2006

Fisheries Monitoring at Mel Price Lock & Dam: May 2005 – June 2006

Nathan Caswell
U.S. Fish and Wildlife Service

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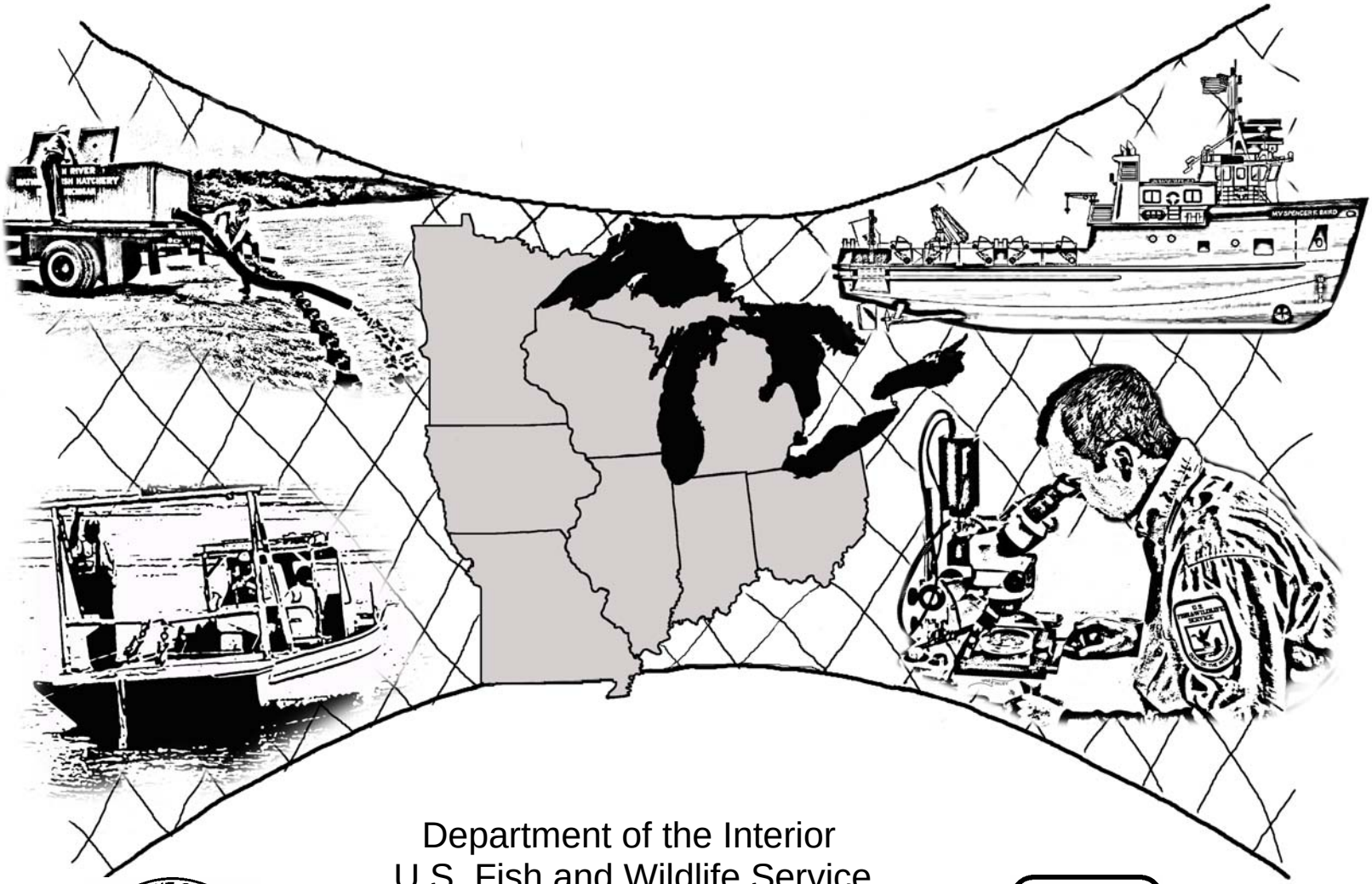

Department of the Interior
U.S. Fish and Wildlife Service
Great Lakes-Big Rivers Region
Carterville Fishery Resources Office
Nathan Caswell

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Introduction

The U.S. Army Corps of Engineers (USACE) Upper Mississippi River-Illinois Waterway System (UMR-IWW) Navigation Study was completed in September 2004 after more than 14 years of intensive study and evaluation of the navigation improvement and ecological restoration needs for the UMR-IWW system for the years 2000-2050. The final recommendation included a program of incremental implementation and comprehensive adaptive management to achieve the dual purposes of ensuring a sustainable natural ecosystem and navigation system. The program was initiated in 2005 as the working title of Upper Mississippi River (UMR) System Navigation and Ecosystem Sustainability Program (NESP) (USACE 2006).

A series of 29 navigation locks and dams is used to manage water levels on 1,033 km of the northern reach of the UMR. Dams impose at least partial barriers to passage of the 143 indigenous fishes (Pitlo et al. 1995) in the UMR (Fremling et al. 1989). Improving upriver fish passage through the navigation dams is recognized as a way to manage the UMR toward a more sustainable river ecosystem (UMRCC 2001; Wilcox et al. 2004). Under the NESP, an interdisciplinary and interagency Navigation Study Fish Passage Team was formed to study fish passage opportunities and alternatives at navigation dams on the UMR (Wilcox et al. 2004).

The Fish Passage Team selected Mel Price Lock and Dam near Alton, Illinois as the location for one of the first fish passage projects on the UMR navigation system. The objective of this study was to determine the species composition of fish aggregations identified through hydroacoustics below Mel Price Lock and Dam. This primarily qualitative study took place in 2005 and 2006, and was accomplished through cooperation with the USACE M/V Boyer. Prior to each sampling event, the M/V Boyer conducted hydroacoustic surveys at the dam to locate fish aggregations. These aggregations were then sampled to determine which species were being located by the M/V Boyer.

This report is a synopsis of our findings from May 2005 through June 2006. The tailwater area of Mel Price Lock and Dam was broken down into three general areas that were repeatedly sampled throughout the year. Results and discussion for each area are treated separately.

