

FINAL REPORT

Evaluation of Larval Fish Density and Diversity within Main Channel and Main Channel Border Habitats of Pools 16, 20, and 22 of the Upper Mississippi River

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**Prepared by:
Harding ESE, Inc.
St. Louis, Missouri
William J. Elzinga, Principal Investigator**

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6. AUTHOR(S) Bryan W. Fuhr under supervision of William J. Elzinga, Principal Investigator			
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13. ABSTRACT (<i>Maximum 200 words</i>) Larval fish sampling was conducted on the Upper Mississippi River (UMR) within main channel and main channel border habitats of Pools 16, 20, and 22 from April 22 through July 17, 2002. Ichthyoplankton sampling resulted in the collection of 148,610 larval fish representing 14 taxa. Freshwater drum (<i>Aplodinotus grunniens</i>) and members of the family Cyprinidae were the dominant taxa in each pool. Mean larval fish densities were highest in June (2.77 fish/m ³) and lowest in the month of May (0.13 fish/m ³). Overall mean fish densities were similar among Pools 20 and 22 (1.54 and 1.37 fish/m ³ , respectively), while Pool 16 had a significantly lower overall density (0.71 fish/m ³).			
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List of Abbreviations and Acronyms

H'	Shannon-Wiener Diversity Index
IWW	Illinois Waterway
MC	main channel
MCB	main channel border
LDB	left descending bank
RDB	right descending bank
RM	River Mile
UMR	Upper Mississippi River
m	meter
m ³	cubic meter
cm	centimeter
mm	millimeter
District	U.S. Army Corps of Engineers – Rock Island District
GPS	Global Positioning System

1.0 Introduction

The U.S. Army Corps of Engineers, Rock Island District (District) is directed by Congress to maintain a 2.75 meter (m) (9-foot) navigation channel on the Upper Mississippi River (UMR) and Illinois Waterway (IWW). Maintenance of the navigation channel involves operating a series of Locks and Dams to maintain minimum pool elevations.

The Upper Mississippi River-Illinois Waterway System Navigation Study, ('Navigation Study') is a feasibility study addressing navigation improvement planning for the UMR and IWW navigation systems for the years 2000-2050. The study assesses the need for navigation improvements at 29 lock and dam facilities (35 locks) on the UMR and 8 locks on the IWW and the impacts of providing these improvements.

Navigation improvements associated with the Navigation Study would likely result in an increase in commercial navigation traffic in the UMR and IWW. This increase in navigation traffic could result in adverse impacts to fisheries communities of the UMR and IWW. One way that fisheries communities may be adversely affected is through propeller entrainment mortality of larval fish. To help characterize potential impacts from larval fish entrainment, the Corps has reviewed available data and has contracted with Harding ESE to conduct additional larval fish sampling to characterize larval fish drift within the UMR.

The purpose of this project is to evaluate larval fish density and diversity within the planktonic drift of main channel and main channel boarder habitats of Pools 16, 20, and 22 of the UMR. Primary tasks to be performed included:

- 1) Perform a series larval drift transect samples across main channel (MC) and main channel border (MCB) habitats of Pools 16, 20, and 22 of the Upper Mississippi River; and
- 2) Prepare a short technical report describing results of the survey. MC and MCB habitats are as defined in the Habitat Needs Assessment for the Upper Mississippi River Technical Report (Corps of Engineers 2000).

2.0 Methods and Materials

2.1 Field Sampling

Ichthyoplankton samples were collected on the UMR during the period April 22 through July 17, 2002. Sampling was performed once during April, twice per month during May and June, and once during July. Diurnal samples were collected during daylight hours (i.e., collection between 0900 and 1600 hours) during each sampling period. In addition to diurnal samples, nocturnal samples (i.e., collection between 2000 to 2400 hours) were taken during three sample periods (two in May, one in June) in the upper reach of each pool. For each sample period involving nocturnal sampling, 24-hour sampling was also performed within the upper reach of Pool 16. 24-hour samples were collected at 6-hour intervals over a period of one day, starting at 0600. The collection at 1200 hours during these sample periods doubled as the diurnal sample, and the collection at 2400 hours doubled as the nocturnal sample for Pool 16.

Sampling was performed along two transects each within Pools 16, 20, and 22 of the UMR. Each transect included one sample collected from the left descending main channel border, one sample from within the main channel, and one sample from the right descending main channel border (i.e., three samples per transect). In each pool, sampling was performed along one transect within the upper reach of the pool, and one transect from the lower reach. Samples were collected from transects at River Miles (RM) 478.0 and 462.2 in Pool 16, RM 360.4 and 344.5 in Pool 20, and RM 323.0 and 304.0 in Pool 22. In total, 153 samples were collected throughout the study.

Sampling was accomplished by towing paired 1-meter 500-micron mesh ichthyoplankton nets upstream approximately 10-cm below the water surface using a boom mounted to the bow of the boat. Each net was equipped with a General Oceanics 2030R Flowmeter to measure the volume of water passing through each net. Each tow was ten minutes in length while maintaining a velocity of 1.0 to 1.5 meters per second through the mouth of each net. A Garmin III Plus GPS was used to mark the starting location of each tow. Starting, middle, and end river depths were recorded for each sample tow. In addition, surface current velocity was measured with a Flowwatch digital meter; water temperature, dissolved oxygen, and pH were measured with a Hydrolab Minisonde unit; and turbidity was measured using a LaMotte Turbidimeter. Each water chemistry parameter was measured after each tow run at a depth of about 30 centimeters.

Each net was washed down from the open end to the collection bucket. The samples from each net were combined and measured to the nearest tenth (0.1) liter. Samples were then transferred into pre-labeled containers and preserved in 10 percent buffered formalin with rose bengal stain added. The samples were then transferred to Harding ESE's laboratory for processing.

2.2 Laboratory Processing

Upon return to the laboratory, samples were logged and entered into Harding ESE's sample tracking system. The samples were sorted by first washing each sample in a 500-micron sieve to remove excess formalin, rose bengal, and silt. A small portion of the sample was then placed in a white sorting pan and examined under a 2x-lighted magnifier. Using forceps, all fish (larvae, juveniles, and adults) were removed, enumerated, and placed in a pre-labeled jar containing 40% isopropyl alcohol. Sorting efficiency was monitored through quality assurance checks conducted by Harding ESE fisheries biologists and fisheries interns. Ten percent of the samples collected were checked for quality assurance. Harding ESE, Inc. Quality Assurance protocols mandate a 90 percent sorting efficiency to pass each lot of samples.

Larval fish were identified, enumerated, and measured using dissecting microscopes equipped with cross-polarized light. Ichthyoplankton taxonomic identifications were made to the lowest level possible (usually family) according to Hogue, et.al. (1976), Auer (1982), and Holland-Bartels (1999). Each taxonomist developed a reference collection containing a representative specimen of all species collected. Damaged or degraded specimens were placed in an unknown category. For each sample the first twenty-five fish of each species were randomly measured in total length to the nearest millimeter.

2.3 Data Analysis

Fish densities were calculated using the number of fish collected in a given sample, divided by the total volume of water sampled (No. fish/m³). MCB densities were calculated by taking total fish collected for the combined left descending bank (LDB) and right descending bank (RDB) and dividing by the total volume of water sampled. Mean fish densities were calculated by averaging the individual fish densities (Sum of Fish Densities/Number of Samples) or by averaging mean fish densities (Sum of Mean Fish Densities/Number of Samples). The Shannon-Wiener Diversity Index (H') was used to describe the diversity of taxa collected. This diversity index has two properties: (1) H' = 0 if and only if there is one species in a sample, and (2) H' is maximum only when all species are represented by the same number of individuals, that is, a perfectly even distribution of abundance. The Shannon-Wiener Diversity equation using natural logarithms is:

$$H' = -\sum_{i=1}^{S^*} (p_i \ln p_i) \text{ (Ludwig and Reynolds 1988).}$$

3.0 Results

3.1 Overview

Larval fish sampling on the UMR resulted in the collection of 153 samples that contained a total of 148,610 larval fish representing 14 different taxa (Table 1). In April, common carp, *Ictiobus/Carpiodes*, and Percidae were all common in collections. In May, common carp and *Ictiobus/Carpiodes* were still common, along with Hiodontidae. By June, freshwater drum and Cyprinidae became co-dominants, and this trend continued into July. Members of the family Clupeidae were also common in June. Uncommon or poorly represented taxa included channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictis olivaris*), paddlefish (*Polydon spathula*), Cottidae, Esocidae and Lepisosteidae.

Results of individual samples collected are presented in Table 2, and include tow time, sample volume for each net, and fish abundance and density within each sample. Tow duration for each sample collected was generally held constant at 600 seconds throughout the sample period. The volume of water sampled by each net was generally similar between samples (approximately 413 m³ per net). Total sample volume (both nets combined) averaged 826.0 m³, with a range from a 424.1 m³ in Pool 16 in early June, to 1,083.6 m³ in Pool 16 in July. Low volumes were generally the result of heavy amounts of floating debris, reducing flow through the nets.

Overall, the mean density was 1.15 fish/m³ (Table 1). However, the density of fish collected was highly variable between sampling locations and dates. Mean larval fish densities within each pool and reach of pools generally remained low until a dramatic increase in June. Densities began to decline again during diurnal sampling in July. Density ranged from a low of 0.01 fish/m³ collected from a sample in Pool 16 in late May, to a high of 26.94 fish/m³ collected from a sample in Pool 20 in early June (Table 2).

3.2 Pool Summaries

Results from analyses of samples from each pool are presented in Table 3 for Pools 16, 20, and 22. In general, total mean densities of the combined collection from Pools 20 and 22 were relatively similar (1.54 and 1.37 fish/m³, respectively), while mean density in Pool 16 was lower (0.71 fish/m³). Shannon-Wiener Diversity Index and taxonomic richness values varied slightly between pools ranging from 9 taxa (Diversity = 1.08) in Pool 20 to 12 taxa (Diversity = 1.46) in Pool 16. Low diversity values from each of the pools were undoubtedly due to the high abundance of the two dominant taxa (freshwater drum, Cyprinidae).

Other taxa that were common in collections included *Cyprinus carpio*, *Ictiobus/Carpiodes* sp., Clupeidae, Percidae, Catostomidae, Centrarchidae, and Hiodontidae from Pool 16; Clupeidae, *Ictiobus/Carpiodes* sp., Hiodontidae, *Cyprinus carpio*, Catostomidae, and Percidae from Pool 20; and *Ictiobus/Carpiodes* sp., *Cyprinus carpio*, Catostomidae, Clupeidae, Percidae, and Hiodontidae from Pool 22.

3.3 Temporal and Spatial Results

3.3.1 Monthly Summary

A presentation of seasonal sampling results is provided in Table 4. June was the peak month for larval fish collection, as densities averaged 2.77 fish/m³ (>116,000 specimens collected for all pools combined). This result was consistent among the three pools sampled, although slightly lower in Pool 16. In Pools 20 and 22, mean fish density resulted in over 3.28 fish/m³ (>37,000 larval fish collected per pool), while in Pool 16, over 26,000 fish were collected resulting in a density of 1.46 fish/m³. Larval fish collection was lowest in May, as densities averaged 0.13 fish/m³ (<7,000 specimens collected). This result also was consistent among the three pools sampled. July yielded a high amount of larval fish among the three pools as overall density averaged 1.09 fish/m³ (>20,000 specimens collected), while April yielded low overall densities (0.34 fish/m³, <4,700 specimens collected). In order from the highest to lowest month for total mean larval fish density, results ranked as follows: June > July > April > May.

3.3.2 Diurnal/Nocturnal Sample Summary

For dates with both day and night sample collections, combined mean larval fish densities were slightly greater for samples collected during the daytime (overall mean density of 0.73 fish/m³) compared to those collected at night (overall mean density of 0.60 fish/m³; Table 5). However, differences did exist between pools. Within Pools 20 and 22, diurnal samples contained higher mean densities (0.88 and 0.83 fish/m³, respectively) than those for nocturnal samples (0.53 and 0.45 fish/m³, respectively). In contrast, Pool 16 had a greater mean nocturnal density (0.81 fish/m³) than mean diurnal density (0.47 fish/m³; Table 5). There were no considerable differences in species composition between day and night samples during the diurnal/nocturnal sample periods.

3.3.3 Twenty-Four Hour Summary

Temporal and spatial results of 24-hour sampling performed in the upper reach of Pool 16 are provided in Tables 6 through 8. Overall, 24-hour samples taken in June yielded a higher mean density (1.77 fish/m³) than samples taken in May (0.15 fish/m³; Table 6). For the two 24-hour sampling events during May, mean densities for all collection times remained relatively constant, ranging from 0.11 to 0.19 fish/m³ (Table 7). For the single 24-hour sampling event during June, mean densities increased considerably, with densities ranging from 1.19 fish/m³ for samples collected at 1200, to 2.04 fish/m³ for samples collected at 2400 (Table 8).

3.3.4 Spatial Summary

Monthly sampling results for the upper and lower reaches of each pool are presented in Table 9. Samples collected from the upper section of Pool 16 had higher mean densities in April and May relative to those within the lower pool, and lower mean densities in June and July. With the exception of Pool 22 in June, mean monthly densities for Pools 20 and 22 were higher for the upper pool reaches, compared to the lower pool reaches.

