooperative effort by Warm Springs NFH; the Eastern Band of Cherokee Indians; USFWS Ecological Services (ES), Asheville, NC; Conservation Fisheries Inc. (CFI); North Carolina Wildlife Resource Commission (NCWRC); Duke Energy; Western Carolina University; and others to address propagation tasks developed by members of the Sicklefin Redhorse Conservation Committee. Sicklefin redhorse conservation efforts are important not only for the species but for their significance in Native American culture.

Sicklefin redhorse. Credit: S. Fraley, North Carolina Wildlife Resources Commission

Sicklefin redhorse are a sucker in the *Moxostoma* genus, their status as a distinct species is currently under review. Sicklefin redhorse are currently confined to the Hiwassee and Little Tennessee rivers of the upper Tennessee River basin as reported in: Propagation and Reintroduction of Sicklefin Redhorse (*Moxostoma* sp.) to the Tuckasegee and Oconaluftee Rivers, North Carolina: Final Report for 2013 by: M.A. Petty, P.L. Rakes, C.L. Ruble, and J.R. Shute, Conservation Fisheries, Inc. February 25, 2014.



Study area for sicklefin redhorse restoration efforts. Credit: USFWS

Sicklefin redhorse were recommended for listing by the FWS in 2016. On April 18th at a ceremony in Cherokee, NC, the partners signed a Candidate Conservation Agreement for the species. Sicklefin redhorse are now currently listed by USFWS as a candidate species (for elevated listing) throughout its entire range. As part of the news coverage of this event ongoing work at Warm Springs NFH was mentioned.

http://www.chattanoogan.com/2016/2/23/318631/Power-Companies-Tribe-Agencies-Take.aspx

Our efforts are currently focused on producing fingerlings for restoration efforts within their historical range and also upon rearing larger sicklefin redhorse for future tagging and telemetry studies as a means to evaluate habitat use and movements of the fish within these river basins.

Warm Springs NFH continued culture of 2014 and 2015 year-class sicklefin redhorse throughout 2016 for evaluation of prospective commercial rations, telemetry, tagging and assessment work. Larger sized fish are needed for telemetry research using internal transmitting tags. We currently have sixty-six 2015 year-class sicklefin averaging 5 inches in length and seventy-six 2014 year-class fish averaging 8.25 inches in length.

Trent Mitchell a Columbus State University undergraduate student and hatchery volunteer, finalized his 2015 study " Comparison of how three diets affect the survival and growth rates of Sicklefin Redhorse *Moxostoma sp*. at Warm Springs National Fish Hatchery, Warm Springs, Georgia." The study was directed towards finding a diet that is nutritionally complete yet does not produce health issues possibly brought on by sole use of high calorie, high fat content rations. The trial diets used were a custom mixed ration made for razorback sucker culture, a soft-moist Rangen feed and frozen bloodworms. Trent presented his study to meet undergraduate requirements at CSU.

Sicklefin redhorse. Credit: USFWS

Warm Springs NFH staff provided technical assistance, attended planning meetings and supported work with other sucker species prior to engaging in sicklefin production work. Haile prepared a 2015 sicklefin production report; Carlos presented the information and participated in the annual sicklefin redhorse meeting held in the U.S. Forest Service Conference Room at USFWS offices in Asheville, NC on February 26, 2016. The committee finalized plans ahead of the formal Candidate Conservation Agreement that was later signed in April.

Program assistance with this program continued for a third year with the hatchery taking an active role in broodstock spawning, egg incubation and fingerling culture. Gametes and tissue samples were collected for cryopreservation, research, genetic typing and health profiles in addition to producing fertilized eggs. Fluctuating water temperatures and variable water flows posed a challenge this year in collecting gravid sicklefin redhorse. The working group utilized two shocking boats in the effort to obtain potential broodfish. Six collection efforts were made on the Little Tennessee River and Tuckasegee River between April 25th and May 20th. The majority of viable eggs were collected on May 2nd on the Little Tennessee River at Franklin, NC. Ripe males were obtained at every effort but gravid females were difficult to obtain. Each female spawned on May 2nd was mated with five different males. Fertilized eggs were split between Conservation Fisheries Inc. and Warm Springs NFH. Warm Springs staff and volunteers that participated with this effort were Haile Macurdy, Jaci Zelko and Elena Macurdy.