Study Site

The study site for this project was the tailwater area of Mel Price Lock and Dam near Alton, Illinois. Throughout all sampling periods, the M/V Boyer identified three general areas below the lock and dam that repeatedly held concentrations of fish based on hydroacoustic surveys. Site 1 was the area below the auxiliary lock along the left descending bank (LDB) extending down below the end of the lock approach wall (Figure 1). Site 2 was the area between the main and auxiliary locks. Site 3 was along the right descending bank (RDB), generally below the public boat ramp. Some limited sampling was conducted in this area above the boat ramp, but not enough to make generalizations about that area.

Methods

Sampling methods for this project have evolved through time. The original intent for this project was to use only deep-water electrofishing for sampling fish aggregations below Mel Price Lock and Dam. We used a 5000-W, 3-phase AC generator (Multi-Quip Model GDP 5000H) wired to

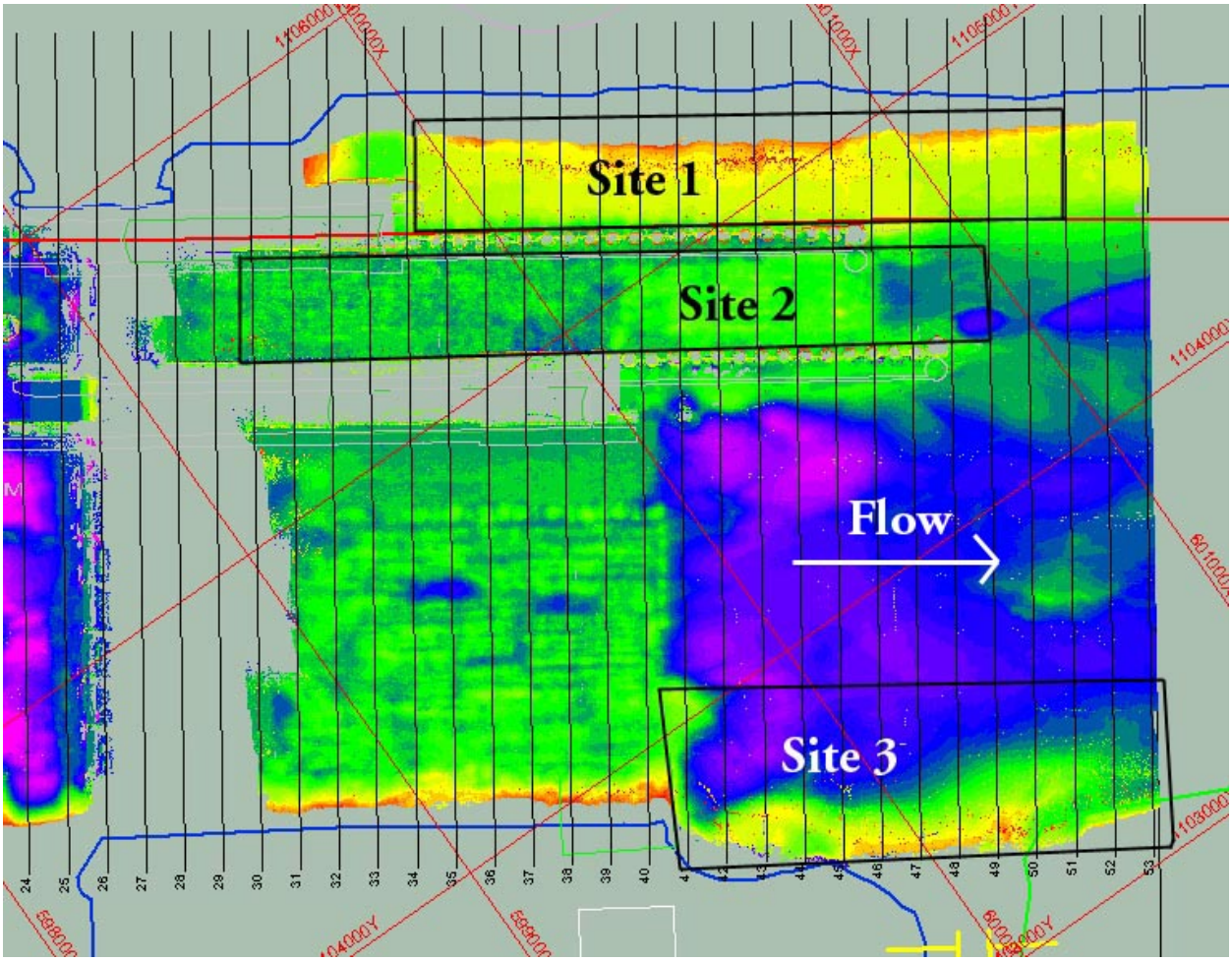

Figure 1. Bathymetric map of the Mel Price Lock and Dam tailwater area showing sampling sites for deep-water electrofishing and netting from June 2005 to June 2006.

three 1.2-m x 6.0-cm diameter electrodes constructed from galvanized steel fence posts. A 12-V powered relay was used with a dual dead-man safety switch system. Wires running to the individual electrodes were 16-ga. multi-strand copper wire. Ropes were used to suspend the electrodes and attach the wires. A chase boat was used to retrieve fish that surfaced away from the electrofishing boat, and each boat had one person to dip fish.

The first trip in May 2005 was unsuccessful, likely due to high water temperature (22^{o}C) which increases the conductivity of fish but decreases their susceptibility to electrofishing. Deep-water electrofishing is not reputed to be effective in water temperatures over 20^{o}C (Jim Garvey, SIUC, pers. comm.). After the unsuccessful deep-water electrofishing attempt, we returned the following week, and began using a variety of gill and trammel nets to sample the tailwaters of Mel Price Lock & Dam. Nets used at Mel Price Lock and Dam included: 1) 5.1-cm bar mesh monofilament gill nets (45.7 m X 2.4 m), 2) experimental multifilament gill nets (30.5-m X 1.8 m), 3) 8.9-cm bar mesh trammel nets (91.4-m X 2.4-m), 4) 8.9-cm bar mesh floating trammel nets (91.4 m X 3.0 m), and 5) 1.2-m diameter hoop nets (See Table 1 for locations and dates). Nets were set on the bottom, at the surface, suspended in the water column, or drifted as needed to capture fish identified at various depths by the M/V Boyer. Deep-water electrofishing, rather

than nets, was used at Mel Price Lock and Dam during November 2005. Cooler water temperatures (12.6-13.0°C) allowed this method to be used effectively during November while allowing us to target fish at specific depths including the middle of the water column.

Table 1. Net types used and dates of use at sampling sites below Mel Price Lock and Dam during June 2005 – June 2006. Net types include 1) monofilament gill, 2) experimental multifilament gill, 3) trammel, 4) floating trammel, and 5) hoop.