Table 10 compares spatial diurnal and nocturnal sampling results across each transect. For diurnal samples, the main channel border (MCB) yielded the highest total mean density (1.42 fish/m³), and the main channel (MC) was slightly lower (1.24 fish/m³). Densities were generally lower in the nocturnal samples. The MCB yielded the highest nocturnal density (0.69 fish/m³) and the MC resulted in a lower total mean density (0.26 fish/m³). It is important to restate that nocturnal sampling was only performed in the upper reaches of each pool.

Tables 7 through 8 present the summary of spatial sampling results for 24-hour sampling in Pool 16. May results yielded the highest average density in the MC (0.16 fish/m³; Table 7), Mean density within the MCB was 0.14 fish/m³. June results were considerably higher than May results (Table 8), with a density of 2.32 fish/m³ in the MC. MCB density was lower at 1.50 fish/m³.

Tables 11-19 provide detail regarding the trends in taxa density with respect to sample location within the channel. In this regard, the following general trends may be observed:

- ❑ Pool 16: densities within the lower pool were typically greatest within the MC,
- ❑ Pool 16: densities within the upper pool were generally greatest in collections taken from the MC,
- ❑ Pool 20: densities within the lower pool fluctuated among MC and MCB habitats, although the MC most frequently yielded the highest densities,
- ❑ Pool 20: densities within the upper pool were greatest in collections taken from the MCB,
- ❑ Pool 22: densities within the lower pool were typically greatest within the MCB, and
- ❑ Pool 22: densities within the upper pool were greatest in collections taken from the MCB.

Tables 20-22 present taxa density trends with respect to sample location for each collection time during the 24-hour sampling events. For each collection time, densities were generally greatest in collections taken from the MC.

3.4 Length Analysis

A representative number of individuals of each taxon were measured from each sample to provide information about trends in larval fish length and hence, developmental stage. Tables 23 to 25 present a summary of the mean lengths of fish specimens collected from each pool during each month.

In general, most larvae, regardless of date of collection or pool location, were found to have total lengths ranging from 5-10 mm. This is particularly true for most of the dominant taxa (i.e., freshwater drum, Cyprinidae, common carp, *Ictiobus/Carpiodes* sp., etc.). There were, however, a few notable exceptions to this general trend. For example, mean lengths of Hiodontidae were typically 8-16 mm, the one Lepisosteidae specimen collected had a length of 23 mm, and the one channel catfish (*Ictalurus punctatus*) specimen collected had a length of 21 mm. In addition, mean lengths of Clupeidae increased from 5-10 mm in April, May, and June to approximately 19 mm in July.

4.0 References

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Table 1. Mean total density of larval fish (expressed as No./m³) collected in Pools 16, 20, and 22 of the Upper Mississippi River, 2002.

Species	Mean Density (No./m ³)			
	April	May	June	July
Catostomidae	0.012	0.010	0.042	0.005
Centrarchidae	0.003	0.002	0.012	0.006
Clupeidae	0.001	0.001	0.091	0.015
Cottidae			0.002	
<i>Cyprinus carpio</i>	0.220	0.017	0.058	0.013
Cyprinidae	0.005	0.005	0.852	0.439
Esocidae		0.001		
Hiodontidae	0.003	0.033	0.009	
<i>Ictalurus punctatus</i>			0.001	
<i>Ictiobus/Carpiodes</i> sp.	0.059	0.070	0.052	0.003
Lepisostidae			0.001	
<i>Morone</i> sp.			0.011	
Percidae	0.051	0.011	0.008	0.001
<i>Polydon spathula</i>		0.002	0.001	
<i>Pylodictis olivaris</i>			0.001	
Sciaenidae			1.673	0.613
Unknown	0.010	0.005	0.018	0.005
Total Fish Collected	148,610			
Species Richness	14			
Mean Density	1.15			
Shannon-Wiener Diversity Index	1.29			

Table 2. Monthly density of larval fish (No. fish/m³) collected in Pools 16, 20, and 22 of the Upper Mississippi River, 2002.

Sample Location	Sample ID	Date	Tow Time (Seconds)	Volume Sampled		No. Fish	Fish Density (No./m ³)
				Net 1 (m ³)	Net 2 (m ³)		
Diurnal							
Pool 16 - Upper	P16-UD-RDB	4/24/2002	600	345.50	340.86	1,028	1.50
Pool 16 - Upper	P16-UD-MC	4/24/2002	600	390.05	391.32	591	0.76
Pool 16 - Upper	P16-UD-LDB	4/24/2002	600	420.81	411.97	411	0.49
Diurnal							
Pool 16 - Lower	P16-LD-RDB	4/24/2002	600	399.93	407.77	354	0.44
Pool 16 - Lower	P16-LD-MC	4/24/2002	600	424.75	426.95	291	0.34
Pool 16 - Lower	P16-LD-LDB	4/24/2002	600	320.82	331.81	563	0.86
Diurnal							
Pool 20 - Upper	P20-UD-RDB	4/23/2002	600	426.40	415.41	256	0.30
Pool 20 - Upper	P20-UD-MC	4/23/2002	600	398.05	373.77	31	0.04
Pool 20 - Upper	P20-UD-LDB	4/23/2002	600	243.95	232.62	37	0.08
Diurnal							
Pool 20 - Lower	P20-LD-RDB	4/23/2002	600	402.90	423.57	97	0.12
Pool 20 - Lower	P20-LD-MC	4/23/2002	600	395.96	418.85	110	0.14
Pool 20 - Lower	P20-LD-LDB	4/23/2002	600	274.56	265.17	34	0.06
Diurnal							
Pool 22 - Upper	P22-UD-RDB	4/22/2002	600	449.37	482.22	274	0.29
Pool 22 - Upper	P22-UD-MC	4/22/2002	600	394.21	410.96	116	0.14
Pool 22 - Upper	P22-UD-LDB	4/22/2002	600	412.33	417.39	140	0.17
Diurnal							
Pool 22 - Lower	P22-LD-RDB	4/22/2002	600	456.02	456.48	312	0.34
Pool 22 - Lower	P22-LD-MC	4/22/2002	600	393.91	370.58	55	0.07
Pool 22 - Lower	P22-LD-LDB	4/22/2002	600	361.19	350.37	35	0.05
Mean Density (No./m³) for 4/24/02 Diurnal Sample Period							0.34

Diurnal = daytime sampling between 0900 and 1600 hours

Table 2. (cont.) Monthly density of larval fish (No. fish/m³) collected in Pools 16, 20, and 22 of the Upper Mississippi River, 2002.

Sample Location	Sample ID	Date	Tow Time (Seconds)	Volume Sampled		No. Fish	Fish Density (No./m ³)
				Net 1 (m ³)	Net 2 (m ³)		
24-Hour Sampling							
Pool 16 - Upper	P16-UD-RDB(0600)	5/12/2002	600	285.31	288.80	152	0.26
Pool 16 - Upper	P16-UD-MC(0600)	5/12/2002	600	356.62	353.68	69	0.10
Pool 16 - Upper	P16-UD-LDB(0600)	5/12/2002	600	303.35	306.81	27	0.04
Diurnal 24-Hour Sampling							
Pool 16 - Upper	P16-UD-RDB(1200)	5/12/2002	600	333.54	341.05	187	0.28
Pool 16 - Upper	P16-UD-MC(1200)	5/12/2002	600	398.76	402.86	115	0.14
Pool 16 - Upper	P16-UD-LDB(1200)	5/12/2002	600	198.57	228.38	10	0.02
24-Hour Sampling							
Pool 16 - Upper	P16-UD-RDB(1800)	5/12/2002	600	402.44	406.09	313	0.39
Pool 16 - Upper	P16-UD-MC(1800)	5/12/2002	600	391.55	403.74	150	0.19
Pool 16 - Upper	P16-UD-LDB(1800)	5/12/2002	600	263.73	278.54	21	0.04
Nocturnal 24-Hour Sampling							
Pool 16 - Upper	P16-UN-RDB(2400)	5/13/2002	600	381.83	382.25	206	0.27
Pool 16 - Upper	P16-UN-MC(2400)	5/13/2002	600	404.06	417.46	180	0.22
Pool 16 - Upper	P16-UN-LDB(2400)	5/13/2002	600	198.17	236.46	35	0.08
Diurnal							
Pool 16 - Lower	P16-LD-RDB	5/11/2002	600	404.33	418.57	68	0.08
Pool 16 - Lower	P16-LD-MC	5/11/2002	600	426.65	437.90	77	0.09
Pool 16 - Lower	P16-LD-LDB	5/11/2002	600	359.59	365.75	43	0.06
Diurnal							
Pool 20 - Upper	P20-UD-RDB	5/10/2002	600	452.26	468.17	29	0.03
Pool 20 - Upper	P20-UD-MC	5/10/2002	600	439.56	440.11	34	0.04
Pool 20 - Upper	P20-UD-LDB	5/10/2002	600	378.83	402.14	113	0.14
Nocturnal							
Pool 20 - Upper	P20-UN-RDB	5/10/2002	600	441.38	455.07	69	0.08
Pool 20 - Upper	P20-UN-MC	5/10/2002	600	421.42	438.70	33	0.04
Pool 20 - Upper	P20-UN-LDB	5/10/2002	600	378.03	397.22	129	0.17

Diurnal = daytime sampling between 0900 and 1600 hours

Nocturnal = nighttime sampling between 2000 and 2400 hours

Diurnal 24-Hour Sampling = 24-hour samples taken during daytime (1200 hours)

Nocturnal 24-Hour Sampling = 24-hour samples taken during nighttime (2400 hours)

Table 2. (cont.) Monthly density of larval fish (No. fish/m³) collected in Pools 16, 20, and 22 of the Upper Mississippi River, 2002.

Sample Location	Sample ID	Date	Tow Time (Seconds)	Volume Sampled		No. Fish	Fish Density (No./m ³)
				Net 1 (m ³)	Net 2 (m ³)		
Diurnal							
Pool 20 - Lower	P20-LD-RDB	5/10/2002	600	436.10	448.38	39	0.04
Pool 20 - Lower	P20-LD-MC	5/10/2002	600	452.58	459.31	65	0.07
Pool 20 - Lower	P20-LD-LDB	5/10/2002	600	368.81	397.86	51	0.07
Diurnal							
Pool 22 - Upper	P22-UD-RDB	5/8/2002	600	468.06	510.72	255	0.26
Pool 22 - Upper	P22-UD-MC	5/8/2002	600	487.66	497.91	38	0.04
Pool 22 - Upper	P22-UD-LDB	5/8/2002	600	475.43	487.98	27	0.03
Nocturnal							
Pool 22 - Upper	P22-UN-RDB	5/9/2002	600	473.95	479.67	516	0.54
Pool 22 - Upper	P22-UN-MC	5/9/2002	600	414.88	432.05	29	0.03
Pool 22 - Upper	P22-UN-LDB	5/9/2002	600	363.81	403.51	70	0.09
Diurnal							
Pool 22 - Lower	P22-LD-RDB	5/8/2002	600	459.31	467.77	296	0.32
Pool 22 - Lower	P22-LD-MC	5/8/2002	600	479.75	486.10	45	0.05
Pool 22 - Lower	P22-LD-LDB	5/8/2002	600	478.00	481.61	62	0.06
Mean Density (No./m³) for 5/10/02 Diurnal/Nocturnal/24-Hour Sample Period							0.13

Diurnal = daytime sampling between 0900 and 1600 hours

Nocturnal = nighttime sampling between 2000 and 2400 hours

Table 2. (cont.) Monthly density of larval fish (No. fish/m³) collected in Pools 16, 20, and 22 of the Upper Mississippi River, 2002.

