Fish Rescue and Relocation at the New York Power Authority Blenheim, NY, 2006-2009

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Table of Contents

Chapter 1: Abstract, General study area, and introduction to fish rescue and relocation from 2006-2009……..…….....p. 3

Chapter 2: Coffer Dam rescue and relocation……..…….....p. 5

Chapter 3: Top Hat rescue and relocation…….p. 7

Chapter 4: Moat (Under Top Hat) rescue and relocation……..p. 7

Chapter 5: Penstocks rescue and relocation……...…p. 10

Chapter 6: Isolated Pool rescue and relocation..……...…..p. 13

Chapter 7: Ecology of Constant Level Ponds…….……p. 15

Chapter 8: Summary…….….....p. 20

Chapter 1

Abstract, General introduction to fish rescue and relocation, from 2006 to 2009

Abstract: A fish rescue and fish fauna characterization was performed at the New York Power Authority Upper Reservoir in North Blenheim, New York, each fall from 2006–2009. Efforts during the study were focused on moving stranded fish from isolated pools around the upper reservoir which had formed by lowering the water level in the reservoir each fall. Over 25 thousand fish from 21 species have been handled by SUNY Cobleskill faculty, staff and students during this 4-yr. project.

Introduction

The New York State Power Authority pumped power storage facility is located in the towns of Blenheim and Gilboa in Schoharie County, New York. The facility consists of two major reservoirs connected by a system of piping which moves water between the upper and lower reservoir. The impounding of the 7.25 billion gallons of water from the two reservoirs has little or no impact on the flow of the Schoharie creek.

Figure 1.1. Topographical map of Upper Blenheim-Gilboa reservoir (upper center) with aerial image of constant level ponds (top right), photograph of thousands of emerald shiners captured at the coffer dam site (lower left), and two students netting fish stranded in an isolated pool (lower right).

The upper reservoir is essentially a massive embankment structure built into the side/top of Brown Mountain in Blenheim, New York. The upper reservoir has a surface area

of approximately 360 acres and can hold 18,500 acre/ft (2.5 billion gal) of water at maximum operating capacity. The reservoir is 11,900 ft long and 162 ft deep at maximum pool. When full, the elevation of the reservoir is at 2003 ft above sea level.

The upper and lower reservoirs are connected by a series of pipes and tunnels which, along with four turbines, move water between the two reservoirs to generate electricity (see Figure 1.1). The first in the series of pipes is a 1040 ft vertical pipe that runs through Brown Mountain. This pipe is located at the southwestern end of the reservoir, and feeds into a 1,447 ft long 28 ft diameter horizontal pipe. This pipe then feeds into a 28 ft diameter 460 ft long perpendicular horizontal pipe which, in turn feeds the four penstocks (each 1960 ft long, 12 ft diameter) that house the turbines for pumping water to the upper reservoir, and generating electricity.

The lower reservoir is approximately 430 acres in surface area and boasts a length of over 3 miles. It has a maximum holding capacity of 15,500 acre/ft (5 billion gal). The lower reservoir is located at approximately 900 ft in elevation above sea level. The lower reservoir releases water through a spillway into the Schoharie Creek.

The construction of the New York State Power Authority (NYPA) pumped power storage facility in Blenheim and Gilboa New York was completed in 1973. The project was initiated as part of an ongoing project by the Authority to supply municipalities and coops throughout New York and neighboring states with large amounts of hydro-electric power at a wholesale price. At full capacity, the facility has the potential to produce 12,000,000 kilowatts of electrical power. In September of 2006, the Authority began a large scale operation to dewater the upper reservoir and fix several components of the existing structure at the NYPA facility.

In 2003, NYPA, along with SUNY Cobleskill and the Schoharie County Conservation Association (SCCA) started a cooperative management effort to augment the existing walleye and trout populations in Schoharie County. The project's goals were to increase angling opportunity for fishermen while promoting an atmosphere of team work between three different interest groups involved with the fisheries resource of Schoharie County. SUNY Cobleskill has stocked trout in the Blenheim-Gilboa reservoirs, as well as in other bodies of water in Schoharie County. Approximately 1,000 trout are stocked at the Power Authority each year by SUNY Cobleskill.

In accordance with the stocking program, NYPA and the SCCA have funded the construction of walleye fingerling ponds on the SUNY Cobleskill campus. As part of this agreement, SUNY Cobleskill has stocked pond fingerling walleye into Blenheim-Gilboa reservoirs in 2010, 2011 and 2012 and will continue to 2013.

The purpose of the fish rescue and relocation at NYPA was to remove fish from unsuitable or dangerous areas in the upper reservoir and penstocks during the LEM (life extension and maintenance activites) conducted by NYPA in 2006-2009. Fish from areas including the small pools in the upper reservoir, coffer dam study area, and top hat area were all relocated to the main upper reservoir. All fish from the penstocks were relocated to the lower reservoir.

Chapter 2

Coffer Dam (2006)

This area will be referred to as the coffer dam study site. This site was a four acre temporary holding reservoir created by the construction of a coffer dam across the mouth of the channel leading to the intake structure. The site was uncovered when the dewatering of the reservoir brought the elevation of the surface water from 2003 ft. to 1943 ft. in elevation. Fish rescue from this site occurred in 2006.

Methods

Fish were relocated at the coffer dam study site through the employment of a 300 ft haul seine. Two 100ft long ropes were thrown down from the cliffs surrounding the coffer dam study site and tied to the float lines of the haul seine so that it could be pulled from the cliffs above the holding reservoir. The net was then hauled from the West end of the four acre holding reservoir and beached on the coffer dam where fish were placed in 100 qt. coolers. Fish were identified, counted, and game fish were measured in millimeters. The collected fish were released into the main upper reservoir.