Of the eggs transferred to Warm Springs, a total of 13,291 fry were produced from the Little Tennessee basin sicklefin redhorse broodfish at a hatch rate of 74.2%. In contrast, of the few eggs collected from the Tuckasegee River only 1.5% hatched. A total of 12,678 fingerlings were released to three stocking locations from Warm Springs NFH.

Date	Lot	Distribution Site	Length	Number
June 20th, 2016	2016-Little TN River	Potters Dam, LTN, Franklin NC	0.99”	2,170
June 20th, 2016	2016-Little TN River	Webster, Tuckasegee R., NC	1.02 ”	3,235
June 20th, 2016	2016-Little TN River	Cullowhee Dam, Tuckasegee R., NC	0.99”	7,273

(L to R) **Sicklefin redhorse spawning habitat, Haile holding a male during spawning season, and 1” sicklefin fingerlings at a release site. Credits: USFWS**

The hatchery also provided assistance to Elise Irwin, USGS Alabama Cooperative Fish & Wildlife Unit, Auburn and her staff with conditioning and spawning protocols for use with river redhorse/black redhorse. Carlos and Haile traveled to Auburn to meet with Elise and share resources for this project. Jaci Zelko, Warm Springs Fish Technology Center also provided assistance with broodfish conditioning. WSNFH sponsored an INAD for an experimental hormone with these captive redhorse. Unfortunately, no fish were spawned using hormone induction this year.

Carlos & Elise Irwin at Auburn's facilities. Credit: USFWS

Redhorse suckers held at Auburn. Credit: USFWS

Freshwater Mussels Research

The goal of our augmentation and reintroduction program is to restore freshwater mussel biodiversity and their ecological functions to appropriate free-flowing reaches of the ACF, and to assist the recovery of federally listed mussels, by augmenting existing populations with hatchery propagated mussels. Some of the aspects of our plan that biologists at the hatchery could potentially implement include: develop technology through research, construct facilities for holding endangered and threatened mussels, continued refinement of existing mussel propagation, and augmentation and reintroduction plans for the seven mussels respectively. The hatchery continues holding mussels and host fish from previous studies; these include several species from the ACF and Altamaha basins. Some of these mussels have been in refugia for up to 13 years or more and continue doing well. They are held in tanks using pond water treated via the alkalinity enhancement building and are fed from commercially available algae cultures and organics present in the pond. The hatchery is also holding several native small ACF riverine fish species in addition to largemouth bass and bluegill for host fish studies.

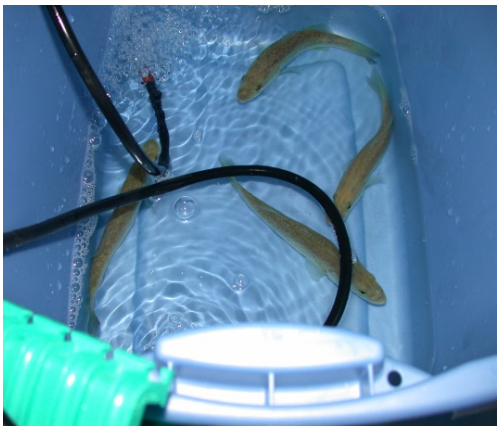
To prepare for mussel work this year, tanks were cleaned, largemouth bass and bluegill sunfish were collected for host work and the Quarantine Building was started up. This included changing out UV bulbs, cleaning filters, added water to holding aquariums for fish, etc. Warm Springs NFH staff developed a 2016 work plan for mussel propagation using, *Elliptoideus sloatianus* (Purple bank climber), *Villosa lienosa* (Little spectaclecase) and *V. villosa* (Downy rainbow). Carlos and Chad attempted to collect purple bank climbers on several different occasions but were thwarted by deep water and high water flows. As a result, no purple bank climbers were collected for this season, however, propagation work continued with other species. Staff and volunteers conducted collection trips in the spring to obtain various fish species for use in mussel host fish tasks.

Nathan Griffin, a Columbus State University student volunteer, undertook many aspects of the work plan this summer. Nathan conducted several host fish collection trips in June. He was able to collect glochidia, infect host fish and transform juvenile mussels for his study. The targeted late summer spawning mussel species include *E. pullata* (Gulf spike), *Toxolasma paulum* (Iridescent lilliput) and *V. lienosa* (Little spectaclecase).