Site	Dates			
	June 05	Nov 05	April 06	June 06
1	2[a], 2[b]	-	1:2[d], 3	-
2	1, 2	-	-	-
3	1, 2, 3[bc]	-	1:2, 4[e]	1, 1[c], 2, 3, 4[d], 5

[a] surface set

[b] suspended

[c] drift

[d] colon indicates tandem set

[e] floating net, bottom set

Similar to November 2005, the water temperatures during the April 2006 survey were also cool enough (12.2-13.5°C) to make deep-water electrofishing effective. Deep-water electrofishing had proven to be moderately effective in capturing fish at various depths, but during the April 2006 survey, we found it was especially effective for fish that are on or near the substrate. As such, we electrofished along the bottom for much of the time we were sampling. In addition, we used a combination of gill and trammel nets to supplement the electrofishing catch.

Water temperatures were too warm (26°C) for deepwater electrofishing to be effective during the June 2006 survey, so we concentrated our efforts on netting. This sample included hoop nets, as well as gill and trammel nets. Only Site 3 was sampled during this time as conditions at Site 2 were too dangerous for setting nets, and nets were lost due to barge traffic at Site 1.

Results and Discussion

Site 1

The first trip by the M/V Boyer to Mel Price Lock and Dam in May 2005 showed large numbers of fish concentrated in the area just below the auxiliary lock. Our sonar showed large numbers of small fish suspended 2-5 m below the surface. Our initial assumption was that these were schools of gizzard shad (*Dorosoma cepedianum*). After the deep-water electrofishing failed, we set nets on and just below the surface in June 2005. We caught two gizzard shad, but we also caught three juvenile silver carp (*Hypophthalmichthys molitrix*) that were ≤200 mm total length (Table 2). We then observed numerous juvenile silver carp jumping around our nets, but not becoming entangled. In addition, we observed juvenile silver carp jumping throughout this area in response to the disturbance created by our boat (Figure 2). Given the fact that gizzard shad should be relatively easy to catch with gill nets, and given the fact that we observed so many

juvenile silver carp, we concluded that the large concentration of fish just below the surface was predominantly silver carp.

Table 2. Totals and species of fish captured at Site 1 below Mel Price Lock and Dam during June 2005 – June 2006. Asterisks denote migratory species as defined in Wilcox et al. (2004).

Species	June 2005	November 2005	April 2006	June 2006	Total
Bighead carp, *Hypophthalmichthys nobilis**	1		2	N	3
Bigmouth buffalo, *Ictiobus cyprinellus**			1	O	1
Blue catfish, *Ictalurus furcatus**	1	12	57		70
Bluegill, *Lepomis macrochirus**			1		1
Channel catfish, *Ictalurus punctatus**		28	46	S	74
Common carp, *Cyprinus carpio*		10	4	A	14
Flathead catfish, *Pylodictis olivaris**		1		M	1
Freshwater drum, *Aplodinotus grunniens**	1	45	70	P	116
Gizzard shad, *Dorosoma cepedianum*	2	64	50	L	116
Goldeye, *Hiodon alosoides**			2	E	2
Goldfish, *Carassius auratus*		15			15
Lake sturgeon, *Acipenser fulvescens**			1		1
Paddlefish, *Polydon spathula**		1			1
Quillback, *Carpoides cyprinus**			1		1
River carpsucker, *Carpoides carpio*	1	14	13		28
Sauger, *Sander Canadensis**		1	1		2
Shorthead redhorse, *Moxostoma macrolepidotum**	5		1		6
Shovelnose sturgeon, *Scaphirhynchus platorynchus**			3		3
Silver carp, *Hypophthalmichthys molitrix**	4	1	3		8
Smallmouth buffalo, *Ictiobus bubalus**		1			1
Skipjack herring, *Alosa chrysochloris**	4				4
Walleye, *Sander vitreum**		1			1
White bass, *Morone chrysops**		3			3
Ictiobus *spp.*			1		1
Total	**19**	**197**	**257**		**473**

Although concentrations of fish were also marked in this area during November 2005, they were not nearly as dense as they were in May/June, and we did not observed the large numbers of silver carp. Rather, this trip revealed a fish community at this site more typical of many areas of the Mississippi River. The most abundant species were gizzard shad (n = 64), freshwater drum (*Aplodinotus grunniens*; n = 45), channel catfish (*Ictalurus punctatus*; n = 28), blue catfish (*Ictalurus furcatus*; n = 12), goldfish (*Carassius auratus*; n = 15), and river carpsucker (*Carpoides carpio*; n = 14). A range of depths were electrofished throughout this area, however the majority of the fish during this trip were captured when the electrodes ran along the bottom.

The M/V Boyer marked fish in this area during the April and June 2006 trips, but no large aggregations were present. Nevertheless, the catch was higher in April 2006 than the previous trips. This was the result of focusing our electrofishing efforts on the substrate rather than the middle of the water column. However, we feel confident that these are the species the Boyer crew marked. The catch was higher, but the species composition was similar to the November 2005 trip. The most abundant species were gizzard shad (n = 50), freshwater drum (n = 70), blue catfish (n = 57), and channel catfish (n = 46). Nets were set at this site during the June 2006 trip,

but they were lost due to barge activity in the area. The nets were not reset because a barge was moored along the LDB, so there was no June 2006 sample at this site.

Figure 2. Juvenile silver carp jumping in Site 1 sampled by USFWS Carterville Fishery Resources Office during June 2005.

Throughout the year we captured 23 species in this area including one lake sturgeon (*Acipenser fulvescens*), one paddlefish (*Polydon spathula*), and three shovelnose sturgeon (*Scaphirhynchus platorynchus*). However, 79% of the overall catch was composed of four species: blue catfish, channel catfish, freshwater drum, and gizzard shad. Of the 37 Upper Mississippi River "migratory" species identified in Wilcox et al. (2004), we caught 19 in this site. Of these, 13 species are represented by $\leq$3 individuals and 16 species are represented by $\leq$8 individuals. Of the three abundant migratory species (blue catfish, channel catfish, freshwater drum), the majority of the individuals were juvenile and non-migratory. Approximately 56% of the blue catfish and 68% of the channel catfish were <150 mm, and 59% of the freshwater drum were <250 mm total length (Figures 3-5).