Results and Discussion

The first major characteristic of the fish community in the coffer dam study site worth noting was the extreme abundance of the emerald shiner (*Notropis atherinoides*) population. These were not counted by number, but rather by the volume (in quarts) as they were so numerous (see Fig 2.2). Emerald shiners were approximately 99.9% of all fish relocated from the coffer dam study site (see appendix for estimates on abundance). A forage base capable of sustaining a sizable game fish population existed in the upper reservoir in 2006. A number of quality game fish were present in the coffer dam and top hat study sites (see Table 2.1).

Figure 2.1. Large quantities of emerald shiners being relocated from the Coffer Dam site to the main reservoir.

Figure 2.2. A typical walleye being relocated from the Coffer Dam sit to the main reservoir.

Major game fish present at the coffer dam study site included walleye (*Sander vitreus*, see Fig 2.5), rock bass (*Ambloplites rupestris*), pumpkinseed (*Lepomis gibbosus*), brown bullhead (*Ameirus nebulosus*), small mouth bass (*Micropterus dolomieui*), redbreast sunfish (*Lepomis auretes*) and common carp (*Cyprinus carpio,* see Table 2.1). All game fish were measured and released into the remaining main reservoir safely.

Table 2.1. Game species present in the 4 acre holding reservoir above the intake at the Coffer Dam and Top Hat study sites 9/26/06 and 9/27/06. Note: Emerald shiners were not included in this table, but comprise the vast majority of the fish population in the area above the hat. Emerald Shiners were counted by the quart and numbered an estimated 950 qts. of volume in this area.

Species	Number	Relative Abundance (%)	Average Length (mm)
Walleye	10	38.4%	351
Rock Bass	5	19.2%	199
Brown Bullhead	4	15.3%	248
Smallmouth Bass	5	19.2%	260
Redbreast Sunfish	1	3.8%	143
Common Carp	1	3.8%	641

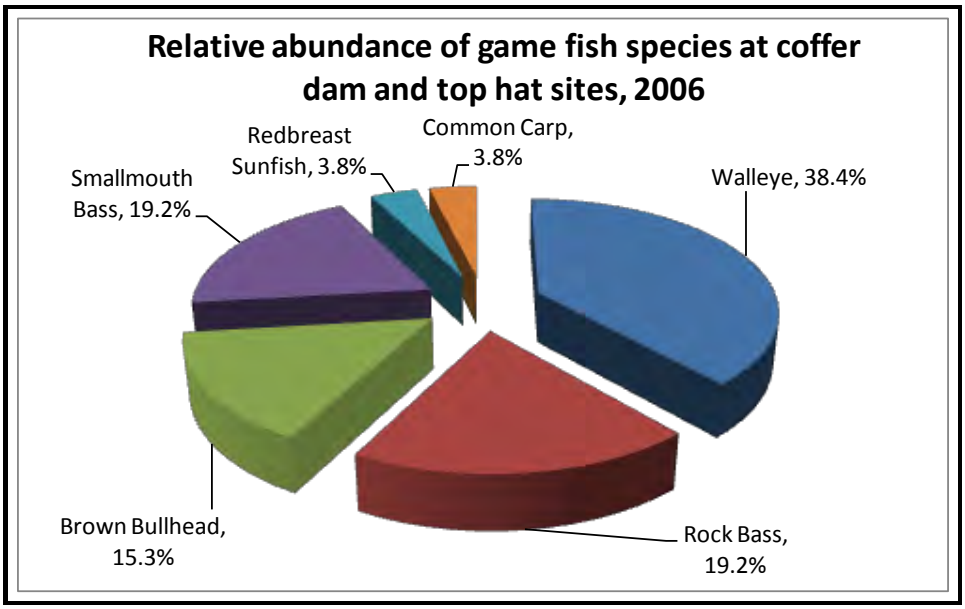

Fig 2.5. The relative abundance of game species present in the coffer dam and top hat study areas.

The abundance of walleye, rock bass and small mouth bass supports the theory that the emerald shiner base promotes the growth of predatory fish in this study site. These three species compose approximately 80% of the game fish population in this area.

The prevalence of the sunfish and carp in this study site probably do not coincide with the large bait fish population in this area, but were more likely stranded in the coffer dam region as a result of the dewatering of the reservoir and construction of the coffer dam. This can be demonstrated by the relatively small populations in comparison with other game fish in the immediate area (Fig 1.5). With the water level constantly changing, and the resulting diminished littoral (inshore) habitat, it is possible or even likely that these species spent most

of their time near the constant level ponds on the east shore of the upper reservoir, as this supports the only littoral habitat.

Chapter 3

Top Hat (2006)

This site will be referred to as the Top Hat study site and was the area immediately below the Coffer Dam study site. The area is located just above the 108 ft. hexagonal cement slab covering the intake known as the Top Hat. This area resulted when dewatering brought the water level from 1943 ft. to 1931 ft. Fish rescue occurred at this site solely in the fall of 2006.

Methods

Fish were relocated from the top hat study site by the use of the same haul seining techniques in the coffer dam site, and also by deploying a haul seine from the bow of a 14 ft john boat in the water. All fish were moved to holding tanks, were counted, and released into the main reservoir. All game fish were measured in millimeters.