Nathan caring for darters. Credit: USFWS

Retrieving glochidia packets for evaluation. Credit: USFWS

Nathan was able to collect glochidia from two mussel species, Iridescent lilliput (*T. paulum*), and Little spectaclecase (*V. lienosa)*. Host fish species utilized in his trial included largemouth bass, black-banded darters, and bluegill sunfish that were available at the hatchery; along with red breasted sunfish, green sunfish and warmouth sunfish collected from Lake Oliver, an impoundment on the Chattahoochee River. Nathan received assistance from Andy Hartzog, Fish/Mussel Biologist at Panama City, in learning techniques needed to conduct his study.



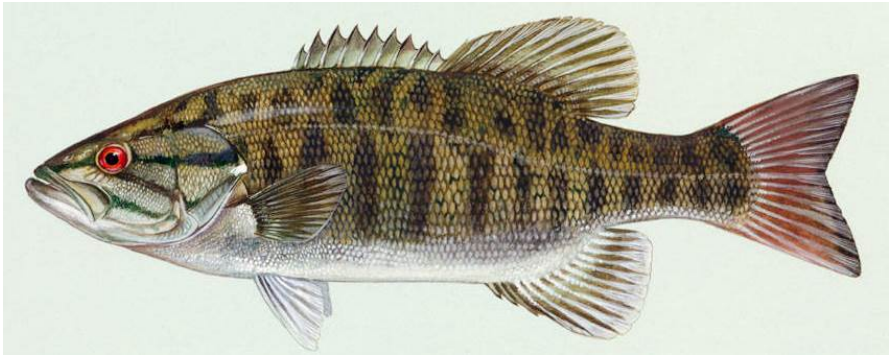
Largemouth bass host fish. Credit: USFWS

A total of six fish species were tested as potential host fish for *T. paulum* and all species successfully transformed glochidia into juveniles. The study shows that sunfish are suitable host fish with green sunfish and warmouth sunfish having the highest production, and they are the best candidates for primary host fish for this *T. paulum*. The mussel used in this study is a surrogate species for a relative, the endangered Savanah Lilliput (*Toxolasma pullus*) as well as other mussels found in the ACF, so the information found in this study could assist in controlled propagation and conservation efforts for other T & E species.

AHAB aquaria holding host fish. Credit: USFWS

Later in the year, Josh Simmons, Fishery Biologist, took the Freshwater Mussel Propagation for Restoration course at the National Conservation Training Center September 19th – 23rd. Carlos also provided information in August to Pennsylvania biologists who are considering setting up a fresh water mussel hatchery.

Smallmouth Bass Restoration Program



Smallmouth Bass. Credit: USFWS

Warm Springs NFH staff met with Allan Brown, Fisheries ARD, John Biagi, GADNR's Chief of Fisheries Management, and Scott Robinson, GADNR Fisheries Biologist on October 29th, 2015 to discuss working with smallmouth bass propagation and culture. Historical smallmouth bass populations in their native Georgia drainages are in decline, influenced by widespread hybridization with introduced spotted bass. Pure strain smallmouth bass are reported to be seriously impacted in Chatuge and Blue Ridge Reservoirs, impoundments within the Tennessee River basin. These reservoirs are state-managed by Tennessee and Georgia DNR's, respectively.

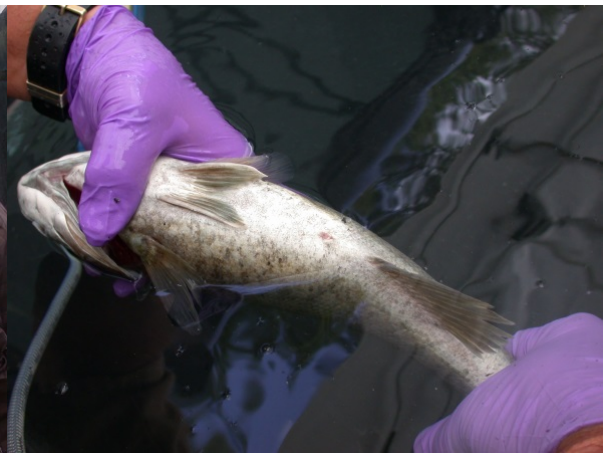
Warm Springs NFH biologists have initiated planning to assist in restoration of smallmouth bass in these two reservoirs with an initial five-year effort to produce and distribute oxytetracycline-marked fingerlings. This cooperative effort involves broodstock collection, transportation, propagation, distribution, assessment and outreach to be conducted by Georgia DNR and Warm Springs NFH staff.