We believe that Site 1, primarily the area just below the auxiliary lock, functions as a "backwater" area. Like many backwaters, the fish may simply be using it as a feeding and nursery area. It is not entirely slack water, but whatever current is there is typically very slow. Depths range from zero at the shoreline to 10 m or more near the lock wall. The substrate

appears to be fairly soft, with rock revetment along the shoreline. This area provides a diversity of depths, and the lock walls provide abundant vertical structure. It is possible that the adult fish we caught there at any given time were not attempting to migrate at this location because its characteristics are like those of a backwater. That is, the characteristics of this site are not those that would attract actively migrating fish.

Given the physical characteristics of this site, and the fact that we caught few adult fish that could truly be considered "migratory," we do not recommend this site for a fish passage structure at Mel Price Lock and Dam as it is currently operated. There has been discussion of assisted fish lockage through the auxiliary lock. However, the physical characteristics of this site (lack of flow) somewhat preclude the presence of large numbers of would-be "target species." In addition, we question whether an attracting flow could be generated for a long enough duration to attract sufficient numbers of these species. Future work at this site should include increasing flow and determining how migratory fish respond.

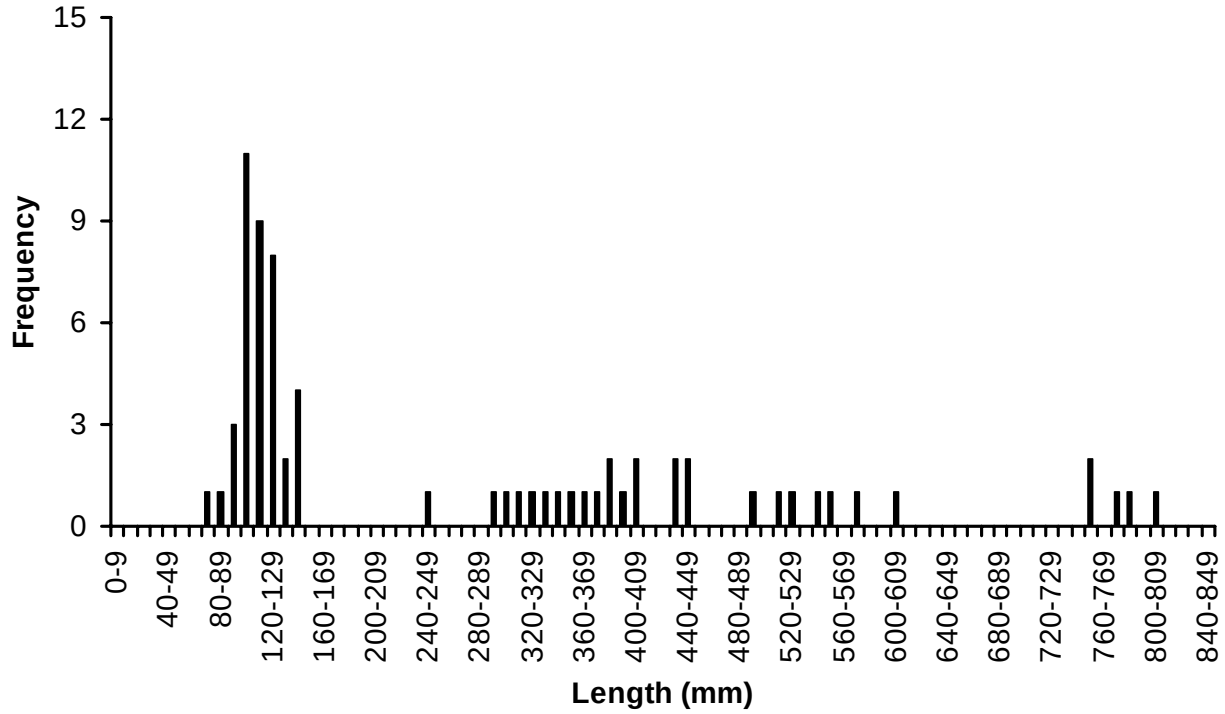

Figure 3. Length-frequency distribution for blue catfish (*Ictalurus furcatus*; n = 70) captured at Site 1 below Mel Price Lock and Dam during June 2005 – June 2006.

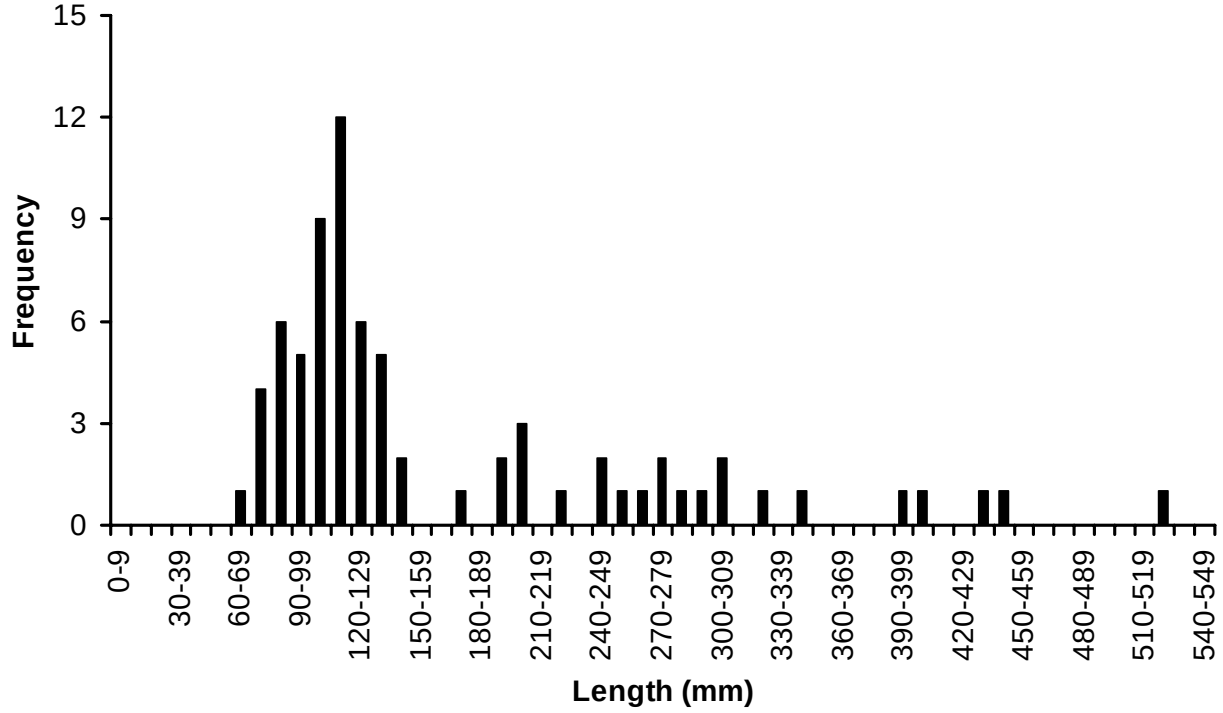

Figure 4. Length-frequency distribution for channel catfish (*Ictalurus furcatus*; n = 74) captured at Site 1 below Mel Price Lock and Dam during June 2005 – June 2006.