Results and Discussion

The results for the Top Hat study site were similar to those of the coffer dam study site in that there was an enormous forage base present for the establishment and propagation of game species populations. Again, emerald shiners comprised nearly 99.9% of the population of the total sample size in the top hat study area, and the same major species comprised the game fish population. These results were summarized in Table 2.1 in the previous chapter.

Chapter 4

Moat (Below Top Hat)

The Moat Site is the area below the Top Hat, created by the dewatering of all remaining water within the temporary four acre holding reservoir. Dewatering processes drained all standing water from the four acre holding reservoir except for the area immediately surrounding the invert of the intake structure. Fish rescue and relocation at this site was performed in the fall of 2006 and 2007.

Methods

Fish were relocated from the moat study area by using shore seines around the trash rack at the bottom of the intake structure. This was accomplished by running two 35 ft shore seines around the base of the intake structure. The shore seines were emptied one at a time and

fish were processed by recording abundance and length in millimeters. Fish in holding tanks were then carried, by hand, up the access cut to the main reservoir, where they were successfully released into the main reservoir, on above the coffer dam.

Results and Discussion

The results for the fish rescue and relocation in the moat study site indicated similar patterns to the Coffer Dam and Top Hat study areas, with an emphasis on the emerald shiner population. The major component of the fish community in 2006 was emerald shiners, nearly 99% of all fish captured. A significantly lesser amount of emerald shiners were collected out of the moat site in 2007. Again, Emerald shiners were not counted due to the fragile nature of their existence. Shiners died when counted and the decision was made to move them, rather than count them, therefore they are not represented in the below tables and figures.

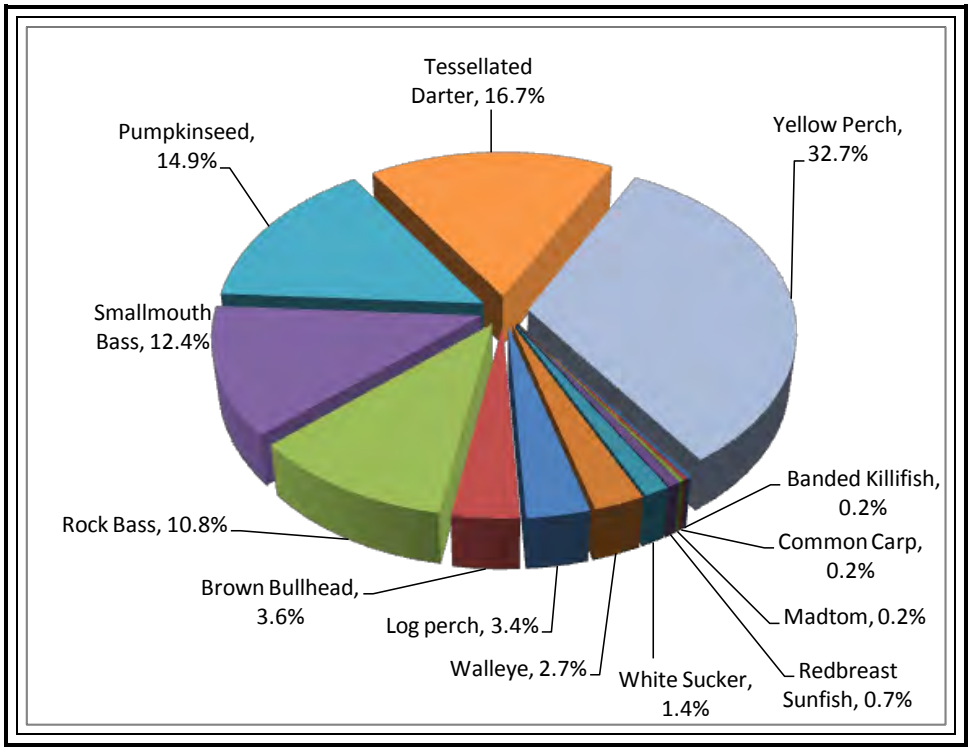

Figure 4.2. The abundance of all fish species at the moat study site. A total of 6 species were present here which were not present in the samples taken at the coffer dam and top hat sites.

The game fish population in the moat study site included yellow perch (*Perca flavescens*), walleye, small mouth bass, brown bullhead, pumpkin seed, redbreast sunfish, rock bass, and white sucker (*Catostomus commersoni*). This population shows a higher species richness than did the coffer dam and top hat study site.

Also present in the moat study site were nongame species of fish including log perch (*Percina caprodes*), tessalated darter (*Etheostoma olmstedii*), stonecat (*Noturus flavus*), common carp, and banded killifish (*Fundulus diaphnus*). These were species which were not captured in the coffer dam and top hat efforts.

Fig 4.3. A log perch from the Moat area.

The results for the fish rescue and relocation at the moat study site showed many interesting trends in fish population. The number of species in this study site was more varied than in either the coffer dam or the top hat sites. The moat relocation also included benthic and demersal fishes which were not present in earlier efforts immediately above the moat. These species comprised a large part of the overall fish community sampled. Species such as tessellated darters and white suckers present in this sample were not present in other pelagic samples because of their affinity for the reservoir bottom.

The presence of littoral species such as sunfishes and basses decreased at the moat study site. This may be because of those few littoral species which did exist in the moat study site were probably carried by current during the drawdown process rather than selecting the moat habitat. The abundance of yellow perch (see Figure 4.2) is thoroughly representative of this theory, in that it is a species primarily associated with shallow, weedy littoral communities which are not present anywhere near the moat, coffer dam, or the entire west end of the reservoir.