Carlos and Josh traveled to Tennessee Wildlife Resource Agency's Eagle Bend Hatchery on Jan. 28th, 2016. They met with biologists and studied the hatchery's broodstock and fry rearing setups prior to retrofitting tank systems at Warm Springs for dedicated smallmouth bass culture. Josh compiled a number of published smallmouth bass culture reports in order to facilitate development of a hatchery propagation plan for tank spawning and culture of smallmouth bass, which was submitted for review. Haile created a work template for this work and Carlos modified WBS financial codes to reflect our moving forward with this new program at Warm Springs.

Staff re-plumbed a bank of 6 foot diameter tanks in the Pole shed and moved an unused raceway into position for fry culture. Gravel spawning pans were also developed for use in these circular tanks.

On March 10th, Carlos brought back 36 broodstock from Eagle Bend State Hatchery. The fish were originally collected by TWRA staff from Cherokee Reservoir, TN. All fish were weighted, measured, PIT tagged and screened by the WS Fish Health Center, then held in isolation. External parasites were found on the fish upon arrival and other infections developed later that stopped any attempts at spawning these fish this year.

Sampling smallmouth bass. Credit: USFWS



Sexing anesthetized fish. Credit: USFWS

Maintenance and Operations

Pre-contract site visits and planning meetings were undertaken for two major projects upcoming for the station during FY 2017. The first involved designing and building a new holding house that will replace the existing structure and the second project involved adding metal roofing to ten existing buildings.

Extensive pre-planning was undertaken to develop a Scope of Work document for removing the existing holding house and replacing it. This project will potentially require work on other associated real property assets such as raising the elevation of an existing water supply pond levees, increasing the diameter of water supply lines to overcome existing flow limitations and adding several outside covered raceways. Hatchery staff met with R4 civil engineer Mr. Carville "Billy" Edwards on several occasions in developing the Scope of Work document. A pre-solicitation site meeting was held on August 30th with design and construction representatives to review the proposed work. Based on the meeting an updated document was developed for the project September 6th.

A number of roofing contractors conducted site visits prior to submitting their bids on the roofing project. The following buildings were scheduled to receive metal roofing, which once in place will add to the insulating value of existing roofs: feed house, vehicle storage, wet lab, two pole sheds, welding shop, genetics / cryopreservation lab, fish health lab, old and new pump house buildings.

Heavy December rains eroded earth beneath a storm drain flume adjacent to the Cold Spring and alkalinity treatment buildings. The damage was filled in with concrete. Additional landscaping work was conducted in the area to redirect future flowing storm waters towards the reinforced flume and associated storm drain.

Runoff after 4 inch rain event. Credit: USFWS

Flume undercut by storm water. Credit: USFWS

A large tree fell and damaged the roof of the Cold Spring building this August. Roof repairs were completed in September.

Spring house (2015 photo) roof damaged in August by a falling tree was repaired. Credit: USFWS

A new pesticide storage building was received and setup. The new building now allows separation of herbicides and pesticides from flammable materials. Prior to this, pesticides were stored in our paint and oil building.

Herbicide and pesticide storage building. Credit: USFWS

Two new high energy efficient heat pumps (Aqua Cal models SQ166R) were purchased to replace existing units at the mussel building. These units are more economical to operate and purchased at a lower cost than the existing units.

A new heat pump. Credit: USFWS

Bank stabilization work was conducted on ten 1/10th acre pond levees. Riprap was strategically placed to prevent erosion adjacent to walkways, steps, water supply and electrical service structures.

Ten pond banks stabilized with riprap. Credit: USFWS

Additionally, a serviceable anti-escapement barrier was constructed for use with facilities of the wet lab pole barn, historically used for striped bass culture.

Added anti-escapement barrier in concrete drain pit at the pole shed. Credit: USFWS

During the summer, staff rebuilt four picnic tables in our public use area with red cedar lumber donated by Valley Red Wood and Fir Company. Two entrance signs were also replaced.

Staff also replaced several water pumps prior to use this year and serviced several chillers and heat pumps.

Our three station emergency generators were serviced in July. These worked through the year without any problems and helped ensure critical infrastructure and culture systems continued to operate during outages.