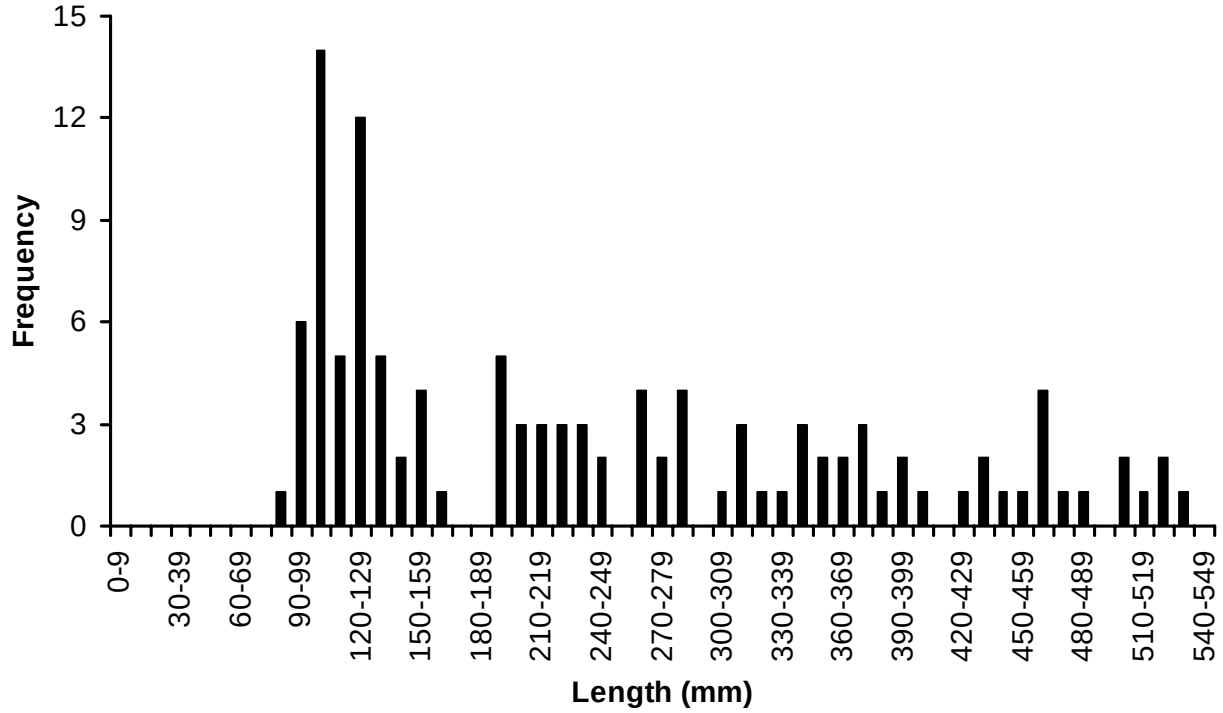

Figure 5. Length-frequency distribution for freshwater drum (*Aplodinotus grunniens*; n = 116) captured at Site 1 below Mel Price Lock and Dam during June 2005 – June 2006.

Site 2

The first trip by the M/V Boyer to Mel Price Lock and Dam in May 2005 showed small concentrations of fish in the area between the locks. In June 2005, we sampled one small concentration of fish along the RDB wall relatively close to the dam gates. Netting in this location during June 2005 resulted in the capture of only 11 fish from four species (Table 3). Two of those fish were shovelnose sturgeon, and seven were blue catfish, including one that was 1090 mm total length and approximately 18 kg. In addition to our catch, we noted Asian carp (likely silver carp) jumping at the dam gates between the locks.

Table 3. Totals and species of fish captured at Site 2 below Mel Price Lock and Dam during June 2005 – June 2006. Asterisks denote migratory species as defined in Wilcox et al. (2004).

Species	June 2005	November 2005	April 2006	June 2006	Total
Bighead carp, *Hypophthalmichthys nobilis**		1	5	N	6
Bigmouth buffalo, *Ictiobus cyprinellus**		1		O	1
Blue catfish, *Ictalurus furcatus**	7		244		251
Blue sucker, *Cycleptus elongates**			1		1
Channel catfish, *Ictalurus punctatus**			2	S	2
Common carp, *Cyprinus carpio*		1		A	1
Flathead catfish, *Pylodictis olivaris**			1	M	1
Freshwater drum, *Aplodinotus grunniens**		1	4	P	5
Gizzard shad, *Dorosoma cepedianum*		6		L	6
Goldeye, *Hiodon alosoides**	1			E	1
River carpsucker, *Carpoides carpio*		3			3
Shovelnose sturgeon, *Scaphirhynchus platorynchus**	2				2
Silver carp, *Hypophthalmichthys molitrix**		4	1		5
Smallmouth buffalo, *Ictiobus bubalus**	1	4	3		8
Total	**11**	**21**	**261**		**293**

During November 2005, the M/V Boyer noted fish concentrated in this site along the LDB wall 2-7 m deep. In addition, fish were located throughout this area, but were not concentrated. A total of 21 fish from eight species were captured here during this trip. The most abundant were gizzard shad (n = 6), silver carp (n = 4), and smallmouth buffalo (*Ictiobus bubalus*; n = 4). Although we had noticed an increase in catch rates when the electrodes were run along the substrate, this area was deeper (up to 10 m) than where the Boyer had noted fish. Thus, we did not electrofish the bottom during November 2005.

The M/V Boyer marked large concentrations of large fish in this site during April 2006. Most of the fish were on or near the bottom 5-10 m deep (Figure 6). We electrofished at these depths, but catches were low except when we ran the electrodes on or within 1 m of the bottom. We captured 261 fish from eight species at this site during November. Electrofishing at 7 m produced only six fish, four of which were bighead carp (*Hypophthalmichthys nobilis)* and silver carp. The 9.5-m runs produced 56 fish, 50 of which were blue catfish. Electrofishing on the bottom produced 193 blue catfish and only six other fish. Of the 251 blue catfish captured at this site during the year, 244 were captured during April 2006. One fish was 130 mm total length and the remaining 250 were 342 mm – 1300 mm total length (Figure 7). No samples were collected at this site in June 2006. Water temperatures were too high for deep-water

electrofishing to be effective, and dangerous currents between the locks prevented the crew from setting nets.