The emerald shiner population in the moat relocation sample was lower in 2007 than either of the previous study sites. The absence of large numbers of this species in the moat area in 2007 was conspicuous. Emerald shiners were observed at the constant level ponds and throughout the main upper reservoir after drawdown in 2007.

A lower number of fish were rescued from the moat site in 2007 when compared to 2006 (Table 4.1). The lower catch of fish in 2007 may be due to lower sampling effort. In 2006, 23 haul seines were deployed in the moat as opposed to 5 haul seines in 2007. The overall lower effort in 2007 was due to a limited time interval in which to sample the area, increased difficulty from 2006 from newly developed structure (the permanat coffer dam), and lower catch per unit effort with each seine deployment. However, catches of prized game fish, such as walleye and smallmouth bass were higher in 2007 (Table 4.1).

Table 4.1. Fish species rescued from the moat site, 2006 – 2007.

Species	2006	2007	Total	Rel. Abund.
Banded Killifish	1	---	1	0.2%
Common Carp	---	1	1	0.2%
Madtom	1	---	1	0.2%
Redbreast Sunfish	3	---	3	0.7%
White Sucker	1	5	6	1.4%
Walleye	4	8	12	2.7%
Log perch	15	---	15	3.4%
Brown Bullhead	16	---	16	3.6%
Rock Bass	30	18	48	10.8%
Smallmouth Bass	10	45	55	12.4%
Pumpkinseed	66	---	66	14.9%
Tessellated Darter	71	3	74	16.7%
Yellow Perch	143	2	145	32.7%
Total	**361**	**82**	**443**	**100%**

Chapter 5

Penstock Relocation

The penstocks were exposed when the drawdown process brought the elevation of the water level from 1931 ft. in the upper reservoir to 898 ft. in the lower reservoir. This area of the rescue and relocation project was performed 2006 only.

Fig 5.2. The Penstock study site. Elevation: 898 ft.

Methods

Fish were relocated from the penstocks through shore seine sampling techniques on 16 October 2006. All sampled fish were counted and placed into holding tanks to be relocated to the lower reservoi. Game fish were measured in millimeters. The four penstocks were the last area of fish rescue before completion of the entire rescue and relocation project in 2006.

Results and Discussion

The results of fish relocated within the penstocks portrayed a similar variance of species as in the area seined within the coffer dam. Fish as large as 465 mm were present. Emerald shiners encompassed the highest density of fauna present, however the amount of shiners were within approximate counting as opposed to volumetric measures. Smallmouth bass, white sucker, brown bullhead, walleye, and rock bass were also present in small numbers.

Table 5.1. Frequency and relative abundance of fish present in Penstocks 16 October 2006.

Species	Number	Relative Abundance
Smallmouth Bass	7	1.5%
White Sucker	1	0.2%
Brown Bullhead	3	0.6%
Walleye	3	0.6%
Emerald Shiner	450	96.4%
Rock Bass	3	0.6%
Total	**467**	**100%**

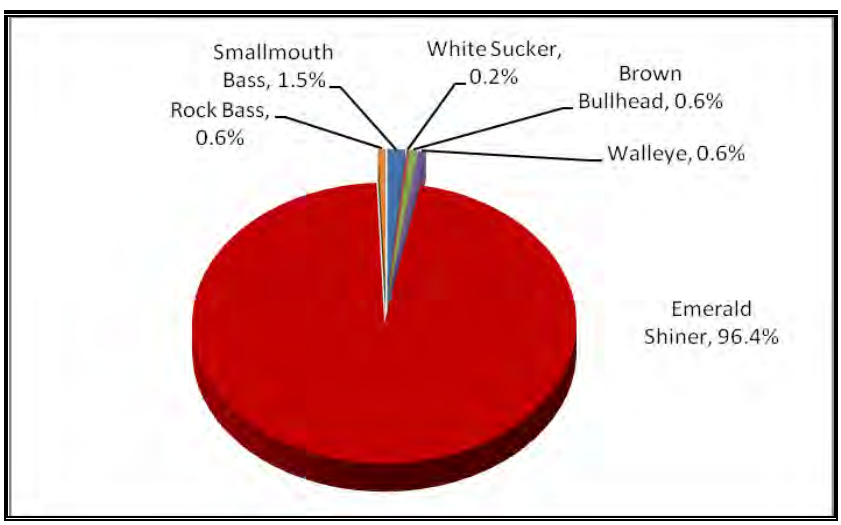

Figure 5.3. Relative abundance of fish collected in penstocks.

Figure 5.4. Mark Cornwell and Steve Coonradt performing seines within a penstock.

Figure 5.5. A walleye being rescued from penstocks.

The fish present within the penstocks represent a similar community to the Upper B-G reservoir. Despite a smaller sample size collected as opposed to the seines performed around the intake, the relative abundance of fish present remains similar. Species of all areas of water column were represented. White sucker and brown bullhead represent fish from the benthic community whereas walleye and the basses were from the rocky littoral community.

Two of the fish collected in the penstocks were over 400 mm (see appendix) indicating that sizable game fish readily fit through the trash racks of the intake structure during drawdown and when the facility is running. This indicates that an indeterminate number of game fish can fit through the trash racks. The vast food source of emerald shiners may buffer the upper reservoir game fish population stress caused by the pump system. The fish collected within the penstocks were the last fish to pass through the trash racks of the intake as the water was drawn down in the upper reservoir. They would have inevitably suffered mortality had they not been rescued.

Chapter 6

Isolated Pool Relocation

Isolated pools resulted from the initial drawdown of the upper reservoir during the elevation drop from 2003 ft. to 1943 ft. The result was several small pools at elevations ranging from 1943 ft to 1955 ft. Isolated pools were the primary focus of rescue and relocation in 2007, 2008, and 2009.