Sample Location	Sample ID	Date	Tow Time (Seconds)	Volume Sampled		No. Fish	Fish Density (No./m ³)
				Net 1 (m ³)	Net 2 (m ³)		
24-Hour Sampling							
Pool 16 - Upper	P16-UD-RDB(0600)	5/21/2002	600	348.77	350.98	127	0.18
Pool 16 - Upper	P16-UD-MC(0600)	5/21/2002	600	356.07	375.07	131	0.18
Pool 16 - Upper	P16-UD-LDB(0600)	5/21/2002	600	432.37	445.79	20	0.02
Diurnal 24-Hour Sampling							
Pool 16 - Upper	P16-UD-RDB(1200)	5/21/2002	600	385.07	367.06	79	0.11
Pool 16 - Upper	P16-UD-MC(1200)	5/21/2002	600	348.66	328.92	82	0.12
Pool 16 - Upper	P16-UD-LDB(1200)	5/21/2002	600	440.36	431.10	9	0.01
24-Hour Sampling							
Pool 16 - Upper	P16-UD-RDB(1800)	5/21/2002	600	356.93	352.90	65	0.09
Pool 16 - Upper	P16-UD-MC(1800)	5/21/2002	600	354.13	337.15	123	0.18
Pool 16 - Upper	P16-UD-LDB(1800)	5/21/2002	600	362.52	412.43	42	0.05
Nocturnal 24-Hour Sampling							
Pool 16 - Upper	P16-UN-RDB(2400)	5/22/2002	600	410.54	405.43	272	0.33
Pool 16 - Upper	P16-UN-MC(2400)	5/22/2002	600	400.22	408.87	150	0.19
Pool 16 - Upper	P16-UN-LDB(2400)	5/22/2002	600	481.65	477.35	54	0.06
Diurnal							
Pool 16 - Lower	P16-LD-RDB	5/20/2002	600	323.24	341.93	74	0.11
Pool 16 - Lower	P16-LD-MC	5/20/2002	600	330.18	336.07	111	0.17
Pool 16 - Lower	P16-LD-LDB	5/20/2002	600	377.08	381.85	25	0.03
Diurnal							
Pool 20 - Upper	P20-UD-RDB	5/19/2002	600	409.40	402.56	72	0.09
Pool 20 - Upper	P20-UD-MC	5/19/2002	600	397.71	381.78	69	0.09
Pool 20 - Upper	P20-UD-LDB	5/19/2002	600	369.02	360.54	197	0.27
Nocturnal							
Pool 20 - Upper	P20-UN-RDB	5/19/2002	600	368.79	386.38	64	0.08
Pool 20 - Upper	P20-UN-MC	5/19/2002	600	381.53	374.25	64	0.08
Pool 20 - Upper	P20-UN-LDB	5/19/2002	600	356.38	340.94	280	0.40

Diurnal = daytime sampling between 0900 and 1600 hours

Nocturnal = nighttime sampling between 2000 and 2400 hours

Diurnal 24-Hour Sampling = 24-hour samples taken during daytime (1200 hours)

Nocturnal 24-Hour Sampling = 24-hour samples taken during nighttime (2400 hours)

Table 2. (cont.) Monthly density of larval fish (No. fish/m³) collected in Pools 16, 20, and 22 of the Upper Mississippi River, 2002.

Sample Location	Sample ID	Date	Tow Time (Seconds)	Volume Sampled		No. Fish	Fish Density (No./m ³)
				Net 1 (m ³)	Net 2 (m ³)		
Diurnal							
Pool 20 - Lower	P20-LD-RDB	5/19/2002	600	336.66	343.96	17	0.02
Pool 20 - Lower	P20-LD-MC	5/19/2002	600	403.83	398.55	37	0.05
Pool 20 - Lower	P20-LD-LDB	5/19/2002	600	348.12	335.99	117	0.17
Diurnal							
Pool 22 - Upper	P22-UD-RDB	5/18/2002	600	394.88	404.36	137	0.17
Pool 22 - Upper	P22-UD-MC	5/18/2002	600	381.11	389.29	41	0.05
Pool 22 - Upper	P22-UD-LDB	5/18/2002	600	407.35	386.99	170	0.21
Nocturnal							
Pool 22 - Upper	P22-UN-RDB	5/18/2002	600	386.85	398.53	355	0.45
Pool 22 - Upper	P22-UN-MC	5/18/2002	600	388.60	389.84	25	0.03
Pool 22 - Upper	P22-UN-LDB	5/18/2002	600	421.51	395.12	86	0.11
Diurnal							
Pool 22 - Lower	P22-LD-RDB	5/18/2002	600	413.62	430.47	234	0.28
Pool 22 - Lower	P22-LD-MC	5/18/2002	600	390.37	389.27	43	0.06
Pool 22 - Lower	P22-LD-LDB	5/18/2002	600	362.84	356.53	51	0.07
Mean Density (No./m³) for 5/20/02 Diurnal/Nocturnal/24-Hour Sample Period							0.14

Diurnal = daytime sampling between 0900 and 1600 hours

Nocturnal = nighttime sampling between 2000 and 2400 hours

Table 2. (cont.) Monthly density of larval fish (No. fish/m³) collected in Pools 16, 20, and 22 of the Upper Mississippi River, 2002.

Sample Location	Sample ID	Date	Tow Time (Seconds)	Volume Sampled		No. Fish	Fish Density (No./m ³)
				Net 1 (m ³)	Net 2 (m ³)		
Diurnal							
Pool 16 - Upper	P16-UD-RDB	6/5/2002	600	242.95	249.81	323	0.66
Pool 16 - Upper	P16-UD-MC	6/5/2002	600	243.80	251.65	316	0.64
Pool 16 - Upper	P16-UD-LDB	6/5/2002	600	195.51	276.67	175	0.37
Diurnal							
Pool 16 - Lower	P16-LD-RDB	6/5/2002	600	212.85	211.23	190	0.45
Pool 16 - Lower	P16-LD-MC	6/5/2002	600	278.12	288.69	1,626	2.87
Pool 16 - Lower	P16-LD-LDB	6/5/2002	600	210.81	214.18	140	0.33
Diurnal							
Pool 20 - Upper	P20-UD-RDB	6/4/2002	600	389.36	403.87	325	0.41
Pool 20 - Upper	P20-UD-MC	6/4/2002	600	442.26	439.23	5,029	5.71
Pool 20 - Upper	P20-UD-LDB	6/4/2002	600	373.96	360.35	19,782	26.94
Diurnal							
Pool 20 - Lower	P20-LD-RDB	6/4/2002	600	436.76	432.56	409	0.47
Pool 20 - Lower	P20-LD-MC	6/4/2002	600	417.73	413.89	699	0.84
Pool 20 - Lower	P20-LD-LDB	6/4/2002	600	517.15	496.84	10,514	10.37
Diurnal							
Pool 22 - Upper	P22-UD-RDB	6/3/2002	600	403.24	424.21	1,190	1.44
Pool 22 - Upper	P22-UD-MC	6/3/2002	600	404.38	418.21	1,746	2.12
Pool 22 - Upper	P22-UD-LDB	6/3/2002	600	474.45	438.72	2,523	2.76
Diurnal							
Pool 22 - Lower	P22-LD-RDB	6/3/2002	600	392.96	398.49	4,209	5.32
Pool 22 - Lower	P22-LD-MC	6/3/2002	600	344.49	357.90	9,523	13.56
Pool 22 - Lower	P22-LD-LDB	6/3/2002	600	353.35	350.46	7,509	10.67
Mean Density (No./m³) for 6/5/02 Diurnal Sample Period							4.77

Diurnal = daytime sampling between 0900 and 1600 hours

Table 2. (cont.) Monthly density of larval fish (No. fish/m³) collected in Pools 16, 20, and 22 of the Upper Mississippi River, 2002.

Sample Location	Sample ID	Date	Tow Time (Seconds)	Volume Sampled		No. Fish	Fish Density (No./m ³)
				Net 1 (m ³)	Net 2 (m ³)		
24-Hour Sampling							
Pool 16 - Upper	P16-UD-RDB(0600)	6/20/2002	600	443.21	444.69	2,212	2.49
Pool 16 - Upper	P16-UD-MC(0600)	6/20/2002	600	414.92	422.31	2,582	3.08
Pool 16 - Upper	P16-UD-LDB(0600)	6/20/2002	600	328.22	346.70	156	0.23
Diurnal 24-Hour Sampling							
Pool 16 - Upper	P16-UD-RDB(1200)	6/20/2002	600	432.60	435.87	1,360	1.57
Pool 16 - Upper	P16-UD-MC(1200)	6/20/2002	600	392.52	426.32	1,299	1.59
Pool 16 - Upper	P16-UD-LDB(1200)	6/20/2002	600	449.60	455.87	372	0.41
24-Hour Sampling							
Pool 16 - Upper	P16-UD-RDB(1800)	6/20/2002	600	528.71	529.87	2,346	2.22
Pool 16 - Upper	P16-UD-MC(1800)	6/20/2002	600	499.41	501.79	2,336	2.33
Pool 16 - Upper	P16-UD-LDB(1800)	6/20/2002	600	509.79	501.25	1,208	1.19
Nocturnal 24-Hour Sampling							
Pool 16 - Upper	P16-UN-RDB(2400)	6/21/2002	600	519.30	509.68	2,986	2.90
Pool 16 - Upper	P16-UN-MC(2400)	6/21/2002	600	541.22	533.94	2,431	2.26
Pool 16 - Upper	P16-UN-LDB(2400)	6/21/2002	600	494.90	474.88	926	0.95
Diurnal							
Pool 16 - Lower	P16-LD-RDB	6/19/2002	600	446.65	452.92	1,516	1.69
Pool 16 - Lower	P16-LD-MC	6/19/2002	600	447.09	452.56	1,869	2.08
Pool 16 - Lower	P16-LD-LDB	6/19/2002	600	392.50	367.94	294	0.39
Diurnal							
Pool 20 - Upper	P20-UD-RDB	6/18/2002	600	487.98	516.22	3,404	3.39
Pool 20 - Upper	P20-UD-MC	6/18/2002	600	473.38	476.06	1,882	1.98
Pool 20 - Upper	P20-UD-LDB	6/18/2002	600	411.30	409.46	1,579	1.92
Nocturnal							
Pool 20 - Upper	P20-UN-RDB	6/18/2002	600	515.02	494.79	1,216	1.20
Pool 20 - Upper	P20-UN-MC	6/18/2002	600	497.98	500.06	1,200	1.20
Pool 20 - Upper	P20-UN-LDB	6/18/2002	600	414.76	421.99	1,247	1.49

Diurnal = daytime sampling between 0900 and 1600 hours

Nocturnal = nighttime sampling between 2000 and 2400 hours

Diurnal 24-Hour Sampling = 24-hour samples taken during daytime (1200 hours)

Nocturnal 24-Hour Sampling = 24-hour samples taken during nighttime (2400 hours)

Table 2. (cont.) Monthly density of larval fish (No. fish/m³) collected in Pools 16, 20, and 22 of the Upper Mississippi River, 2002.

Sample Location	Sample ID	Date	Tow Time (Seconds)	Volume Sampled		No. Fish	Fish Density (No./m ³)
				Net 1 (m ³)	Net 2 (m ³)		
Diurnal							
Pool 20 - Lower	P20-LD-RDB	6/18/2002	600	439.25	457.83	2,487	2.77
Pool 20 - Lower	P20-LD-MC	6/18/2002	600	448.47	446.52	1,680	1.88
Pool 20 - Lower	P20-LD-LDB	6/18/2002	600	420.87	417.33	653	0.78
Diurnal							
Pool 22 - Upper	P22-UD-RDB	6/17/2002	600	413.81	437.31	1,662	1.95
Pool 22 - Upper	P22-UD-MC	6/17/2002	600	407.20	411.17	979	1.20
Pool 22 - Upper	P22-UD-LDB	6/17/2002	600	388.30	392.01	2,756	3.53
Nocturnal							
Pool 22 - Upper	P22-UN-RDB	6/17/2002	600	503.48	529.51	1,695	1.64
Pool 22 - Upper	P22-UN-MC	6/17/2002	600	454.20	452.90	167	0.18
Pool 22 - Upper	P22-UN-LDB	6/17/2002	600	439.52	414.92	847	0.99
Diurnal							
Pool 22 - Lower	P22-LD-RDB	6/17/2002	600	408.57	425.62	1,735	2.08
Pool 22 - Lower	P22-LD-MC	6/17/2002	600	382.90	397.69	550	0.70
Pool 22 - Lower	P22-LD-LDB	6/17/2002	600	330.08	335.77	728	1.09
Mean Density (No./m³) for 6/19/02 Diurnal/Nocturnal/24-Hour Sample Period							1.68

Diurnal = daytime sampling between 0900 and 1600 hours

Nocturnal = nighttime sampling between 2000 and 2400 hours

Table 2. (cont.) Monthly density of larval fish (No. fish/m³) collected in Pools 16, 20, and 22 of the Upper Mississippi River, 2002.

Sample Location	Sample ID	Date	Tow Time (Seconds)	Volume Sampled		No. Fish	Fish Density (No./m ³)
				Net 1 (m ³)	Net 2 (m ³)		
Diurnal							
Pool 16 - Upper	P16-UD-RDB	7/17/2002	600	540.42	528.40	639	0.60
Pool 16 - Upper	P16-UD-MC	7/17/2002	600	539.72	531.39	529	0.49
Pool 16 - Upper	P16-UD-LDB	7/17/2002	600	542.45	541.18	292	0.27
Diurnal							
Pool 16 - Lower	P16-LD-RDB	7/17/2002	600	542.47	503.02	771	0.74
Pool 16 - Lower	P16-LD-MC	7/17/2002	600	520.19	497.05	2,156	2.12
Pool 16 - Lower	P16-LD-LDB	7/17/2002	600	431.93	423.13	1,288	1.51
Diurnal							
Pool 20 - Upper	P20-UD-RDB	7/16/2002	600	517.07	520.59	639	0.62
Pool 20 - Upper	P20-UD-MC	7/16/2002	600	517.93	546.96	1,182	1.11
Pool 20 - Upper	P20-UD-LDB	7/16/2002	600	536.26	519.11	1,115	1.06
Diurnal							
Pool 20 - Lower	P20-LD-RDB	7/16/2002	600	512.85	509.49	210	0.21
Pool 20 - Lower	P20-LD-MC	7/16/2002	600	485.02	512.38	379	0.38
Pool 20 - Lower	P20-LD-LDB	7/16/2002	600	552.95	506.33	2,102	1.98
Diurnal							
Pool 22 - Upper	P22-UD-RDB	7/15/2002	600	527.89	531.33	1,750	1.65
Pool 22 - Upper	P22-UD-MC	7/15/2002	600	497.96	493.57	1,557	1.57
Pool 22 - Upper	P22-UD-LDB	7/15/2002	600	527.89	531.33	2,207	2.08
Diurnal							
Pool 22 - Lower	P22-LD-RDB	7/15/2002	600	536.37	516.50	1,548	1.47
Pool 22 - Lower	P22-LD-MC	7/15/2002	600	519.30	528.42	1,502	1.43
Pool 22 - Lower	P22-LD-LDB	7/15/2002	600	541.66	522.34	445	0.42
Mean Density (No./m³) for 7/17/02 Diurnal Sample Period							1.09

Diurnal = daytime sampling between 0900 and 1600 hours

Table 3. Mean density of larval fish (No. fish/m³) collected in Pools 16, 20 and 22 of the Upper Mississippi River, 2002.