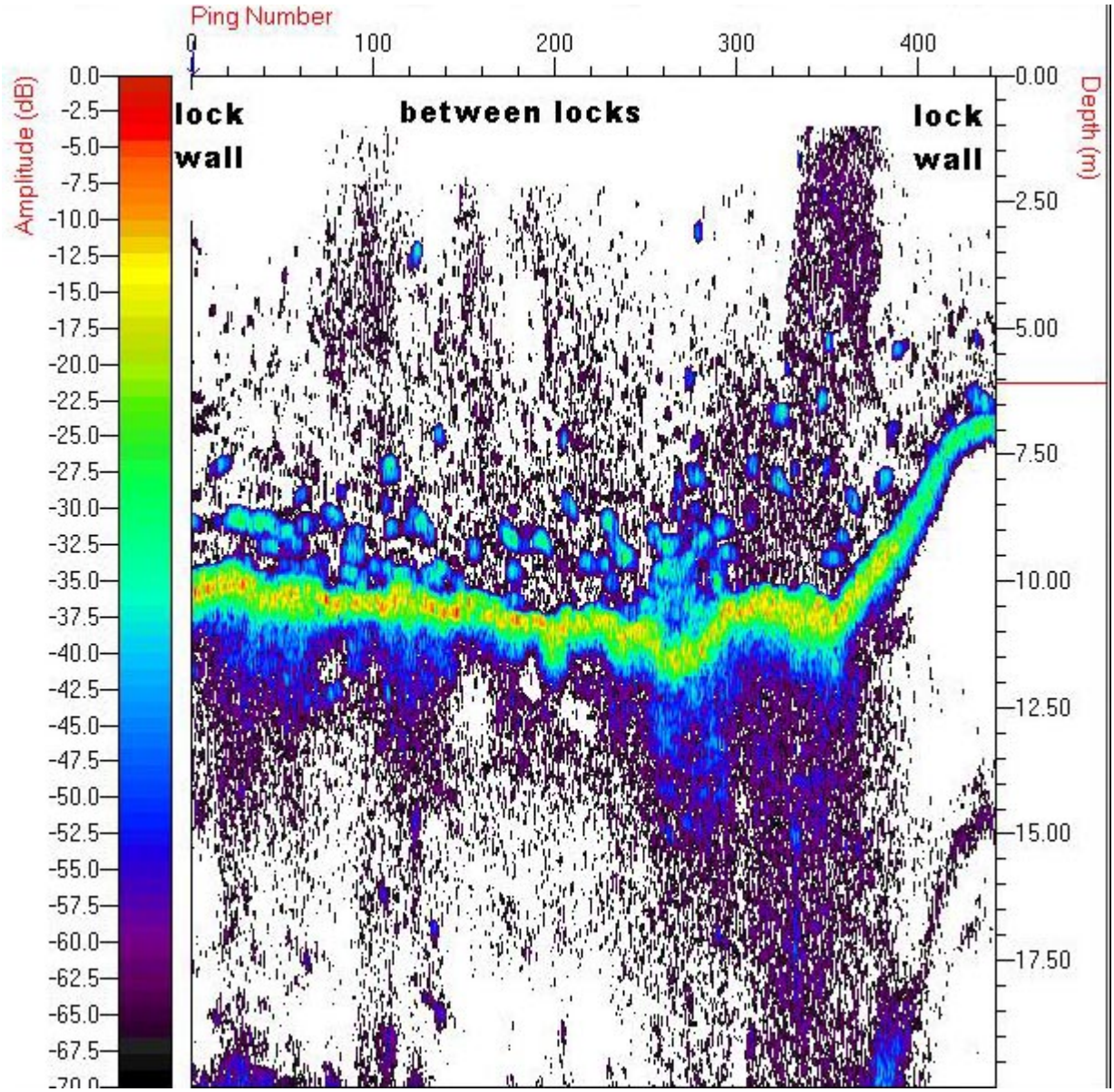

Figure 6. Hydroacoustic output from the M/V Boyer at Site 2 below Mel Price Lock and Dam during April 2006.

Site 2 is characterized by vertical walls (lock walls) with deep water (up to 11 m) in between. When the dam gates are open there are strong downstream currents and turbulent water along the walls. When either of the locks is being emptied, the water is highly turbulent from the outflow of the lock. Although some smaller fish were captured in this site, the majority of our catch was composed of large fish (>300 mm). Our catch was highest during the April 2006 sample, and this was also when the M/V Boyer marked the greatest numbers of large fish in this area. We believe we have collected a relatively good representation of the species that are present at this site. In this case they included blue catfish and a few other species (e.g. Asian carp, buffalo).

We may not have captured Asian carp in proportion to the numbers present at this site at different times, but Asian carp are notoriously difficult to capture in any location. We can speculate that the concentration of blue catfish was here for one of two reasons: either this was a large feeding aggregation, or they were, in fact, migrating and trying to pass the dam (or both). We feel that this area may have potential for fish passage improvements due to the high flows when the gates are open and the presence of high numbers of adults of at least one migratory species.