Figure 6.1. An isolated pool located near constant level ponds. Elevation: 1943 – 1955 ft. above sea level.

Methods

An effort was made to get to every isolated pool that was visible in the upper reservoir. Fish were removed from the isolated pools to the main reservoir by the deployment of shore seines. The isolated pools occurred near constant level ponds, main reservoir, and areas surrounding the coffer dam. All fish were counted and game fish were measured in millimeters. All fish were relocated to either the constant level ponds or upper reservoir, depending on their proximity to each.

Results and Discussion

The results of the fish rescue and relocation at the small pools near the constant level ponds demonstrated that very few fish of large size were stranded (or surviving) within the micro-ecosystems of the pools. The pools were much too small and stagnant to support most fish species. Of the 21 species of fish found in the isolated pools, over 85% were tessellated darter, yellow perch, emerald shiner, bluegill, or rock bass (Table 6.1; Figure 6.4).

Table 6.1. Frequency and total relative abundance of fish collected from isolated pools 2007-2009. Isolated pools were not a primary focus in 2006.

Species	2007	2008	2009	Total	Rel. Abund.
Tessellated Dater	854	4,444	2,439	7,737	32.4%
Yellow Perch	1,315	1,272	3,096	5,683	23.8%
Emerald Shiner	61	3,584	6	3,651	15.3%
Bluegill	185	1,495	147	1,827	7.6%
Rock Bass	223	590	787	1,600	6.7%
Smallmouth Bass	382	150	690	1,222	5.1%
Banded Killifish	215	675	9	899	3.8%
Pumpkinseed	298	364	165	827	3.5%
Brown Bullhead	46	205	45	296	1.2%
Log Perch	24	35	13	72	0.3%
Walleye	5	5	20	30	0.1%
Spottail Shiner	0	7	6	13	0.1%
Redbreast Sunfish	5	6	1	12	0.1%
Golden Shiner	0	9	0	9	0.0%
Stonecat	0	8	1	9	0.0%
Margined Madtom	0	7	0	7	0.0%
Largemouth Bass	0	2	3	5	0.0%
Alewife	0	2	1	3	0.0%
Carp	0	2	0	2	0.0%
Rosyface Shiner	0	2	0	2	0.0%
White Sucker	1	0	0	1	0.0%
Total	**3,614**	**12,864**	**7,429**	**23,907**	**100%**

Figure 6.2. Students performing fish rescue seines in an isolated pool.

Figure 6.3. A staple, which was found in almost every isolated pool: the banded killifish.

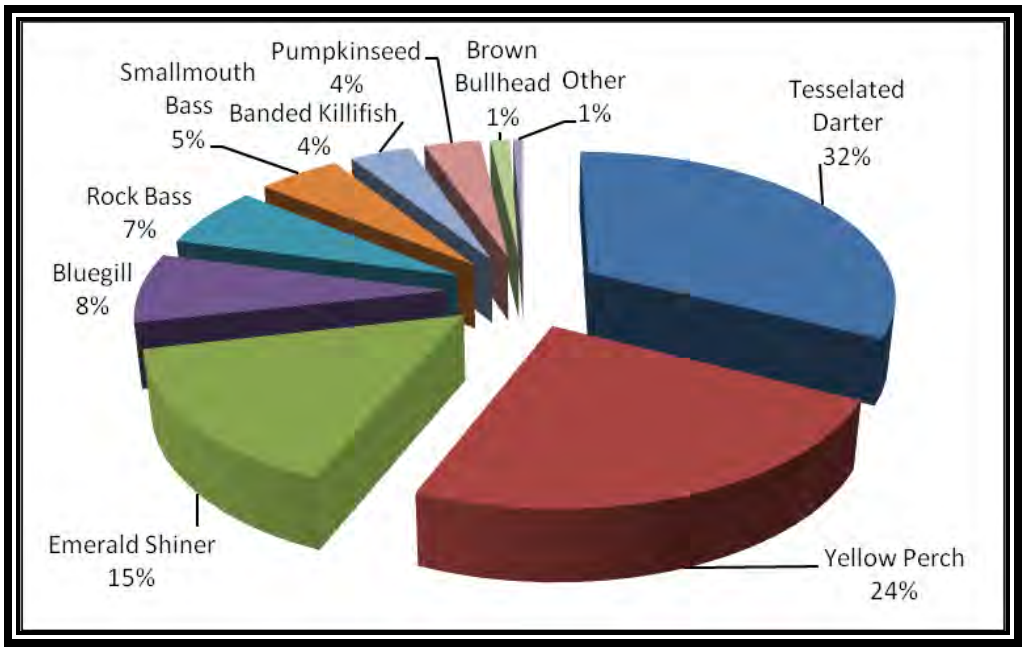

Figure 6.4. Relative abundance of fish collected from isolated pools from 2006 – 2009.

The fish rescue and relocation of the small pools was successful in moving almost 25,000 fish from 2007-2009. The most abundant fish in the isolated pools was the tessellated darter. Tessellated darters are a tolerant species and thrive in most conditions. They are well adapted for the conditions of Upper B-G as they thrive in sandy to muddy bottoms and running water. Darters also feed on aquatic insects and organic matter found within the micro-habitats of the isolated pools.

Chapter 7

Ecology of Constant Level Ponds

The constant level ponds are located at the northwestern shoreline of the main reservoir. The ponds were engineered for the purposes of maintaining a stable littoral zone offering adequate habitat for many game and pan fish and also to serve as a nursery habitat for young littoral fish. The highest relative abundance of largemouth bass (*Micropterus salmoides*) anywhere at BG occurs within the constant level ponds. These ponds become submerged intermittently with the rising levels in the upper reservoir.