Species	Pool 16		Pool 20		Pool 22	
	Total Fish Collected	Mean Density (No./m ³)	Total Fish Collected	Mean Density (No./m ³)	Total Fish Collected	Mean Density (No./m ³)
Catostomidae	385	0.012	338	0.013	1,105	0.040
Centrarchidae	358	0.010	84	0.005	145	0.006
Clupeidae	819	0.036	2,938	0.137	820	0.041
Cottidae	1	0.002				
<i>Cyprinus carpio</i>	3,964	0.089	864	0.023	1,371	0.037
Cyprinidae	16,598	0.465	13,330	0.635	14,791	0.742
Esocidae	1	0.001				
Hiodontidae	346	0.014	679	0.032	657	0.027
<i>Ictalurus punctatus</i>					1	0.001
<i>Ictiobus/Carpionodes</i> sp.	2,635	0.059	1,766	0.051	2,244	0.058
Lepisostidae	1	0.001				
<i>Morone</i> sp.	115	0.007	187	0.015	117	0.013
Percidae	387	0.012	292	0.013	733	0.028
<i>Polydon spathula</i>	2	0.001	3	0.002	1	0.001
<i>Pylodictis olivaris</i>					1	0.001
Sciaenidae	12,709	0.565	39,115	2.183	27,780	1.627
Unknown	272	0.008	181	0.006	474	0.016
Total Fish Collected	38,593		59,777		50,240	
Species Richness	12		9		11	
Mean Density (No./m³)	0.71		1.54		1.37	
Shannon-Wiener Diversity Index	1.46		1.08		1.27	

Table 4. Summary of combined sampling results of larval fish in Pools 16, 20, and 22 of the Upper Mississippi River, 2002.

Location		April	May	June	July
Pool 16	Total Fish	3,238	3,017	26,663	5,675
	Mean Density (No. fish/m ³)	0.73	0.14	1.46	0.95
Pool 20	Total Fish	565	1,479	52,106	5,627
	Mean Density (No. fish/m ³)	0.12	0.11	4.09	0.89
Pool 22	Total Fish	932	2,480	37,819	9,009
	Mean Density (No. fish/m ³)	0.18	0.16	3.28	1.44
Total Fish		4,735	6,976	116,588	20,311
Mean Density (No. fish/m³)		0.34	0.13	2.77	1.09

Table 5. Summary of diurnal and nocturnal sampling results for dates with both diurnal and nocturnal sampling of larval fish in Pools 16, 20, and 22 of the Upper Mississippi River, 2002.

Location	Diurnal Sampling	Nocturnal Sampling	
Pool 16	Total Fish	3,513	7,240
	Mean Density (No. fish/m ³)	0.47	0.81
Pool 20	Total Fish	7,379	4,302
	Mean Density (No. fish/m ³)	0.88	0.53
Pool 22	Total Fish	6,065	3,790
	Mean Density (No. fish/m ³)	0.83	0.45
Total Fish		16,957	15,332
Mean Density (No. fish/m³)		0.73	0.60

Table 6. Summary of temporal sampling results for 24-hour sampling of larval fish within the upper reach of Pool 16 of the Upper Mississippi River, 2002.

Collection Time		May	June	Total
0600	Total Fish	526	4,950	5,476
	Mean Density (No. fish/m ³)	0.13	1.94	0.73
1200	Total Fish	482	3,031	3,513
	Mean Density (No. fish/m ³)	0.11	1.19	0.47
1800	Total Fish	714	5,890	6,604
	Mean Density (No. fish/m ³)	0.16	1.91	0.74
2400	Total Fish	897	6,343	7,240
	Mean Density (No. fish/m ³)	0.19	2.04	0.81
Total Fish		2,619	20,214	22,833
Mean Density (No. fish/m³)		0.15	1.77	0.69

Table 7. Summary of spatial sampling results for 24-hour sampling of larval fish within the upper reach of Pool 16 of the Upper Mississippi River, May 2002.

Collection Time		Location		
		Main Channel	Main Channel Border	Total
0600	Total Fish	200	326	526
	Mean Density (No. fish/m ³)	0.14	0.13	0.13
1200	Total Fish	197	285	482
	Mean Density (No. fish/m ³)	0.13	0.10	0.11
1800	Total Fish	273	441	714
	Mean Density (No. fish/m ³)	0.18	0.14	0.16
2400	Total Fish	330	567	897
	Mean Density (No. fish/m ³)	0.20	0.18	0.19
	Total Fish	1,000	1,619	2,619
	Mean Density (No. fish/m³)	0.16	0.14	0.15

Table 8. Summary of spatial sampling results for 24-hour sampling of larval fish within the upper reach of Pool 16 of the Upper Mississippi River, June 2002.

Collection Time		Location		
		Main Channel	Main Channel Border	Total
0600	Total Fish	2,582	2,368	4,950
	Mean Density (No. fish/m ³)	3.08	1.36	1.94
1200	Total Fish	1,299	1,732	3,031
	Mean Density (No. fish/m ³)	1.59	0.99	1.19
1800	Total Fish	2,336	3,554	5,890
	Mean Density (No. fish/m ³)	2.33	1.71	1.91
2400	Total Fish	2,431	3,912	6,343
	Mean Density (No. fish/m ³)	2.26	1.93	2.04
	Total Fish	8,648	11,566	20,214
	Mean Density (No. fish/m³)	2.32	1.50	1.77

Table 9. Summary of temporal sampling results of larval fish within upper and lower reaches in Pools 16, 20, and 22 of the Upper Mississippi River, 2002.

Location	April	May	June	July	Total
Pool 16 - Upper					
Total Fish	2,030	2,619	21,028	1,460	27,137
Mean Density (No. fish/m ³)	0.92	0.15	1.26	0.45	0.64
Pool 16 - Lower					
Total Fish	1,208	398	5,635	4,215	11,456
Mean Density (No. fish/m ³)	0.55	0.09	1.30	1.45	0.80
Pool 20 - Upper					
Total Fish	324	1,153	35,664	2,936	40,077
Mean Density (No. fish/m ³)	0.14	0.13	4.92	0.93	1.81
Pool 20 - Lower					
Total Fish	241	326	16,442	2,691	19,700
Mean Density (No. fish/m ³)	0.11	0.07	2.85	0.86	1.13
Pool 22 - Upper					
Total Fish	530	1,749	13,565	5,514	21,358
Mean Density (No. fish/m ³)	0.20	0.17	1.76	1.77	0.88
Pool 22 - Lower					
Total Fish	402	731	24,254	3,495	28,882
Mean Density (No. fish/m ³)	0.15	0.14	5.57	1.11	2.11
Total Fish	4,735	6,976	116,588	20,311	148,610
Mean Density (No. fish/m³)	0.34	0.13	2.77	1.09	1.15

Table 10. Summary of spatial diurnal (daytime) and nocturnal (nighttime) sampling results of larval fish in Pools 16, 20, and 22 of the Upper Mississippi River, 2002.

Location		Diurnal Sampling		Nocturnal Sampling	
		Main Channel	Main Channel Border	Main Channel	Main Channel Border
Pool 16 - Upper	Total Fish	2,932	4,885	2,761	4,479
	Mean Density (No. fish/m ³)	0.62	0.52	1.02	0.81
Pool 16 - Lower	Total Fish	6,130	5,326	N/A	N/A
	Mean Density (No. fish/m ³)	1.28	0.56	N/A	N/A
Pool 20 - Upper	Total Fish	8,227	27,548	1,297	3,005
	Mean Density (No. fish/m ³)	1.49	2.94	0.44	0.57
Pool 20 - Lower	Total Fish	2,970	16,730	N/A	N/A
	Mean Density (No. fish/m ³)	0.56	1.42	N/A	N/A
Pool 22 - Upper	Total Fish	4,477	13,091	221	3,569
	Mean Density (No. fish/m ³)	0.85	1.21	0.08	0.64
Pool 22 - Lower	Total Fish	11,718	17,164	N/A	N/A
	Mean Density (No. fish/m ³)	2.64	1.85	N/A	N/A
Total Fish		36,454	84,744	4,279	11,053
Mean Density (No. fish/m³)		1.24	1.42	0.26	0.69

* LDB = Left Descending Bank

** MC = Main Channel

*** RDB = Right Descending Bank

Table 11. Diurnal (daytime) larval fish density expressed as No. fish/m³ for taxa collected during the April 24, 2002 sample period (+/- 3 days) in the Upper Mississippi River.

Pool 16				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae	0.004	0.010	0.003	0.001
Centrarchidae	0.001	0.004	0.001	0.003
Clupeidae				0.001
<i>Cyprinus carpio</i>	0.302	0.512	0.651	0.709
Cyprinidae	0.001	0.001		0.005
Hiodontidae		0.001		0.003
<i>Ictiobus/Carpiones</i>	0.018	0.064	0.081	0.187
Percidae	0.016	0.018	0.019	0.023
Unknown		0.019	0.001	0.016
Total Density (No./m³)	0.34	0.63	0.76	0.95

Pool 20				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae	0.054	0.012	0.013	0.014
Clupeidae				0.001
<i>Cyprinus carpio</i>	0.032	0.037	0.009	0.166
Cyprinidae	0.001	0.001		
Hiodontidae				0.001
<i>Ictiobus/Carpiones</i>	0.001	0.012		
Percidae	0.034	0.029	0.008	0.036
Unknown	0.012	0.005	0.010	0.005
Total Density (No./m³)	0.14	0.10	0.04	0.22

Pool 22				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae	0.009	0.017	0.016	0.003
Centrarchidae		0.001		
<i>Cyprinus carpio</i>	0.003	0.014	0.010	0.026
Cyprinidae		0.007		
<i>Ictiobus/Carpiones</i>	0.009	0.055	0.024	0.056
Percidae	0.043	0.118	0.072	0.144
Unknown	0.008	0.001	0.022	0.006
Total Density (No./m³)	0.07	0.21	0.14	0.24

Table 12. Diurnal (daytime) larval fish density expressed as No. fish/m³ for taxa collected during the May 10, 2002 sample period (+/- 3 days) in the Upper Mississippi River.

Pool 16				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae		0.002	0.031	0.049
Centrarchidae	0.001			0.003
<i>Cyprinus carpio</i>	0.009	0.007	0.011	0.006
Cyprinidae		0.016		0.001
Hiodontidae	0.001	0.003		0.042
<i>Ictiobus/Carpionodes</i>	0.065	0.035	0.066	0.054
Percidae	0.007	0.005	0.024	0.017
Unknown	0.006	0.003	0.011	0.007
Total Density (No./m³)	0.09	0.07	0.14	0.18

Pool 20				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae	0.015	0.005		0.004
<i>Cyprinus carpio</i>	0.020	0.015	0.009	0.009
Hiodontidae	0.004	0.010	0.001	0.011
<i>Ictiobus/Carpionodes</i>	0.023	0.013	0.022	0.040
Percidae	0.003	0.008	0.006	0.018
Unknown	0.005	0.004	0.001	0.002
Total Density (No./m³)	0.07	0.05	0.04	0.08

Pool 22				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae	0.006	0.006	0.001	0.010
Centrarchidae		0.003		
Clupeidae	0.001			
<i>Cyprinus carpio</i>	0.011	0.075	0.011	0.034
Cyprinidae		0.003		0.005
Hiodontidae		0.003	0.002	0.002
<i>Ictiobus/Carpionodes</i>	0.018	0.074	0.017	0.060
Percidae	0.007	0.020	0.005	0.027
Unknown	0.003	0.006	0.002	0.008
Total Density (No./m³)	0.05	0.19	0.04	0.15

Table 13. Nocturnal (nighttime) larval fish density expressed as No. fish/m³ for taxa collected during the May 10, 2002 sample period (+/- 3 days) in the Upper Mississippi River.

Pool 16 - Upper

Species	Main Channel	Main Channel Border
Catostomidae		0.002
Centrarchidae	0.001	0.002
<i>Cyprinus carpio</i>	0.016	0.021
Esocidae	0.001	
Hiodontidae	0.013	0.062
<i>Ictiobus/Carpiones</i>	0.161	0.098
Percidae	0.018	0.013
Unknown	0.009	0.004
Total Density (No./m³)	0.22	0.20

Pool 20 - Upper

Species	Main Channel	Main Channel Border
Catostomidae	0.003	0.004
<i>Cyprinus carpio</i>	0.003	0.014
Hiodontidae	0.010	0.003
<i>Ictiobus/Carpiones</i>	0.017	0.035
Percidae	0.003	0.010
Unknown		0.002
Total Density (No./m³)	0.04	0.07

Pool 22 - Upper

Species	Main Channel	Main Channel Border
Catostomidae	0.006	0.003
Centrarchidae		0.001
Clupeidae		0.001
<i>Cyprinus carpio</i>	0.007	0.031
Hiodontidae	0.004	0.018
<i>Ictiobus/Carpiones</i>	0.014	0.263
Percidae		0.021
Unknown	0.004	0.003
Total Density (No./m³)	0.03	0.34

Table 14. Diurnal (daytime) larval fish density expressed as No. fish/m³ for taxa collected during the May 20, 2002 sample period (+/- 3 days) in the Upper Mississippi River.