Annual cleaning and maintenance was completed by service representative on all microscopes belong to the hatchery.

Safety equipment such as emergency showers and fire extinguishers were maintained by staff.

Work also includes maintaining water treatment equipment for the entire complex. The bulk limestone storage tower used to treat the water from Cold Spring was refilled with approximately 25 tons of high calcium content limestone in January and again in July. The liquid chemical storage tanks located at the wet lab were re-charged periodically through the year.

Staff dedicated time for preventative maintenance of roads, pond levees, buildings, equipment, and grounds. This includes the time required for operation and maintenance of intensive culture systems required for high priority work with lake sturgeon, alligator gar, mussels and sicklefin redhorse.

During the fall, staff winterized culture systems, water supply lines and buildings to prevent below freezing temperatures from damaging equipment. Forage ponds were harvested to cycle and separate broodfish from forage and provide feed for use in the display pool and aquarium building through the winter. Ponds utilized for striped bass production were drained as a means of removing unwanted aquatic vegetation over the winter and air stones were removed for cleaning.

These same culture systems and buildings were then de-winterized in late January in preparation for use this spring. Activities included putting recirculation systems back into production, and conditioning water supplies for culture work. This work was undertaken in the wet lab, holding house, lake sturgeon, and mussel buildings. Chad serviced our utility carts, fish and egg transport trailers and equipment ahead of pending culture work. Our staff put together new trotlines and repaired of others following their use with lake sturgeon assessment work in preparation for the sampling efforts.

Staff maintained the hatchery grounds, public use areas, ponds, roads and levees through the year. Grounds were mowed on frequent occasions through the year. Newly planted weeping willows along the bank of display pond were watered, fertilized and landscaped by the staff. Chad Shirey disked the sides of a dry pond now converted for use as a Monarch Butterfly habitat in order to serve as a fire break.

Chad repaired leaks in water supply lines at the holding house, one of the residences and near the aquarium. Staff pressure washed around the office, aquarium, fish health lab, feed building ramp and steps, sidewalks leading into pole shed.

Several decaying trees were removed where they presented a pending hazard. Staff also worked on leaf removal from landscaped areas and ditches ahead of fall and winter rains. Those rains did arrive, producing significant amounts of runoff.

Ecosystem/ Habitat Assessment, Fish Passage and Habitat Restoration

Monarch Habitat Restoration Project:

In response to the Service's initiative to implement conservation efforts that will benefit monarch butterflies, Warm Springs NFH staff developed a project to provide forage and reproductive habitat for monarchs and other pollinators.

An unused production pond was set aside for the pollinator project in 2015, however the initial seeding efforts in did not take. In order to remove unwanted overgrowth from the pond, staff worked with the Warm Springs Fire Department coordinating a training event for the department to burn off the pond. The pollinator habitat pond was then burned off on January 14th. Replanting took place in April following removal of this overgrowth and a soil analysis conducted by University of Georgia Extension Office staff.

Burning off overgrowth prior to replanting. Credit: USFWS

Girl Scout Troop 50316 from Columbus, Ga and members of Friends of Warm Springs NFH, replanted seeds of assorted plant species beneficial to pollinators along with native swamp milkweed sprouts on April 23rd.

Newly installed kiosks describing monarch butterfly lifecycle. Credit: USFWS

Our pollinator habitat area has begun to attract butterflies. Plant species that are beneficial to pollinators will continue to be cultivated in order to improve the habitat.

Gulf fritillary is one of several butterfly species utilizing pollinator habitat at the hatchery. Credit: USFWS

Habitat Initiatives and Watershed Restoration:

Chad and other members of the Southeast Aquatic Habitat Restoration Team travelled to Region 2 to conduct a dam removal from January 17th – 24th. The Ottine dam on the San Marcus River in Texas was safety hazard and a barrier for aquatic wildlife.

A view overlooking the Ottine dam. Credit: USFWS

Chad Shirey operating track hoe. Credit: USFWS

Barrier removed on San Marcus River, TX. Credit: USFWS

Chad also participated with members of the Fish Habitat Restoration Team on a collaborative strategic habitat project with North Carolina Wildlife Resources Commission, June 19th – 29th. The team assembled and installed four culverts at the South Mountain Game Lands, located near Morganton, NC. These culverts provide proper passage for native species found there.