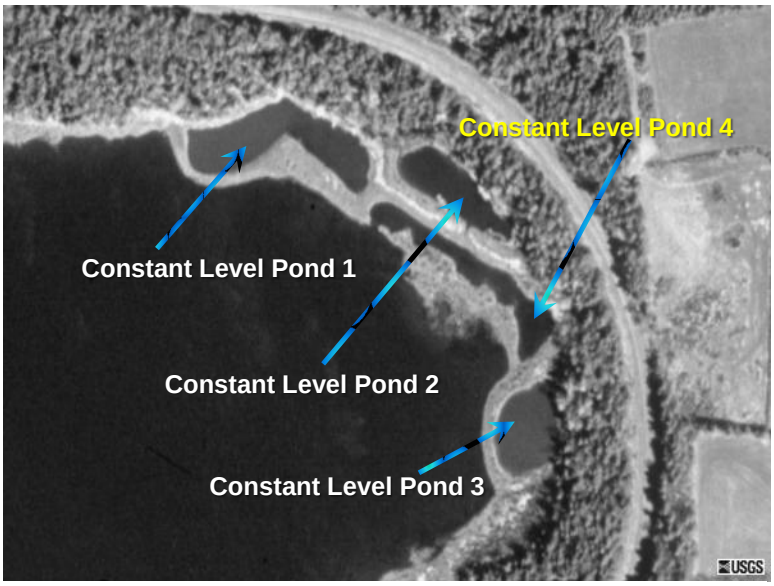

Figure 7.1. Aerial photograph of constant level ponds at the east end of the upper reservoir. Note the sequence of order.

Figure 7.2. A constant level pond with an established weedy littoral zone.

Methods

Shore seines were used to collect fish. All species were placed in temporary totes of water while they were counted. Major game and pan fish were measured with a measuring board to the nearest millimeter. After processing all fish were released within the same body of water.

Figure 7.3. Students performing shore seines on a constant level pond.

Figure 7.4. A sample of fish collected by shore seine at a constant level pond. Note the abundance of plants and panfish.

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Results and Discussion

Weedy, littoral zone associated fish species occur in each constant level pond. The sunfish family (Centrarchids) was well represented. With the exception of emerald shiners, pumpkinseeds and bluegills dominate the fish community in each pond. The overall data (see Table 7.1) may be skewed due to an uncertain number of shore seines performed on the each of the constant level ponds. Surveys of pond 2 and pond 4 were not performed in 2008. Surveys of ponds 1 and 3 were not performed in 2009.

Table 7.1. Fish fauna sampled at the four constant level ponds, 2006 – 2009.

Species	Pond 1		Pond 2		Pond 3		Pond 4	
	Number	Relative Abundance	Number	Relative Abundance	Number	Relative Abundance	Number	Relative Abundance
Emerald Shiner	1,461	63%	---	---	239	23%	119	19%
Pumpkinseed	539	23%	89	19%	250	24%	357	56%
Bluegill	85	4%	269	58%	206	20%	44	7%
Yellow Perch	165	7%	73	16%	48	5%	30	5%
Tessellated Darter	26	1%	---	---	148	14%	17	3%
Rock Bass	10	0%	16	3%	70	7%	16	3%
Smallmouth Bass	6	0%	1	0%	42	4%	28	4%
Redbreast	2	0%	4	1%	8	1%	13	2%
Brown Bullhead	6	0%	4	1%	8	1%	---	---
Banded Killifish	3	0%	---	---	---	---	4	1%
Log Perch	1	0%	---	---	3	0%	---	---
Largemouth Bass	---	---	4	1%	2	0%	7	1%
Alewife	---	---	---	---	2	0%	---	---
Golden Shiner	1	0%	---	---	---	---	---	---
Stone Cat	---	---	1	0%	---	---	---	---
Margined Madtom	---	---	---	---	1	0%	---	---

Constant Level Pond 1

The fish collected at this site primarily belonged to the sunfish or perch family. Excluding emerald shiners, yellow perch, bluegill, and pumpkinseed encompass 95% of the fish present here. Despite the large abundance of pumpkinseed and yellow perch sampled from pond-1, the presence of redbreast, bluegill, smallmouth, rock bass, brown bullhead, and tessellated darter portray a diverse littoral system. Representatives of benthic fish (brown bullhead) were also collected.

The diversity of fauna indicated the mixing of the water between the contant level ponds and the main upper reservoir. A pond of this nature should likely be dominated by weedy littoral associated species, however the presence of emerald shiners, smallmouth bass, and even rock bass indicate a connection with the main reservoir. Although more associated with rocky embankments and sparse vegetation, the smallmouth and rock bass coexist with the weedy littoral species due to the supply of prey (emerald shiners) from the main reservoir. The emerald shiners are more associated with the pelagic atmosphere of the main reservoir. Brown bullheads were observed in every area of rescue in the project, even the penstocks. The presence of brown bullhead and emerald shiners in constant level pond 2 bolsters the fact that this pond has a used connection with the main reservoir. This pond is likely submerged when the main reservoir is at its highest level or there is at least an outlet connecting the two bodies of water. The dominance of the yellow perch and pumpkinseed indicate that the plant community they depend upon in this pond is relatively unaffected by the connection with the main reservoir.