Pool 16				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae	0.003			0.001
Centrarchidae	0.002	0.001	0.001	
<i>Cyprinus carpio</i>	0.006	0.015	0.016	0.018
Cyprinidae		0.001	0.001	
Hiodontidae	0.005	0.004	0.016	0.004
<i>Ictiobus/Carpionodes</i>	0.129	0.042	0.062	0.027
Percidae	0.020	0.007	0.015	0.006
<i>Polydon spathula</i>			0.001	
Unknown	0.003	0.004	0.007	0.001
Total Density (No./m³)	0.17	0.07	0.12	0.06

Pool 20				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
<i>Cyprinus carpio</i>	0.001	0.004	0.006	0.009
Hiodontidae	0.006	0.062	0.035	0.088
<i>Ictiobus/Carpionodes</i>	0.035	0.029	0.046	0.075
Percidae	0.004	0.004	0.001	0.005
Unknown				0.001
Total Density (No./m³)	0.05	0.10	0.09	0.18

Pool 22				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae	0.003			
Centrarchidae	0.003	0.001		
<i>Cyprinus carpio</i>	0.005	0.034	0.008	0.014
Hiodontidae	0.014	0.058	0.006	0.116
<i>Ictiobus/Carpionodes</i>	0.024	0.083	0.034	0.058
Percidae	0.004		0.001	0.003
Unknown	0.003	0.001	0.004	0.003
Total Density (No./m³)	0.06	0.18	0.05	0.19

Table 15. Nocturnal (nighttime) larval fish density expressed as No. fish/m³ for taxa collected during the May 20, 2002 sample period (+/- 3 days) in the Upper Mississippi River.

Pool 16 - Upper

Species	Main Channel	Main Channel Border
Catostomidae		0.002
Centrarchidae	0.005	0.002
<i>Cyprinus carpio</i>	0.028	0.024
Cyprinidae	0.001	0.001
Hiodontidae	0.004	0.020
<i>Ictiobus/Carpiones</i>	0.132	0.118
Percidae	0.012	0.014
Unknown	0.002	0.005
Total Density (No./m³)	0.19	0.18

Pool 20 - Upper

Species	Main Channel	Main Channel Border
Catostomidae		0.001
<i>Cyprinus carpio</i>	0.011	0.018
Cyprinidae	0.001	
Hiodontidae	0.009	0.137
<i>Ictiobus/Carpiones</i>	0.061	0.074
Percidae		0.003
<i>Polydon spathula</i>		0.001
Unknown	0.003	0.003
Total Density (No./m³)	0.08	0.24

Pool 22 - Upper

Species	Main Channel	Main Channel Border
Catostomidae	0.004	0.001
Centrarchidae		0.001
<i>Cyprinus carpio</i>		0.025
Hiodontidae	0.010	0.118
<i>Ictiobus/Carpiones</i>	0.017	0.123
Percidae	0.001	0.003
Unknown		0.004
Total Density (No./m³)	0.03	0.28

Table 16. Diurnal (daytime) larval fish density expressed as No. fish/m³ for taxa collected during the June 5, 2002 sample period (+/- 3 days) in the Upper Mississippi River.

Pool 16				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae	0.007	0.005		0.006
Centrarchidae	0.032	0.015	0.006	0.046
Clupeidae	0.081	0.005	0.010	0.015
<i>Cyprinus carpio</i>	0.316	0.113	0.117	0.256
Cottidae		0.001		
Cyprinidae	0.759	0.066	0.099	0.064
Hiodontidae	0.004		0.002	0.001
<i>Ictiobus/Carpiodes</i>	0.037	0.006	0.006	0.018
<i>Morone</i> sp.	0.002		0.006	0.002
Percidae	0.011	0.014	0.002	0.013
Sciaenidae	1.567	0.140	0.383	0.086
Unknown	0.055	0.009	0.006	0.009
Total Density (No./m³)	2.87	0.37	0.64	0.52

Pool 20				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae	0.016	0.029	0.015	0.032
Centrarchidae	0.007	0.004	0.007	0.004
Clupeidae	0.012	0.162	0.024	0.071
<i>Cyprinus carpio</i>	0.047	0.050	0.057	0.075
Cyprinidae	0.145	1.878	0.901	3.037
Hiodontidae	0.026	0.020	0.019	0.010
<i>Ictiobus/Carpiodes</i>	0.038	0.050	0.301	0.103
<i>Morone</i> sp.	0.017	0.028	0.061	0.009
Percidae	0.012	0.025	0.010	0.007
Sciaenidae	0.517	3.549	4.292	9.804
Unknown	0.002	0.006	0.019	0.012
Total Density (No./m³)	0.84	5.80	5.71	13.16

Pool 22				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae	0.302	0.254	0.260	0.089
Centrarchidae	0.001	0.007	0.002	0.036
Clupeidae	0.033	0.029	0.088	0.168
<i>Cyprinus carpio</i>	0.001	0.003	0.012	0.004
Cyprinidae	3.502	3.724	0.569	1.151
Hiodontidae	0.004	0.007	0.036	0.010
<i>Ictiobus/Carpiodes</i>	0.004	0.052	0.052	0.135
<i>Morone</i> sp.	0.004	0.014	0.015	0.038
Percidae	0.001	0.001	0.004	0.017
Sciaenidae	9.532	3.678	1.053	0.442
Unknown	0.172	0.066	0.032	0.044
Total Density (No./m³)	13.56	7.84	2.12	2.13

Table 17. Diurnal (daytime) larval fish density expressed as No. fish/m³ for taxa collected during the June 19, 2002 sample period (+/- 3 days) in the Upper Mississippi River.

Pool 16				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae				0.001
Centrarchidae	0.019	0.014	0.021	0.023
Clupeidae	0.041	0.049	0.022	0.052
<i>Cyprinus carpio</i>	0.001	0.016	0.002	0.032
Cyprinidae	0.571	0.704	0.573	0.552
Hiodontidae	0.006	0.001	0.002	0.001
<i>Ictiobus/Carpiones</i>	0.002	0.012	0.002	0.024
<i>Morone</i> sp.	0.013	0.011	0.009	0.006
Percidae		0.002	0.001	
<i>Polydon spathula</i>			0.001	
Sciaenidae	1.424	0.279	0.953	0.286
Unknown		0.002		
Total Density (No./m³)	2.08	1.09	1.59	0.98

Pool 20				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae	0.001	0.006		0.008
Centrarchidae	0.001	0.001	0.004	0.001
Clupeidae	0.027	0.145	0.038	0.861
<i>Cyprinus carpio</i>	0.016	0.015	0.001	0.014
Cyprinidae	0.087	0.131	0.111	0.346
Hiodontidae	0.006	0.005	0.003	0.002
<i>Ictiobus/Carpiones</i>	0.003	0.025	0.027	0.105
<i>Morone</i> sp.		0.005	0.007	0.015
Percidae				0.001
Sciaenidae	1.726	1.474	1.791	1.369
Unknown	0.010	0.003		0.010
Total Density (No./m³)	1.88	1.81	1.98	2.73

Pool 22				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae		0.003	0.007	0.002
Centrarchidae	0.004	0.003	0.001	0.007
Clupeidae	0.013	0.116	0.002	0.048
<i>Cyprinus carpio</i>	0.032	0.210	0.029	0.140
Cyprinidae	0.068	0.385	0.121	0.368
Hiodontidae	0.003	0.003	0.002	0.028
<i>Ictiobus/Carpiones</i>	0.020	0.064	0.028	0.052
<i>Morone</i> sp.	0.003	0.002		0.001
Percidae		0.001		0.003
<i>Pylodictus olivaris</i>		0.001		
Sciaenidae	0.561	0.847	0.997	2.048
Unknown	0.001	0.008	0.007	0.009
Total Density (No./m³)	0.70	1.64	1.20	2.71

Table 18. Nocturnal (nighttime) larval fish density expressed as No. fish/m³ for taxa collected during the June 19, 2002 sample period (+/- 3 days) in the Upper Mississippi River.

Pool 16 - Upper

Species	Main Channel	Main Channel Border
Catostomidae	0.088	0.039
Centrarchidae	0.004	0.007
Clupeidae	0.003	0.084
<i>Cyprinus carpio</i>	0.030	0.041
Cyprinidae	1.281	1.147
Hiodontidae		0.001
<i>Ictiobus/Carpiones</i>	0.034	0.069
<i>Morone</i> sp.	0.003	0.006
Sciaenidae	0.818	0.563
Unknown	0.001	0.002
Total Density (No./m³)	2.26	1.96

Pool 20 - Upper

Species	Main Channel	Main Channel Border
Catostomidae	0.005	0.002
Centrarchidae		0.002
Clupeidae	0.003	0.221
<i>Cyprinus carpio</i>	0.004	0.010
Cyprinidae	0.263	0.294
Hiodontidae	0.003	
<i>Ictiobus/Carpiones</i>	0.035	0.155
<i>Morone</i> sp.	0.003	0.004
Percidae		0.001
<i>Polydon spathula</i>		0.001
Sciaenidae	0.885	0.633
Unknown	0.002	0.010
Total Density (No./m³)	1.20	1.33

Pool 22 - Upper

Species	Main Channel	Main Channel Border
Catostomidae	0.002	0.001
Centrarchidae	0.002	0.003
Clupeidae	0.002	0.041
<i>Cyprinus carpio</i>	0.017	0.104
Cyprinidae	0.045	0.644
Hiodontidae		0.005
<i>Ictalurus punctatus</i>		0.001
<i>Ictiobus/Carpiones</i>	0.028	0.091
<i>Morone</i> sp.		0.004
Percidae		0.001
<i>Polydon spathula</i>	0.001	
Sciaenidae	0.084	0.452
Unknown	0.003	0.002
Total Density (No./m³)	0.18	1.35

Table 19. Diurnal (daytime) larval fish density expressed as No. fish/m³ for taxa collected during the July 17, 2002 sample period (+/- 3 days) in the Upper Mississippi River.

Pool 16				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae	0.006	0.004		0.000
Centrarchidae	0.001	0.003	0.005	0.010
Clupeidae	0.002	0.003	0.001	
<i>Cyprinus carpio</i>	0.001	0.002	0.072	0.046
Cyprinidae	1.318	0.805	0.373	0.338
<i>Ictiobus/Carpiodes</i>	0.001		0.001	0.003
Sciaenidae	0.760	0.264	0.037	0.033
Unknown	0.030	0.004	0.006	0.002
Total Density (No./m³)	2.12	1.08	0.49	0.43

Pool 20				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae	0.015	0.010		0.005
Centrarchidae	0.015	0.004	0.008	0.007
Clupeidae	0.017	0.007	0.108	0.025
<i>Cyprinus carpio</i>	0.005	0.005	0.003	0.001
Cyprinidae	0.140	0.581	0.317	0.335
<i>Ictiobus/Carpiodes</i>	0.003	0.000	0.001	0.004
Sciaenidae	0.180	0.502	0.672	0.455
Unknown	0.004	0.001	0.001	0.006
Total Density (No./m³)	0.38	1.11	1.11	0.84

Pool 22				
Species	Lower		Upper	
	Main Channel	Main Channel Border	Main Channel	Main Channel Border
Catostomidae	0.001	0.001	0.005	0.004
Centrarchidae	0.008	0.003	0.002	0.007
Clupeidae	0.002	0.009	0.005	0.008
<i>Cyprinus carpio</i>	0.002	0.005	0.006	0.012
Cyprinidae	0.169	0.106	0.226	0.498
<i>Ictiobus/Carpiodes</i>		0.004	0.002	0.003
Percidae				0.000
Sciaenidae	1.249	0.809	1.321	1.335
Unknown	0.003	0.004	0.003	0.001
Total Density (No./m³)	1.43	0.94	1.57	1.87

Table 20. Larval fish density expressed as No. fish/m³ for taxa collected during the May 10, 2002 24-hour sample period (+/- 3 days) in the Upper Mississippi River.