Assembling a culvert. Credit: USFWS

One of four culverts installed. Credit: USFWS

Carlos met with Zoo Atlanta staff this summer to discuss future collaborative conservation efforts. Based on the meeting, we are conducting background research into assisting with gopher frog conservation work in 2017. Gopher frogs *Lithobates capito*, also known as the Carolina gopher frog, are currently under review for listing under the endangered species act.

Warm Springs NFH has four Hydrolab 5SDX sondes that are deployed as needed for baseline aquatic habitat assessments through the region. Haile conducted preventative maintenance, cleaning, calibration and service of the units after a recent deployment, getting them ready for the next use.

Bill Bouthillier assisted the Fish Health Center by conducting periodic triploid grass carp inspections during the year.

Outreach: Connecting People with Nature and Volunteers

Warm Springs NFH is a valued venue that demonstrates the Service's commitment to environmental leadership. To that end, the station provides facilities, kiosks, public access and scheduled events increasing the public's awareness of their natural resources while promoting our accomplishments. In addition to facilitating onsite professional tours, staff also provided (volunteered) time for occasional off-site programs as time permitted.

Carlos Echevarria, Bill Bouthillier, Haile Macurdy and members of the Friends Group participated in the annual "**Help the Hooch**" river cleanup along the Chattahoochee River at Columbus, GA October 3th. Hatchery staff and Friends Group members set up touch tanks featuring turtles, tadpoles and crayfish. This event had over 3,000 children attending the after clean up watershed festival. This event is always well attended with lots of community support.

(L to R) Staff and Friends Group members who picked up trash along the Chattahoochee River. USFWS Booth at the Help the Hooch Festival. Credits: USFWS

The Annual Open House sponsored by the hatchery, was held for the community Saturday, October 10th. It featured exhibits and demonstrations from all WSNFH programs. Hatchery staff and Friends Group members cooked hotdogs and provided bottle water to the attendees. The food and water was donated by the Friends Group. Over 225 visitors were on hand to view the exhibits and to chat with staff members from the entire Warm Springs Fisheries Complex: Warm Springs NFH, Fish Health Lab and Fish Technology Center. Children who attended the open house had chances

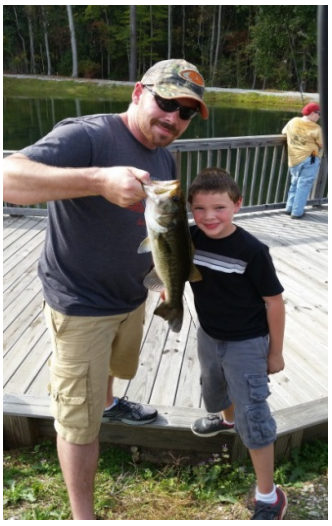
of winning door prizes for getting their passports stamp at each station and playing the pollinator game at the kid's activity table. This year we were honored to host a few members of Outdoor Afro. Outdoor Afro is a community that reconnects African-Americans with natural spaces and one another through recreational activities such as camping, hiking, biking, birding, fishing, gardening, skiing - and more! Outdoor Afro uses social media to create interest communities, events, and to partner with regional and national organizations that support diverse participation in the Great Outdoors.

Carlos Echevarria stamping a child's passport

Friends Group Members and Kate Toniolo from Regional Office cooking hotdogs

Members of Outdoor Afro. Credits: USFWS

Cub Scout Pack 106 consisting of 12 boys and 8 adults from Meansville, GA completed an overnight stay at the hatchery on Oct 24th. While on station the boys completed the Biologist-in-Training program and worked on their fishing merit badge. The boys had fun performing water quality testing and collecting aquatic insects in the stream on station. The scouts were allowed to catch and release bluegill and largemouth bass from one of the ponds on station.



Over 400 kids participated this year on our Annual Fishing Day. Credit: USFWS

Haile and Elizabeth Shields (Friends Group Secretary) attended the Moving Friends Forward National Conference at NCTC January 22-24th. Board members of our Friends of Warm Springs National Fish Hatchery group held an annual meeting in the aquarium on March 30th.