Constant Level Pond 2

Three species of fish dominated this site. Pumpkinseeds, bluegills, and yellow perch encompass about 95% of the fauna in this pond. Some of the few largemouth basses observed in any of the ponds were found here (see Table 7.1). Representing the benthic community were several brown bullheads as well as one stone cat. Pond 2 was the only constant level pond to yield a stone cat.

The species collected within this pond were highly associated with a weedy littoral environment. Only thirteen largemouth bass were collected among the constant level ponds, four of which were in this pond. This pond may be critical to the largemouth bass population in the entire reservoir. The complete absence of emerald shiners and other species more associated with pelagic and rocky littoral zones indicate that this pond may be more isolated from the main reservoir. Largemouth bass contribute to the diversity of game fish available to anglers in the Upper B-G. This body of water must be at the highest elevation of all five constant level ponds studied.

Constant Level Pond 3

This pond had the highest species richness of the four ponds. Rock bass, yellow perch, emerald shiners, tessellated darter, bluegill, smallmouth bass, and log perch were all represented in significant numbers. This pond was one of the two ponds to contain log perch, and the only pond to have a margined madtom and alewife.

Although diverse in the number of species, this pond is not overwhelmingly dominated by any particular fish. Frequent mixing with the main reservoir may prevent the establishment of a typical trophic system; where the large presence of baitfish, such as emerald shiner, dominates a much smaller number of consumers, such as panfish and bass. This pond has high association with the reservoir considering the presence of emerald shiners.

Constant Level Pond 4

Over half of the fish counted in Pond 4 were pumpkinseeds. The prominence of the yellow perch as well as centrarchid panfish once again indicates the establishment of a weedy littoral zone. Yellow perch, tessellated darter, rock bass, redbreast, bluegill, banded killifish, and smallmouth bass were seined in small numbers.

Banded killifish, which were not observed in this body of water in prior studies on the Upper B-G, are a species highly adapted to turbid water. Their presence indicates a direct relationship with this pond and the main reservoir. These two bodies of water must have frequent aquatic interaction because of the diverse index of species and the presence of banded killifish. This pond contained some of the only banded killifish obtained out of all the constant level ponds.

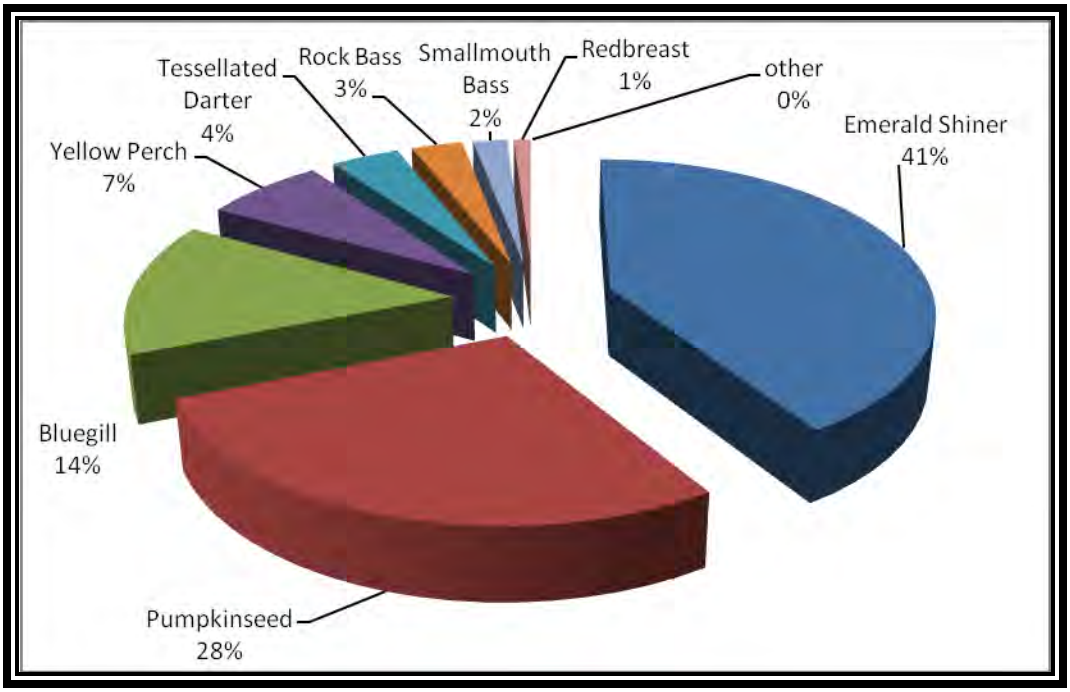


Figure 5.1. Relative Abundance of all fish species collected at all constant level ponds

The overall trend observed at these sites was the prominence of littoral game fish. Although littoral species such as pumpkinseed were seined at other locations in the reservoir (including the moat around the intake structure), they were most likely stranded at those locations from the dewatering of the Upper B-G. The relationship between the constant level ponds and the main reservoir is very important. When the upper reservoir is full of water, the shorelines meet with the constant level ponds and an exchange of fish occurs, creating diversity in both bodies of water that enhances the richness of the ecosystem.

Chapter 8

Summary

A total of 21 species of game and pan fish were relocated from the four acre holding reservoir, penstocks, and isolated ponds (see Table 8.1). An estimated weight of 1,000 lbs. of emerald shiners were also relocated in the process in 2006. Tessellated darters comprised of almost one third of all fish rescued. Approximately 28% of all fish rescued were game species. Observations of the main reservoir and constant level ponds were on a catch and release basis.

Table 8.1. Total of all fish rescued from moat, penstocks, coffer dam, and isolated pools, 2006 – 2008.