0600

Species	Main Channel	Main Channel Border
Catostomidae	0.010	0.008
Centrarchidae		0.002
<i>Cyprinus carpio</i>	0.008	0.010
Cyprinidae		0.002
Hiodontidae	0.001	0.023
<i>Ictiobus/Carpiones</i>	0.068	0.081
Percidae	0.008	0.020
Unknown	0.001	0.007
Total Density (No./m³)	0.10	0.15

1200

Species	Main Channel	Main Channel Border
Catostomidae	0.031	0.049
Centrarchidae		0.003
<i>Cyprinus carpio</i>	0.011	0.006
Cyprinidae		0.001
Hiodontidae		0.042
<i>Ictiobus/Carpiones</i>	0.066	0.054
Percidae	0.024	0.017
Unknown	0.011	0.007
Total Density (No./m³)	0.14	0.18

1800

Species	Main Channel	Main Channel Border
Catostomidae	0.049	0.001
Centrarchidae	0.001	0.002
<i>Cyprinus carpio</i>	0.013	0.004
Hiodontidae	0.006	0.051
<i>Ictiobus/Carpiones</i>	0.092	0.166
Percidae	0.019	0.015
Unknown	0.009	0.008
Total Density (No./m³)	0.19	0.25

2400

Species	Main Channel	Main Channel Border
Catostomidae		0.002
Centrarchidae	0.001	0.002
<i>Cyprinus carpio</i>	0.016	0.021
Esocidae	0.001	
Hiodontidae	0.013	0.062
<i>Ictiobus/Carpiones</i>	0.161	0.098
Percidae	0.018	0.013
Unknown	0.009	0.004
Total Density (No./m³)	0.22	0.20

Table 21. Larval fish density expressed as No. fish/m³ for taxa collected during the May 21, 2002 24-hour sample period (+/- 3 days) in the Upper Mississippi River.

0600

Species	Main Channel	Main Channel Border
Centrarchidae		0.001
<i>Cyprinus carpio</i>	0.023	0.029
Hiodontidae	0.005	0.008
<i>Ictiobus/Carpiones</i>	0.140	0.044
Percidae	0.005	0.008
Unknown	0.005	0.004

Total Density (No./m³) 0.18 0.09

1200

Species	Main Channel	Main Channel Border
Catostomidae		0.001
Centrarchidae	0.001	
<i>Cyprinus carpio</i>	0.016	0.017
Cyprinidae	0.001	
Hiodontidae	0.016	0.004
<i>Ictiobus/Carpiones</i>	0.062	0.025
Percidae	0.015	0.006
<i>Polydon spathula</i>	0.001	
Unknown	0.007	0.001

Total Density (No./m³) 0.12 0.05

1800

Species	Main Channel	Main Channel Border
Catostomidae	0.003	0.001
Centrarchidae	0.003	
<i>Cyprinus carpio</i>	0.035	0.011
Hiodontidae	0.004	0.001
<i>Ictiobus/Carpiones</i>	0.126	0.049
Percidae	0.006	0.007
Unknown	0.001	0.003

Total Density (No./m³) 0.18 0.07

2400

Species	Main Channel	Main Channel Border
Catostomidae		0.002
Centrarchidae	0.005	0.002
<i>Cyprinus carpio</i>	0.028	0.024
Cyprinidae	0.001	0.001
Hiodontidae	0.004	0.020
<i>Ictiobus/Carpiones</i>	0.132	0.118
Percidae	0.012	0.014
Unknown	0.002	0.005

Total Density (No./m³) 0.19 0.18

Table 22. Larval fish density expressed as No. fish/m³ for taxa collected during the June 20, 2002 24-hour sample period (+/- 3 days) in the Upper Mississippi River.

0600

Species	Main Channel	Main Channel Border
Catostomidae	0.001	0.004
Centrarchidae	0.030	0.022
Clupeidae	0.020	0.050
<i>Cyprinus carpio</i>	0.005	0.017
Cyprinidae	0.549	1.056
Hiodontidae	0.005	
<i>Ictiobus/Carpiodes</i>	0.002	0.041
<i>Morone</i> sp.	0.013	0.012
Sciaenidae	2.457	0.312
Unknown	0.001	0.002
Total Density (No./m³)	3.08	1.52

1200

Species	Main Channel	Main Channel Border
Catostomidae		0.001
Centrarchidae	0.021	0.023
Clupeidae	0.022	0.052
<i>Cyprinus carpio</i>	0.002	0.032
Cyprinidae	0.573	0.552
Hiodontidae	0.002	0.001
<i>Ictiobus/Carpiodes</i>	0.002	0.024
<i>Morone</i> sp.	0.009	0.006
Percidae	0.001	
<i>Polydon spathula</i>	0.001	
Sciaenidae	0.953	0.286
Total Density (No./m³)	1.59	0.98

1800

Species	Main Channel	Main Channel Border
Catostomidae	0.002	0.000
Centrarchidae	0.004	0.015
Clupeidae	0.007	0.110
<i>Cyprinus carpio</i>	0.015	0.016
Cyprinidae	1.168	0.909
<i>Ictiobus/Carpiodes</i>	0.006	0.012
Lepisosteidae		0.000
<i>Morone</i> sp.	0.007	0.005
Percidae		0.002
Sciaenidae	1.125	0.646
Unknown		0.001
Total Density (No./m³)	2.33	1.72

2400

Species	Main Channel	Main Channel Border
Catostomidae	0.088	0.039
Centrarchidae	0.004	0.007
Clupeidae	0.003	0.084
<i>Cyprinus carpio</i>	0.030	0.041
Cyprinidae	1.281	1.147
Hiodontidae		0.001
<i>Ictiobus/Carpiodes</i>	0.034	0.069
<i>Morone</i> sp.	0.003	0.006
Sciaenidae	0.818	0.563
Unknown	0.001	0.002
Total Density (No./m³)	2.26	1.96

Table 23. Mean lengths (mm) and length ranges of larval fish collected from Pool 16 of the Upper Mississippi River, 2002.

Species	April		May		June		July	
	Mean	(Min - Max)						
Catostomidae	6.38	(5-7)	6.78	(4-13)	4.09	(3-19)	3.07	(3-4)
Centrarchidae	4.83	(4-6)	5.42	(4-7)	5.57	(4-11)	5.94	(4-12)
Clupeidae	5.00	N/A			7.49	(4-19)	18.75	(9-27)
Cottidae					7.00	N/A		
<i>Cyprinus carpio</i>	6.71	(5-8)	6.95	(5-12)	7.91	(5-19)	6.24	(4-7)
Cyprinidae	5.80	(5-7)	7.00	(4-9)	5.58	(4-8)	6.61	(4-17)
Esocidae			10.00	N/A				
Hiodontidae	7.80	(7-9)	10.63	(7-14)	16.89	(11-26)		
<i>Ictiobus/Carpoides</i> sp.	6.76	(5-8)	7.74	(6-12)	7.54	(4-15)	6.78	(6-7)
Lepisostidae					23.00	N/A		
<i>Morone</i> sp.					11.09	(3-18)		
Percidae	5.77	(4-9)	6.06	(4-11)	7.12	(4-20)		
<i>Polydon spathula</i>			8.00	N/A	7.00	N/A		
Sciaenidae					6.05	(3-12)	4.28	(4-5)

Table 24. Mean lengths (mm) and length ranges of larval fish collected from Pool 20 of the Upper Mississippi River, 2002.

Species	April		May		June		July	
	Mean	(Min - Max)						
Catostomidae	6.34	(5-9)	5.79	(4-9)	5.46	(3-20)	3.24	(3-11)
Centrarchidae					5.92	(4-16)	5.89	(4-18)
Clupeidae	5.00	N/A			10.50	(4-22)	19.89	(5-27)
<i>Cyprinus carpio</i>	6.42	(5-7)	7.08	(5-10)	7.54	(5-22)	7.14	(6-12)
Cyprinidae	6.33	(5-8)	5.00	N/A	5.67	(3-12)	7.67	(4-21)
Hiodontidae	10.00	N/A	12.15	(7-14)	14.83	(10-31)		
<i>Ictiobus/Carpoides</i> sp.	7.59	(6-10)	7.63	(5-10)	7.34	(4-14)	8.23	(5-14)
<i>Morone</i> sp.					8.33	(4-23)		
Percidae	6.05	(4-9)	6.74	(4-15)	5.89	(4-21)		
<i>Polydon spathula</i>			11.00	N/A	8.00	N/A		
Sciaenidae					5.95	(4-14)	4.90	(4-7)

Table 25. Mean lengths (mm) and length ranges of larval fish collected from Pool 22 of the Upper Mississippi River, 2002.

Species	April		May		June		July	
	Mean	(Min - Max)						
Catostomidae	6.08	(3-9)	6.71	(5-10)	4.98	(3-19)	3.94	(3-18)
Centrarchidae	5.00	N/A	6.50	(4-10)	7.09	(4-15)	7.17	(4-14)
Clupeidae			8.00	(6-10)	6.70	(4-19)	18.47	(6-25)
<i>Cyprinus carpio</i>	6.26	(4-9)	7.48	(5-13)	7.95	(5-20)	6.84	(6-8)
Cyprinidae	7.58	(4-10)	5.86	(5-7)	6.25	(4-14)	7.07	(5-23)
Hiodontidae			11.89	(7-15)	13.83	(6-28)		
<i>Ictalurus punctatus</i>					21.00	N/A		
<i>Ictiobus/Carpionodes</i> sp.	7.26	(4-10)	7.46	(5-10)	7.29	(5-12)	7.13	(6-10)
<i>Morone</i> sp.					5.95	(4-15)		
Percidae	7.16	(4-10)	7.39	(4-12)	5.95	(4-12)	6.00	N/A
<i>Polydon spathula</i>					11.00	N/A		
<i>Pylodictis olivaris</i>					10.00	N/A		
Sciaenidae					6.06	(4-17)	5.22	(3-12)

Appendix A
Project Correspondence



DEPARTMENT OF THE ARMY
ROCK ISLAND DISTRICT, CORPS OF ENGINEERS
CLOCK TOWER BUILDING - P.O. BOX 2004
ROCK ISLAND, ILLINOIS 61204-2004

Contracting Division

March 7, 2002

SUBJECT: Scope of Work for Evaluation of Larval Fish Diversity and Relative Abundance within Main Channel and Main Channel Boarder Habitats of Pools 16, 20 and 22 of the Upper Mississippi River, Contract No. DACW25-00-D-0005.

Environmental Science & Engineering Inc.
ATTN: Stephen R. Carter
3199 Riverport Tech Center Drive
St. Louis, Missouri 63043

Dear Mr. Carter:

Enclosed is the scope of work for proposed Task Order. It is requested that you submit a proposal for the required services in accordance with the Scope of Work.

It is requested that your proposal be returned to this office by Close of Business March 18, 2002 or sooner. Please E-Mail it to JANET.L.HANCKS@MVR.USACE.ARMY.MIL Contract Specialist, with the original to follow in the mail.

Should you have additional questions please do not hesitate to contact Janet L. Hancks, Contract Specialist at AC 309/794-5443.

Sincerely,

Enclosures

Janet L. Hancks
Contract Specialist
Contracting Division

March 18, 2002

Ms. Janet L. Hancks
Contract Specialist
Department of the Army
Rock Island District, Corps of Engineers
P.O. Box 2004
Rock Island, Illinois 61204-2004

**RE: Evaluation of Larval Fish Diversity and Relative Abundance Within MC and MCB
Habitats of Pools 16, 20, and 22 of the Upper Mississippi River-Contract #DACW25-00-D-0005**

Dear Ms. Hancks:

Please find enclosed the cost proposal and assumptions for the above-referenced Larval Fish surveys. The Harding ESE, Inc team is excited by the opportunity to work with the Rock Island District on this important component of the U.S. Army Corps of Engineers' Upper Mississippi River-Illinois Waterway System Navigation Study.

Please note that all costs are presented in Attachment A. Attachment B provides a list of assumptions that have been used in costing this project.

Please contact me at 314/209-5957 or Steve Carter at 314/209-5911, if there are any questions, comments, or concerns. Again, Harding ESE appreciates the opportunity that this task order affords. We are confident that all work will be completed per Corps specifications.

Sincerely,

William J. Elzinga
Principal Project Manager

Steve R. Carter
Vice President

Attachments



Harding ESE
A MACTEC COMPANY

Harding ESE, Inc.
3199 Riverport Tech Center Drive
St. Louis, MO 63043

Telephone: 314/209-5900
Fax: 314/209-5929
Home Page: www.mactec.com

April 2, 2002

Ms. Janet L. Hancks
Contract Specialist
Rock Island District, Corps of Engineers
Contracting Division
Clock Tower Building - P.O. Box 2004
Rock Island, IL 61204-2004

Re: Evaluation of Larval Fish Diversity and Abundance, Upper Mississippi River.
Task Order for Contract No. DACW25-00-D-0005

Dear Ms. Crawford:

Please find enclosed our final negotiated cost proposal to perform Upper Mississippi River larval fish field sampling, laboratory analysis and report preparation agreed upon by Harding ESE and Rock Island District on April 1, 2002.

The agreed upon larval fish taxonomy rate is included in other significant costs. The agreed upon sorting costs have been included under the data analysis section of the proposal worksheet. A total of 1,147.5 hours have been added to the fisheries intern hours (7.5 hours to sort each sample x 153 samples) and the 0.2 hours per sample for quality assurance has been split between the fisheries biologist I and fisheries biologist II, adding 15.3 hours to each position.

During our telephone negotiations, Mr. Elliott Stefanik made numerous changes to the scope of work (SOW). We have received this revised SOW and find everything in order. We have attached this SOW with our final cost proposal.

Once again, we appreciate that opportunity to provide technical assistance to the Rock Island District. If you need additional information or clarification, please feel free to contact us at 314-209-5900.

Sincerely,

Harding ESE, Inc.