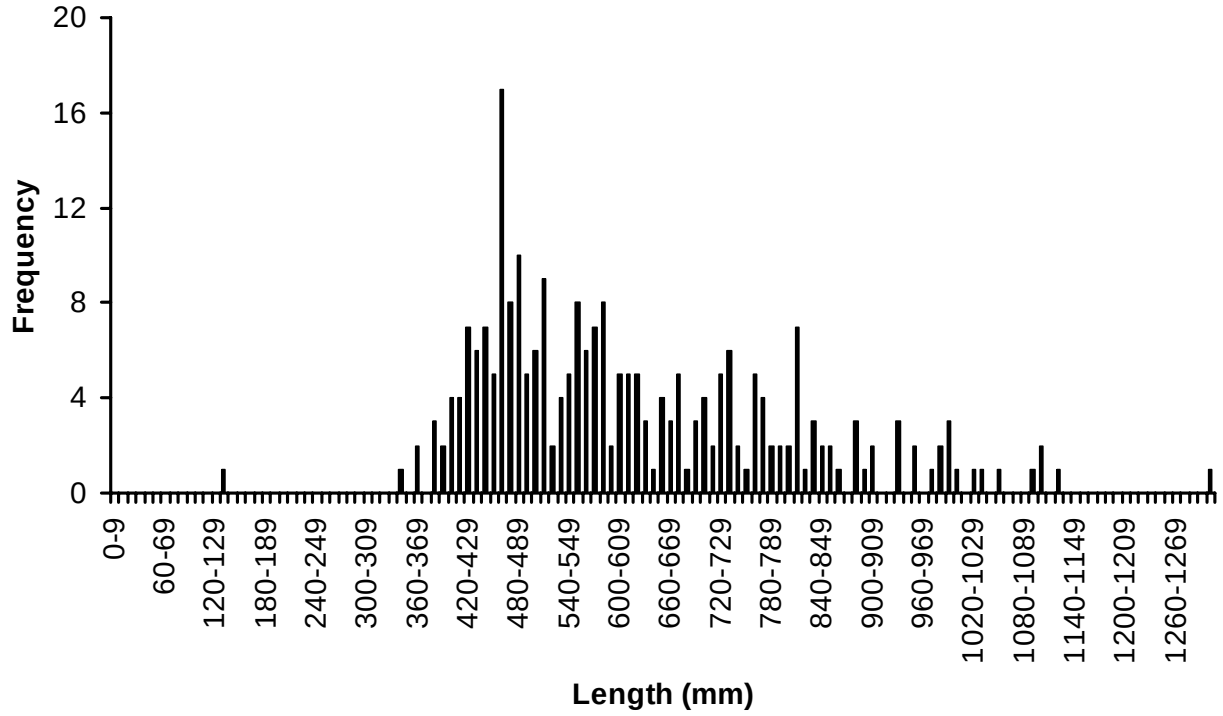

Figure 7. Length-frequency distribution for blue catfish (*Ictalurus furcatus*; n = 251) captured at Site 2 below Mel Price Lock and Dam during June 2005 – June 2006.

Site 3

Site 3 held large numbers of fish during every sampling period throughout the year. Unfortunately, these fish proved difficult to catch. Fish were typically concentrated along the slope of the shoreline ranging 5-12 m deep. Many of the fish were rather large based on the hydroacoustic images (Figure 8). Our initial assumption was that these fish were either Asian carp, paddlefish, both. Stationary or bottom set netting during June 2005 produced only 54 fish from eight species (Table 4). However, 42 of the fish were shovelnose sturgeon. Nets were drifted as well, but did not produce any paddlefish or Asian carp. We did observe numerous adult Asian carp jumping at this site in the vicinity of the Maple Island Chute, and we also observed several adult paddlefish surfacing in open water off Maple Island itself.

The November 2005 and April 2006 samples produced similar results. Large numbers of fish were marked along the RDB, but we succeeded in capturing only 13 fish from four species during the November sample, and 66 fish from 10 species during the April sample. The most

abundant species during the April sample were shovelnose sturgeon (n = 26) and freshwater drum (n = 22). No paddlefish were produced in either sample, and only seven silver carp were captured during the April 2006 sample. The Illinois Department of Natural Resources (IDNR) participated in the April sample, even drifting specially-made paddlefish nets with no success. However, numerous snag fishermen were using the shoreline above the site to fish for paddlefish. We informally interviewed two unrelated snag fishermen on the last day of our sample. Both fishermen gave the same reply when asked how many Asian carp they were catching for every paddlefish they caught, "about 10:1."

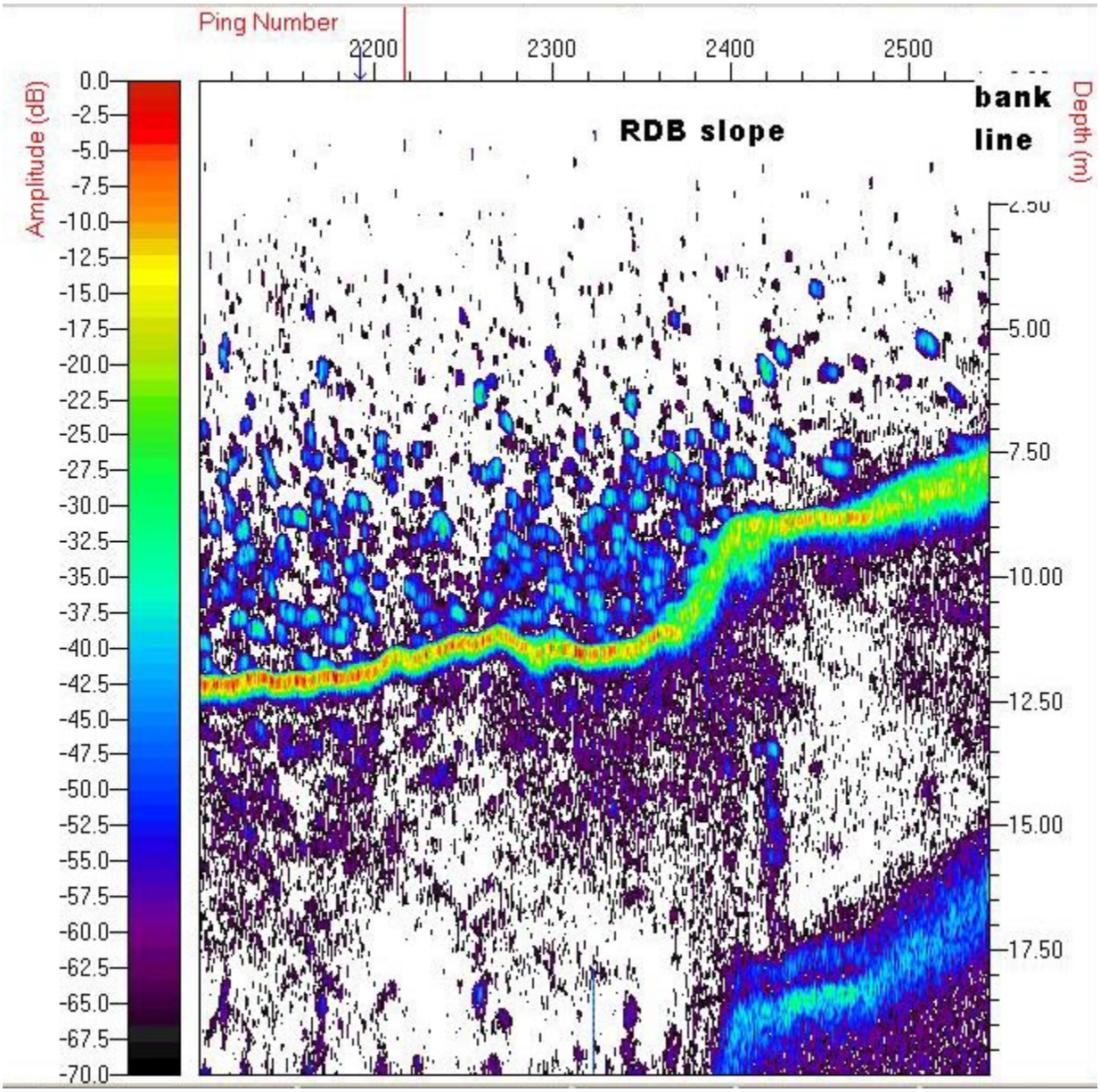

Figure 8. Hydroacoustic output from the M/V Boyer at Site 3 below Mel Price Lock and Dam during April 2006.