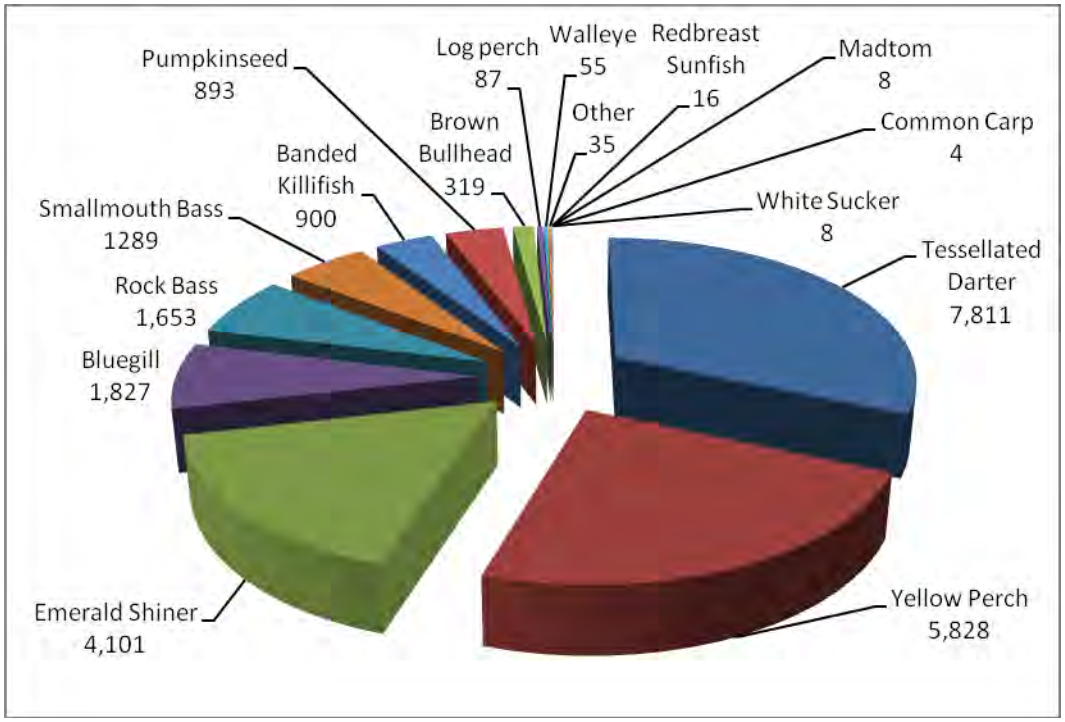
Species	Moat	Penstocks	Coffer Dam	Isolated Pools	Total	Percentage
Tessellated Darter	74	---	---	7,737	7,811	31%
Yellow Perch	145	---	---	5,683	5,828	23%
Emerald Shiner	N/A	450	N/A	3,651	4,101	17%
Bluegill	---	---	---	1,827	1,827	7%
Rock Bass	48	---	5	1600	1653	7%
Smallmouth Bass	55	7	5	1222	1289	5%
Banded Killifish	1	---	---	899	900	4%
Pumpkinseed	66	---	---	827	893	4%
Brown Bullhead	16	3	4	296	319	1%
Log perch	15	---	---	72	87	0%
Walleye	12	3	10	30	55	0%
Other	---	---	---	35	35	0%
Redbreast Sunfish	3	---	1	12	16	0%
Madtom	1	---	---	7	8	0%
White Sucker	6	1	---	1	8	0%
Common Carp	1	---	1	2	4	0%
Total	**443**	**464**	**26**	**23,901**	**24,834**	100%

The fish rescue and relocation project from 2006 – 2009 was successful. At least one thousand pounds of emerald shiners were relocated in 2006, providing a stable keystone to the ecosystem of the reservoir and an excellent prey source for the relocated walleye and other predatory fish. The presence of emerald shiners indicated an abundance of zooplankton. If the zooplankton population is dense, a high amount of primary production is taking place by phytoplankton, despite the turbid waters. The constant change of water level of the reservoir created by the pumped power system limits any primary production created in a weedy littoral zone. Therefore, the entire ecosystem is dependent on the primary production of the pelagic phytoplankton or the detrital pathway. Legal game and pan fish are present in good numbers due to the vast source of prey (emerald shiners).

Despite the considerable efforts to rescue fish, some changes were notable from year to year. An item of concern was that the observed 1,000 lbs. of emerald shiners rescued in 2006,

were not present at the end of the LEM in 2009. The 2009 fish rescue efforts produced only six emerald shiners. This drastic drop in the shiner population is unexplained. Banded Killifish also delined. In 2007-2008 banded killifish relative abundance was quite high; however, in 2009 only nine killifish were rescued.

Some species such as the yellow perch and smallmouth bass actually increased during the LEM. Both of these species had larger numbers rescued in 2009 compared to 2008. This increase in population is also unexplained.



This project provided new information on the upper reservoir and the constant level ponds. The reservoir appears to have regular direct relationship with all but one of the constant level ponds, despite the absence of a natural watershed. The constant level ponds provide a contributing source of productivity to the main reservoir through the frequent contact with each other due to the constant change of the shoreline.

The only futile efforts performed during the entire project were when the water was level with the top hat of the intake in 2006. The physical features of the top hat structure made it almost impossible to use the 300 ft. haul seine in the four acre holding reservoir. Although the action was attempted, it proved to be hazardous to the equipment used and more time consuming than productive. The remaining fish that were not seined during this time were later rescued in the moat or in the penstocks.