William J. Elzinga
Project Manager

Stephen R. Carter
Vice President

Enclosure



Harding ESE, Inc.
3199 Riverport Tech Center Dr.
St. Louis, MO 63043

Telephone: 314/209-5900
Fax: 314/209-5929
Home Page: www.mactec.com

May 1, 2002

US Army Corps of Engineers, Rock Island
Attn: Ronald Pulcher, COR
Clock Tower Building - P.O. Box 2004
Rock Island, IL 61204-2004

Re: Upper Mississippi River Ichthyoplankton Study.
Contract No. DACW25-00-D-0005, Work Order No. 10.

Dear Mr. Pulcher:

As specified in Section 7.2.2 of our Scope of Work for the above referenced project, we are hereby enclosing for your use a copy of the sample log for the April 24, 2002 diurnal sampling event. GPS coordinates recorded at the start of each sampling site have also been included.

If you have any questions please feel free to contact me at 314/209-5957.

Sincerely,

Harding ESE, Inc.

William J. Elzinga
Principal Investigator

cc: Elliott Stefanik (email)

Encl.



Harding ESE
A MACTEC COMPANY

Harding ESE, Inc.
3199 Riverport Tech Center Dr.
St. Louis, MO 63043

Telephone: 314/209-5900
Fax: 314/209-5929
Home Page: www.mactec.com

May 17, 2002

US Army Corps of Engineers, Rock Island
Attn: Ronald Pulcher, COR
Clock Tower Building - P.O. Box 2004
Rock Island, IL 61204-2004

*mailed
kaf
5/17*

Re: Upper Mississippi River Ichthyoplankton Study.
Contract No. DACW25-00-D-0005, Work Order No. 10.

Dear Mr. Pulcher:

As specified in Section 7.2.2 of our Scope of Work for the above referenced project, we are hereby enclosing for your use a copy of the sample log for the May 10, 2002 diurnal, nocturnal, and 24-hour sampling event. GPS coordinates recorded at the start of each sampling site have also been included.

If you have any questions please feel free to contact me at 314/209-5957.

Sincerely,

Harding ESE, Inc.

William J. Elzinga
Principal Investigator

cc: Elliott Stefanik (email)

Encl.



Harding ESE, Inc.
3199 Riverport Tech Center Drive
St. Louis, MO 63043

Telephone: 314/209-5900
Fax: 314/209-5929
Home Page: www.mactec.com

May 23, 2002

US Army Corps of Engineers, Rock Island
Attn: Ronald Pulcher, COR
Clock Tower Building - P.O. Box 2004
Rock Island, IL 61204-2004

Re: Upper Mississippi River Ichthyoplankton Study.
Contract No. DACW25-00-D-0005, Work Order No. 10.

Dear Mr. Pulcher:

As specified in Section 7.2.2 of our Scope of Work for the above referenced project, we are hereby enclosing for your use a copy of the sample log for the May 20, 2002 diurnal, nocturnal, and 24-hour sampling event. GPS coordinates recorded at the start of each sampling site have also been included.

If you have any questions please feel free to contact me at 314/209-5957.

Sincerely,

Harding ESE, Inc.

William J. Elzinga
Principal Investigator

cc: Elliott Stefanik (email)

Encl.



Harding ESE
A MACTEC COMPANY

Harding ESE, Inc.
3199 Riverport Tech Center Dr.
St. Louis, MO 63043

Telephone: 314/209-5900
Fax: 314/209-5929
Home Page: www.mactec.com

June 11, 2002

US Army Corps of Engineers, Rock Island
Attn: Ronald Pulcher, COR
Clock Tower Building - P.O. Box 2004
Rock Island, IL 61204-2004

Re: Upper Mississippi River Ichthyoplankton Study.
Contract No. DACW25-00-D-0005, Work Order No. 10.

Dear Mr. Pulcher:

As specified in Section 7.2.2 of our Scope of Work for the above referenced project, we are hereby enclosing for your use a copy of the sample log for the June 5, 2002 diurnal sampling event. GPS coordinates recorded at the start of each sampling site have also been included.

If you have any questions please feel free to contact me at 314/209-5957.

Sincerely,

Harding ESE, Inc.

William J. Elzinga
Principal Investigator

cc: Elliott Stefanik (email)

Encl.



Harding ESE
A MACTEC COMPANY

Harding ESE, Inc.
3199 Riverport Tech Center Drive
St. Louis, MO 63043

Telephone: 314/209-5900
Fax: 314/209-5929
Home Page: www.mactec.com

June 26, 2002

US Army Corps of Engineers, Rock Island
Attn: Ronald Pulcher, COR
Clock Tower Building - P.O. Box 2004
Rock Island, IL 61204-2004

Re: Upper Mississippi River Ichthyoplankton Study.
Contract No. DACW25-00-D-0005, Work Order No. 10.

Dear Mr. Pulcher:

As specified in Section 7.2.2 of our Scope of Work for the above referenced project, we are hereby enclosing for your use a copy of the sample log for the June 19, 2002 diurnal, nocturnal, and 24-hour sampling event. GPS coordinates recorded at the start of each sampling site have also been included.

If you have any questions please feel free to contact me at 314/209-5957.

Sincerely,

Harding ESE, Inc.

William J. Elzinga
Principal Investigator

cc: Elliott Stefanik (email)

Encl.



Harding ESE, Inc.
3199 Riverport Tech Center Dr.
St. Louis, MO 63043

Telephone: 314/209-5900
Fax: 314/209-5929
Home Page: www.mactec.com

June 26, 2002

US Army Corps of Engineers, Rock Island
Attn: Ronald Pulcher, COR
Clock Tower Building - P.O. Box 2004
Rock Island, IL 61204-2004

Re: Progress Report
Upper Mississippi River Ichthyoplankton Study.
Contract No. DACW25-00-D-0005, Work Order No. 10.

Dear Mr. Pulcher:

As requested by the Rock Island District, Harding ESE Inc. is hereby providing an updated progress report to include field and laboratory services completed for the above referenced contract through the end of June 2002. A summary of the primary project tasks and their respective status is provided below.

Field Sampling

- Currently 88% of the total field effort has been completed with only the July 17th sample collection remaining.
- As specified by Section 8.2 of the SOW, 50% of the data acquisition costs will remain unbilled until the final sampling event has been completed. The remaining 50% of the data acquisition costs will therefore be billed subsequent to the final sampling event.

Laboratory Analysis

- Currently 49 samples have been sorted with QA/QC checks and Harding ESE projects having a total of 55 samples sorted by June 30, 2002.
- Taxonomy has been completed for 5,700 fish and Harding ESE projects 6,400 fish from 35 samples will be identified by June 30, 2002. QA/QC checks have not yet been completed.

Reporting

- Interim Reports: four previously submitted reports (sample logs, GPS coordinates, etc.).
- Draft Report: No activity to date.

In addition, as specified in Section 7.2.2 of our Scope of Work, we are hereby enclosing for your use a copy of the sample log for the June 19, 2002 diurnal, nocturnal, and 24-hour sampling event. GPS coordinates recorded at the start of each sampling site have also been included.

If you have any questions please feel free to contact me at 314/209-5957.

Sincerely,

Harding ESE, Inc.
William J. Elzinga
Principal Investigator

cc: Elliott Stefanik (email)



Harding ESE

A MACTEC COMPANY

Harding ESE, Inc.
3199 Riverport Tech Center Dr.
St. Louis, MO 63043

Telephone: 314/209-5900
Fax: 314/209-5929
Home Page: www.mactec.com

July 22, 2002

Attn: Mr. Ronald Pulcher, PM-A
US Army Corps of Engineers
Rock Island District
P.O. Box 2004
Clock Tower Bldg.
Rock Island, IL 61204-2004

Re: 2002 Upper Mississippi River Ichthyoplankton Study
Contract No. DACW25-00-D-0005, Work Order No. 0010

Dear Mr. Pulcher:

Please find enclosed with this letter an invoice for costs associated with the 2002 Upper Mississippi River Ichthyoplankton Survey in accordance with Section 8.2 of the Scope of Work. These charges are labor and other direct costs associated with the completion of 100% of the field surveys that were conducted in June and July.

If you have any questions please feel free to contact me at 314/209-5913.

Sincerely,

Harding ESE, Inc.

John S. Vile
Project Manager

Enclosure



Harding ESE, Inc.
3199 Riverport Tech Center Dr.
St. Louis, MO 63043

Telephone: 314/209-5900
Fax: 314/209-5929
Home Page: www.mactec.com

July 22, 2002

Attn: Mr. Ronald Pulcher, PM-A
US Army Corps of Engineers
Rock Island District
P.O. Box 2004
Clock Tower Bldg.
Rock Island, IL 61204-2004

**Re: 2002 Upper Mississippi River Ichthyoplankton Study
Contract No. DACW25-00-D-0005, Work Order No. 0010**

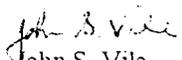
Dear Mr. Pulcher:

Please find enclosed with this letter an invoice for costs associated with the 2002 Upper Mississippi River Ichthyoplankton Survey in accordance with Section 8.2 of the Scope of Work. These charges are labor costs associated with the completion of the sorting process (including QA/QC) for the first 77 samples collected in April and May.

If you have any questions please feel free to contact me at 314/209-5913.

Sincerely,

Harding ESE, Inc.


John S. Vile
Project Manager

Enclosure



Harding ESE, Inc.
3199 Riverport Tech Center Drive
St. Louis, MO 63043

Telephone: 314/209-5900
Fax: 314/209-5929
Home Page: www.mactec.com

July 24, 2002

US Army Corps of Engineers, Rock Island
Attn: Ronald Pulcher, COR
Clock Tower Building - P.O. Box 2004
Rock Island, IL 61204-2004

Re: Upper Mississippi River Ichthyoplankton Study.
Contract No. DACW25-00-D-0005, Work Order No. 10.

Dear Mr. Pulcher:

As specified in Section 7.2.2 of our Scope of Work for the above referenced project, we are hereby enclosing for your use a copy of the sample log for the July 17, 2002 diurnal sampling event. GPS coordinates recorded at the start of each sampling site have also been included.

If you have any questions please feel free to contact me at 314/209-5957.

Sincerely,

Harding ESE, Inc.

William J. Elzinga
Principal Investigator

cc: Elliott Stefanik (email)

Encl.



Harding ESE

A MACTEC COMPANY

Harding ESE, Inc.
3199 Riverport Tech Center Dr.
St. Louis, MO 63043

Telephone: 314/209-5900
Fax: 314/209-5929
Home Page: www.mactec.com

July 30, 2002

US Army Corps of Engineers, Rock Island
Attn: Ronald Pulcher, COR
Clock Tower Building - P.O. Box 2004
Rock Island, IL 61204-2004

Re: Progress Report
Upper Mississippi River Ichthyoplankton Study.
Contract No. DACW25-00-D-0005, Work Order No. 10.

Dear Mr. Pulcher:

As requested by the Rock Island District, Harding ESE Inc. is hereby providing an updated progress report to include field and laboratory services completed for the above referenced contract through the end of July 2002. A summary of the primary project tasks and their respective status is provided below.

Laboratory Analysis

- Currently 102 samples have been sorted with QA/QC checks and Harding ESE projects having a total of 107 samples sorted by July 31, 2002. As specified by Section 8.2 of the SOW, the remaining 76 samples collected will remain unbilled until all sorting and QA/QC has been completed. Therefore, the remaining 76 samples will be billed subsequent to sorting and QA/QC completion.
- Taxonomy has been completed for 12,902 fish from 85 samples. QA/QC checks have not yet been completed.

Reporting

- Draft Report: No activity to date.

If you have any questions please feel free to contact me at 314/209-5957.

Sincerely,

Harding ESE, Inc.
William J. Elzinga
Principal Investigator

cc: Elliott Stefanik (email)



Harding ESE
A MACTEC COMPANY

Harding ESE, Inc.
3199 Riverport Tech Center Dr.
St. Louis, MO 63043

Telephone: 314/209-5900
Fax: 314/209-5929
Home Page: www.mactec.com

July 30, 2002

Attn: Mr. Ronald Pulcher, PM-A
US Army Corps of Engineers
Rock Island District
P.O. Box 2004
Clock Tower Bldg.
Rock Island, IL 61204-2004

Re: 2002 Upper Mississippi River Ichthyoplankton Study
Contract No. DACW25-00-D-0005, Work Order No. 0010

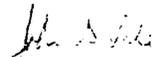
Dear Mr. Pulcher:

Please find enclosed with this letter an invoice for costs associated with the 2002 Upper Mississippi River Ichthyoplankton Survey in accordance with Section 8.3.2 of the Scope of Work. These charges are labor costs associated with the larval fish taxonomy performed on the first 40 samples collected in April and May. A total of 6,851 fish were measured and positively identified with the appropriate QA/QC procedures from these first 40 samples.

If you have any questions please feel free to contact me at 314/209-5913.

Sincerely,

Harding ESE, Inc.