Our annual fishing rodeo for kids was held on June 11th this year during National Fish Week. This year was a record for us with 405 kids age 12 and under fishing in the event. Almost everyone caught fish, a total of 1,451 channel catfish were taken home by the kids. Twenty three of these kids were fishing for the first time ever. Our annual kids fishing event would not be possible without the combined participation from members of Friends of Warm Springs NFH, volunteers and staff, all working with the kids' parents to provide a learning experience for the kids. We have a dedicated group of bass fisherman (Benning Bass Club) who volunteer for the event each year and provide assistance to our young visitors. Our thanks go out to Wen Marr Management Corporation, (Wendy's), LaGrange, GA who provided food for all participants and families again for this year's event. Door prizes included fishing poles donated by Zebco Brands and Callaway Blue in Pine Mountain provided bottled water.

Combined efforts from parents, Friend Group members, volunteers and staff made for a great event. Credit: USFWS

Outreach programs continued throughout the year that included visits of scouting programs, church and home schools, science camps and groups from Roosevelt Institute for Rehabilitation, also located in Warm Springs. The station provides numerous onsite kiosks and public accommodations for our visitors. A sampling of these programs is listed below.

Nov. 5th, Deerfield Winsor Academy with 40 children and 5 adults toured the aquarium and hatchery.

Jan. 16th, Bill submitted an E-grits article - pollinator habitat area and observation construction.

Feb. 9th, the hatchery participated with Meriwether County Schools on a job shadowing day; seven Manchester High School students visited for the day.

Feb. 11th, Columbus State University – Vertebrate Zoology Class – 14 students/ 1 Professor.

Feb. 26th, Columbus State University – Biology of Fishes Class – 12 students/ 1 Professor

March 7th, restocked a viewing pool inside Callaway Gardens Butterfly exhibit with native fish species including largemouth bass, bluegill and channel catfish.

March 12th, Cub Scout Pack 134 from Thomaston, GA completed Biologist-in-Training activities, toured the hatchery and fished for bluegill (catch and release) to complete requirements for First Catch Patch. Thirteen boys and eleven eight adults attended.

May 4th, Carlos met staff at Zoo Atlanta discussing future cooperative efforts. Carlos facilitated a follow up visit June 1st to Warm Springs NFH and associated programs by Dr. Joseph Mendelson and Robert Hill, two Zoo Atlanta staff. We also transferred a few display fish for exhibits at the zoo.

April 8th, Haile delivered catchable catfish to Sweetwater State Park; located near Lithia Springs, GA. WSNFH provided the catfish to support the parks April 9th fishing rodeo targeting urban kids.

June 9th, staff provided a tour to Professor Jeff Terhune's Auburn University undergraduate fisheries science class. The tour focused on the diversity of conservation programs undertaken by FWS hatcheries and associated programs.

Aug. 3rd, Warm Springs NFH hosted a station tour for FWS interns participating in the Regional Pathways Program.

Sept. 25th, staff assisted Roosevelt State park staff with their kids fishing event, providing extra fishing rods and supplies for the event.

September, host fish no longer needed for our mussel program were set aside for donation for OxBow Meadows Environmental Education Center in Columbus, GA. The center is renovating their aquatic displays.

Through the year, WSNFH staff hosted a number of drop-by tours of home school groups, scouts and area social services programs. Environmental education materials were shared with youth leaders on several occasions.

Volunteer Activities:

The Benning Bass Club, Friends of the Hatchery and staff came together to build an observation deck over the new Monarch butterfly and pollinator garden on October 24th. Lumber was donated by WestRock (formerly MeadWestvaco) and pressured treated by Universal Forest Products Union City, LLC free of charge to support this endeavor. The Benning Bass Club supplied the workers; the Friends Group supplied snacks, coffee and water to the volunteers. In addition, they paid for some of the building supplies need. Hatchery staff assisted in the building of the deck. The Benning Bass Club has worked annually with the Hatchery on environmental projects for the last four years. These partnerships help leverage funds and workloads to benefit both fisheries and other wildlife.

Benning Bass Club members framing the observation deck. Credit: USFWS

Finished deck waiting on new signage. Credit: USFWS

Three volunteers worked with us this summer and each contributed greatly to the success of our programs. Trent Mitchell, a great volunteer working with us last year, presented results on a sicklefin redhorse diet study he conducted as part of a research project at Columbus State University.

Steven Schultz brought a wealth of experience to us volunteering during his off days managing a commercial tropical fish distribution center. Steven started on April 4th and helped with our public facilities, mussel program, pond management and alligator gar programs two days a week.