The June 2006 sample gave credence to what the fishermen were experiencing. We captured 123 fish from 18 species. Two of the most abundant species were bighead carp (n = 22) and silver carp (n = 11). In addition, nine paddlefish were also captured during this sampling period. The water elevation during this sample was relatively low, which may have helped to increase our catches over previous attempts. However, the fact that our catch ratio was greater than 3:1 Asian carp to paddlefish, and given the difficulty of capturing Asian carp, we feel that what the fishermen described (10:1) may have been close to the actual ratio of Asian carp to paddlefish in that area at that time. This would account for the lack of success in capturing the large numbers of fish marked in this area despite the fact that many different methods were used.

Table 4. Totals and species of fish captured at Site 3 below Mel Price Lock and Dam during June 2005 – June 2006. Asterisks denote migratory species as defined in Wilcox et al. (2004).

Species	June 2005	November 2005	April 2006	June 2006	Total
Bighead carp, *Hypophthalmichthys nobilis**				22	22
Bigmouth buffalo, *Ictiobus cyprinellus**				2	2
Black buffalo, *Ictiobus niger*				7	7
Black crappie, *Pomoxis nigromaculatus*				1	1
Blue catfish, *Ictalurus furcatus**	2	2		11	15
Channel catfish, *Ictalurus punctatus**			1	5	6
Common carp, *Cyprinus carpio*	1		2	1	4
Flathead catfish, *Pylodictis olivaris**	1		2	4	7
Freshwater drum, *Aplodinotus grunniens**	5	5	22	14	46
Gizzard shad, *Dorosoma cepedianum*	1	4	1	8	14
Goldeye, *Hiodon alosoides**			2		2
Lake sturgeon, *Acipenser fulvescens**			1		1
Paddlefish, *Polydon spathula**				9	9
Quillback, *Carpoides cyprinus**				2	2
River carpsucker, *Carpoides carpio*	1	2		10	13
Sauger, *Sander Canadensis**				2	2
Shovelnose sturgeon, *Scaphirhynchus platorynchus**	42		26	7	75
Silver carp, *Hypophthalmichthys molitrix**			7	11	18
Smallmouth buffalo, *Ictiobus bubalus**			2	5	7
Skipjack herring, *Alosa chrysochloris**	1				1
White bass, *Morone chrysops**				2	2
Total	**54**	**13**	**66**	**123**	**256**

Site 3 has the most habitat diversity of all of the sites. Depths range from zero at the shoreline to more than 12 m. There is a strong, steady current present throughout most water elevations. There is a strong back-eddy just below the upstream end of the site, and there is a large side channel present here. We believe that the concentrations of large fish present in this site throughout the year were primarily Asian carp, some paddlefish, and an assortment of common riverine species. We feel that the physical characteristics of the river along the RDB and the layout of Mel Price Lock and Dam may make the RDB the most suitable location for a fish passage structure. In addition, the strong steady currents appear to attract numbers of large fish at different times of the year.

An argument could be made against choosing this location for a fish passage structure due to the high numbers of Asian carp that are apparently present in this location. However, Asian carp have already expanded their range far above Mel Price Lock and Dam. Creating fish passage for native species (e.g. paddlefish, shovelnose sturgeon, lake sturgeon) may be the best option to help restore native species regardless of the presence of Asian carp. Biologists have captured large numbers of paddlefish in this area in the past (Butch Atwood, Illinois Department of Natural Resources, pers. comm.).

Recommendations

At this time we do not recommend Site 1 as a suitable site for a fish passage structure, pending further investigation of assisted lockage. We do recommend Site 2 for further consideration for fish passage improvements due to the high flows when the gates are open and the presence of high numbers of adults of at least one migratory species during part of the year. We also recommend Site 3 for further consideration for fish passage improvements because the physical characteristics and fish community at this site may make it a suitable location.

We recommend that additional sampling be conducted at Mel Price Lock and Dam in order to learn more about the fish community below the dam at different times of the year under different annual water regimes. What we saw in 2005-2006 may not be what we would see if the dam was to enter "open river" conditions, which it did not do in 2006. Another alternative would be to focus our efforts during the spring when most migratory fish would be moving upriver. When water temperature is below 20^{o}C, a combination of deep-water electrofishing and netting will be used to collect future samples. Netting alone will be used when water temperatures are $\geq$20^{o}C.

Regardless of the sampling regime selected for FY 2007, we feel that the Fish Passage Team should also discuss, and possibly redefine, the goals of this project. Until this point the project has been largely *qualitative*. This is acceptable as long as that is what we are looking for. If we simply want to know what the M/V Boyer is seeing, we believe we have accomplished that. We have learned some very valuable information about the fish community below the dam. We could improve on the qualitative study by intensifying sampling at sites 2 and 3 and reducing sampling at Site 1. That is, unless the Team wishes to experiment with assisted lockage at this site. By focusing our work on fewer areas below the dam we could follow even more closely behind sampling by the M/V Boyer which can be critical when the river approaches open river conditions.

If a *quantitative* approach is desired, we should reevaluate our methods. Until now, the M/V Boyer has mapped concentrations of fish, and we have attempted to sample those concentrations through whatever means was necessary. As previously discussed, sampling methods were inconsistent and have evolved over time. This prevents most quantitative analyses due to the bias introduced by continually changing methods. At this point we cannot even legitimately determine a necessary sample size to detect a change for a given species because the samples we have taken thus far are not similar. In order to make this a quantitative study to examine changes brought about by a fish passage structure, we would need to develop a consistent sampling protocol and would have to be less flexible in response to the information we receive from the Boyer. In short, the team needs to use the information we have gathered to date, and determine what course of action may be most beneficial to the project.

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