Nathan Griffin started on June 1st whole heartedly undertook mussel propagation work here this summer. Working up to four days a week, he undertook a study while attending Columbus State University.

Cassie Bates started June 14th and provided assistance with our lake sturgeon, alligator gar and general pond management activities one day a week during the busy production season.

Cassie Bates testing water quality. Credit: USFWS

Staff met with Dorita Smith, Roosevelt Warm Springs Institute for Rehabilitation, regarding volunteer placement of students' onsite as volunteers for development of work training skills.

Training, Safety and Administrative

Training & Safety:

Haile Macurdy and Elizabeth Shields attended the Moving Friends Forward National Conference at the National Conservation Training Center (NCTC) January 22-24th. This was a very informative conference for the friends group and service staff.

Josh Simmons attended the Fisheries Academy at NCTC from February 21st – March 4th.

Josh also took the Freshwater Mussel Propagation for Restoration course at NCTC September 19th – 23rd.

Haile completed annual safety training refresher courses as required for the station's safety officer in January.

All staff completed EEO and Diversity training by mid-September. Staff also reviewed training documents related to R4 Heavy Equipment Safety Instructor Recertification.

All staff completed security aware training by the May 1st deadline and reviewed performance progress reports.

Safety plans were reviewed for updating. Equipment such as fire extinguishers were inspected and certified.

EMS and safety plans were reviewed and updated during the year. Staff reviewed disaster preparedness plans going into this year's typical hurricane season. Our annual review and submittal of the current Disaster Action Plan was completed on June 21st.

Staff took required online training during the year that included the Scientific Integrity course and several FBMS module courses.

Meetings:

Carlos attended the project leaders meeting in Chattanooga, TN July 25th-29th. He also participated in periodic project leader conference calls during the year including calls on April 6th, May 5th and June 2nd, August 11th and September 12th.

Warm Springs NFH is scheduled to get a replacement holding house. Carlos began consultation, design and planning for this new building. Carlos and Chad met with Brian Ellington and Carville Edwards during an initial onsite visit June 14 and a later meeting during the month.

Staff conducted interviews with several high school students for an YCC position at the hatchery.

Staff met with FWS National Fleet Manager Michael Hale on June 14th providing a site tour and overview of our heavy equipment and vehicle program at Warm Springs.

Chad participated in several Wage Grade Committee conference calls.

Staff took "use or lose" vacation time accumulated through the year in November and December.

Reports:

Considerable effort was applied towards meeting year end requirements for personnel actions, budgeting and annual reporting requirements.

Work included updating staff EPAP's and developing the station's PRS targeted goals in FIS. Annual fish distribution records were completed for FY 2015 in FIS and FONS projects were also updated for 2016.

Staff developed new work templates for major FY 2016 fisheries programs and their corresponding budgets for 2016.

A 2015 4th quarter and 2015 annual report were submitted in addition to three quarterly reports for 2016.

Environmental Management System records were maintained and safety plans were reviewed.

A pesticide use report for 2015 and pesticide use proposals (PUPS) for 2016 were prepared and submitted.

Monthly vehicle and building energy use data was compiled and submitted for use in FBMS.

A pickup truck, two outboard motors, a boat trailer, flatbed trailer (fifth wheel) and a Cushman Commander cart were removed from inventory through GSA auctions during the year and staff updated property management records.

Staff submitted information on work with pollinators, outreach updates, a negative response to Sikes Acts reporting requirements and submitted a FY 2016 spending request for computer equipment and services.

Staff completed the Southeast Water Resources Survey.

Responded to Ecological Services' blanket permit T & E take data call Jan. 6th and T&E Expenditures report requests.

Submitted online data as required January 7th for the annual solid waste diversion data call.

Responded to data call for GA Scientific Collecting Permit new species for 2016.

Renewed the hatchery NOI Pesticide NPDES permit Feb. 2nd

Bill Bouthillier updated Monarch Butterfly accomplishments for the regional office and updated the station fact sheets in FIS.

Considerable time was devoted to working in FBMS updating WBS codes as they are related to real property assets. Monthly fuel and energy reporting as required was conducted.

Staff sent in the FY 2015 T & E Expenditures Report April 1, 2016.

Staff continued efforts to integrate FBMS guidelines into daily operations. Carlos dedicated considerable time through the year with budget items and managing FBMS.

CONSERVING AMERICA'S fisheries

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