/John S. Vile
Project Manager

Enclosure

COPY



Harding ESE

A MACTEC COMPANY

Harding ESE, Inc.
3199 Riverport Tech Center Dr.
St. Louis, MO 63043

Telephone: 314/209-5900
Fax: 314/209-5929
Home Page: www.mactec.com

September 4, 2002

Attn: Mr. Ronald Pulcher, PM-A
US Army Corps of Engineers
Rock Island District
P.O. Box 2004
Clock Tower Bldg.
Rock Island, IL 61204-2004

Re: 2002 Upper Mississippi River Ichthyoplankton Study
Contract No. DACW25-00-D-0005, Work Order No. 0010

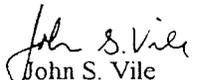
Dear Mr. Pulcher:

Please find enclosed with this letter an invoice for costs associated with the 2002 Upper Mississippi River Ichthyoplankton Survey in accordance with Section 8.3.2 of the Scope of Work. These charges are labor costs associated with the larval fish taxonomy performed on samples 41 through 80 collected in May. A total of 4,320 fish were measured and positively identified with the appropriate QA/QC procedures from these 40 samples.

If you have any questions please feel free to contact me at 314/209-5913.

Sincerely,

Harding ESE, Inc.


John S. Vile
Project Manager

Enclosure



Harding ESE, Inc.
3199 Riverport Tech Center Drive
St. Louis, MO 63043

Telephone: 314/209-5900
Fax: 314/209-5929
Home Page: www.mactec.com

September 12, 2002

US Army Corps of Engineers, Rock Island
Attn: Ronald Pulcher, COR
Clock Tower Building - P.O. Box 2004
Rock Island, IL 61204-2004

Re: Progress Report
Upper Mississippi River Ichthyoplankton Study.
Contract No. DACW25-00-D-0005, Work Order No. 10.

Dear Mr. Pulcher:

As requested by the Rock Island District, Harding ESE Inc. is hereby providing an updated progress report to include field and laboratory services completed for the above referenced contract through the end of August 2002. A summary of the primary project tasks and their respective status is provided below.

Laboratory Analysis

- Currently 123 samples have been sorted with QA/QC checks as of August 31, 2002. As specified by Section 8.2 of the SOW, the final 76 samples collected will remain unbilled until all sorting and QA/QC has been completed. Therefore, the final 76 samples will be billed subsequent to sorting and QA/QC completion.
- Taxonomy has been completed for 57,454 fish from 98 samples. QA/QC checks have been completed for samples 1 through 80.

Reporting

- Draft Report: No activity to date.

If you have any questions please feel free to contact me at 314/209-5957.

Sincerely,

Harding ESE, Inc.
William J. Elzinga
Principal Investigator

cc: Elliott Stefanik (email)



Harding ESE, Inc.
3199 Riverport Tech Center Dr.
St. Louis, MO 63043
Telephone: 314/209-5900
Fax: 314/209-5929

September 27, 2002

Attn: Mr. Ronald Pulcher, PM-A
US Army Corps of Engineers
Rock Island District
P.O. Box 2004
Clock Tower Bldg.
Rock Island, IL 61204-2004

**Re: 2002 Upper Mississippi River Ichthyoplankton Study
Contract No.DACW25-00-D-0005, Work Order No. 0010**

Dear Mr. Pulcher:

Please find enclosed with this letter an invoice for costs associated with the 2002 Upper Mississippi River Ichthyoplankton Survey in accordance with Section 8.2 of the Scope of Work. These charges are labor costs associated with the completion of the sorting process (including QA/QC) for the final 76 samples collected from May through July.

If you have any questions please feel free to contact Bill Elzinga at 314/209-5957.

Sincerely,

Harding ESE, Inc.

Bryan W. Fuhr
Project Biologist

Enclosure

COPY



Harding ESE
A MACTEC COMPANY

Harding ESE, Inc.
3199 Riverport Tech Center Dr.
St. Louis, MO 63043

Telephone: 314/209-5900
Fax: 314/209-5929
Home Page: www.mactec.com

October 9, 2002

Attn: Mr. Ronald Pulcher, PM-A
US Army Corps of Engineers
Rock Island District
P.O. Box 2004
Clock Tower Bldg.
Rock Island, IL 61204-2004

Re: 2002 Upper Mississippi River Ichthyoplankton Study
Contract No.DACW25-00-D-0005, Work Order No. 0010

Dear Mr. Pulcher:

Please find enclosed with this letter an invoice for costs associated with the 2002 Upper Mississippi River Ichthyoplankton Survey in accordance with Section 8.3.3 of the Scope of Work. These charges are labor and other direct costs associated with the completion of the taxonomy of 135,000 larval fish as per the Scope of Work.

If you have any questions please feel free to contact me at 314/209-5913.

Sincerely,

Harding ESE, Inc.

William Elzinga, MS
Principal Investigator

Enclosure



Harding ESE, Inc.
3199 Riverport Tech Center Dr.
St. Louis, MO 63043

Telephone: 314/209-5900
Fax: 314/209-5929
Home Page: www.mactec.com

October 31, 2002

Attn: Mr. Ronald Pulcher, PM-A
US Army Corps of Engineers
Rock Island District
P.O. Box 2004
Clock Tower Bldg.
Rock Island, IL 61204-2004

**Re: 2002 Upper Mississippi River Ichthyoplankton Study
Contract No.DACW25-00-D-0005, Work Order No. 0010**

Dear Mr. Pulcher:

Please find enclosed with this letter an invoice for costs associated with the 2002 Upper Mississippi River Ichthyoplankton Survey in accordance with Section 8.3.3 of the Scope of Work. These charges are labor and other direct costs associated with the completion of the taxonomy of larval fish as per the Scope of Work.

If you have any questions please feel free to contact me at 314/209-5913.

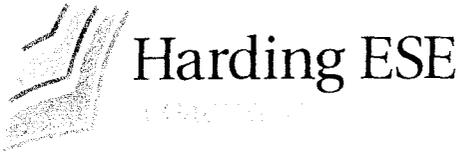
Sincerely,

Harding ESE, Inc.

William Elzinga, MS
Principal Investigator

Enclosure

COPY



Harding ESE, Inc.
3199 Riverport Tech Center Dr.
St. Louis, MO 63043
Telephone: 314/209-5900
Fax: 314/209-5929

November 27, 2002

US Army Corps of Engineers, Rock Island
Attn: Richard Fristik
P.O. Box 2004
Rock Island, IL 61204-2004

**Re: Evaluation of Larval Fish Density and Diversity within Main Channel and Main Channel Border Habitats of Pools 16, 20, and 22 of the Upper Mississippi River.
Contract No. DACW25-00-D-0005 Delivery Order No. 0010**

Dear Mr. Fristik:

Please find enclosed with this letter 10 copies of the draft report for the evaluation of larval fish density and diversity within main channel and main channel border habitats of Pools 16, 20, and 22 of the Upper Mississippi River.

If you have any questions regarding this draft report, please contact me at 314/209-5957.

Sincerely,

Harding ESE, Inc.

A handwritten signature in dark ink, appearing to read "William J. Elzinga", is written over a light-colored background.

William J. Elzinga
Principal Investigator

Enclosure

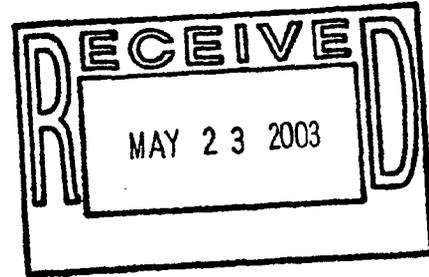


REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
ROCK ISLAND DISTRICT, CORPS OF ENGINEERS
CLOCK TOWER BUILDING - P.O. BOX 2004
ROCK ISLAND, ILLINOIS 61204-2004

May 15, 2003

Planning, Programs, and
Project Management Division



Mr. William Elzinga
Principal Investigator
Harding, ESE, Inc.
3199 Riverport Tech Center Drive
St. Louis, Missouri 63043

Dear Mr. Elzinga:

The Rock Island District of the U.S. Army Corps of Engineers (Corps) has reviewed the draft report entitled Evaluation of Larval Fish Density and Diversity within Main Channel and Main Channel Border Habitats of Pools 16, 20, and 22 of the upper Mississippi River. William Elzinga, of Harding ESE, Inc., St. Louis, Missouri, prepared the report under Corps Contract DACW25-00-D-0005, Work Order No. 00010.

Enclosed is one CEMVR Form 44E. Please address all comments contained in this form before submitting the final report.

Before submitting the final reports, please review the statements of work in both the main contract and this work order and prepare your submittals accordingly.

If you have any questions regarding this matter, please call me at telephone 309/794-5384, or write to me at our address above, ATTN: Planning, Programs, and Project Management Division (Ron Pulcher).

Sincerely,

Ronald E. Pulcher
Authorized Representative
of the Contracting Officer

Enclosure

Appendix B
Scope of Work

ORDER FOR SUPPLIES OR SERVICES

1. CONTRACT/PURCH. ORDER/ AGREEMENT NO. DACW25-00-D-0005	2. DELIVERY ORDER/ CALL NO. 0010	3. DATE OF ORDER/CALL 2002Apr04	4. REQ./ PURCH. REQUEST NO. 965147-2064-6552	5. PRIORITY
--	-------------------------------------	------------------------------------	---	-------------

6. ISSUED BY CONTRACTING DIVISION CLOCK TOWER BUILDING PO BOX 2004 ROCK ISLAND IL 61204-2004	CODE DACW25	7. ADMINISTERED BY JAN HANCKS (309)794-5443 PO BOX 2004 CLOCK TOWER BLDG ROCK ISLAND IL 61204-2004	CODE DACW25	8. DELIVERY FOB <input checked="" type="checkbox"/> DEST <input type="checkbox"/> OTHER (See Schedule if other)
--	----------------	--	----------------	--

9. CONTRACTOR HARDING ESE, INC. DANNY J. LAVERGNE 1819 DENVER WEST DR., STE 400 GOLDEN CO 80401	CODE 3X857	FACILITY 3X857	10. DELIVER TO FOB POINT BY (Date) 2002Dec30	11. MARK IF BUSINESS IS <input type="checkbox"/> SMALL <input type="checkbox"/> SMALL DISADVANTAGED <input type="checkbox"/> WOMEN-OWNED
			12. DISCOUNT TERMS	13. MAIL INVOICES TO THE ADDRESS IN BLOCK See Item 15

14. SHIP TO ECON AND ENV ANALYSIS BRANCH CLOCK TOWER BUILDING PO BOX 2004 ROCK ISLAND IL 61204-2004	CODE DACW25	15. PAYMENT WILL BE MADE BY US ARMY ENGINEER DISTRICT, ROCK ISLAND NOTE: SEND INVOICES TO ADDRESS IN BLOCK 14 XXXXXXXXXXXXXXXXXXXXXXXXXXXX IL XXXXX	CODE DACW25	MARK ALL PACKAGES AND PAPERS WITH IDENTIFICATION NUMBERS IN BLOCKS 1 AND 2.
--	----------------	---	----------------	--

16. TYPE OF ORDER	DELIVERY/ CALL	<input checked="" type="checkbox"/>	This delivery order/call is issued on another Govt. agency or in accordance with and subject to terms and conditions of above numbered contract.	
	PURCHASE		Reference your quote dated	Furnish the following on terms specified herein.
ACCEPTANCE. THE CONTRACTOR HEREBY ACCEPTS THE OFFER REPRESENTED BY THE NUMBERED PURCHASE ORDER AS IT MAY PREVIOUSLY HAVE BEEN OR IS NOW MODIFIED, SUBJECT TO ALL OF THE TERMS AND CONDITIONS SET FORTH, AND AGREES TO PERFORM THE SAME.				
NAME OF CONTRACTOR		SIGNATURE		TYPED NAME AND TITLE
				DATE SIGNED (YYYYMMDD)
<input type="checkbox"/> If this box is marked, supplier must sign Acceptance and return the following number of copies:				

17. ACCOUNTING AND APPROPRIATION DATA/ LOCAL USE
See Schedule

18. ITEM NO.	19. SCHEDULE OF SUPPLIES/ SERVICES	20. QUANTITY ORDERED/ ACCEPTED*	21. UNIT	22. UNIT PRICE	23. AMOUNT
SEE SCHEDULE					

* If quantity accepted by the Government is same as quantity ordered, indicate by X. If different, enter actual quantity accepted below quantity ordered and encircle	24. UNITED STATES OF AMERICA <i>Cynthia J. Pleasant</i> BY: CYNTHIA J PLEASANT	CONTRACTING / ORDERING OFFICER	25. TOTAL \$141,278.21
			29. DIFFERENCES

26. QUANTITY IN COLUMN 20 HAS BEEN <input type="checkbox"/> INSPECTED <input type="checkbox"/> RECEIVED <input type="checkbox"/> ACCEPTED, AND CONFORMS TO THE CONTRACT EXCEPT AS NOTED DATE _____ SIGNATURE OF AUTHORIZED GOVT. REP. _____	27. SHIP NO. <input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL	28. DO VOUCHER NO.	30. INITIALS
36. I certify this account is correct and proper for payment. DATE _____ SIGNATURE AND TITLE OF CERTIFYING OFFICER _____	31. PAYMENT <input type="checkbox"/> COMPLETE <input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL	32. PAID BY	33. AMOUNT VERIFIED CORRECT FOR
			34. CHECK NUMBER
			35. BILL OF LADING NO.

37. RECEIVED AT	38. RECEIVED BY	39. DATE RECEIVED (YYYYMMDD)	40. TOTAL CONTAINERS	41. S/R ACCOUNT NO.	42. S/R VOUCHER NO.
-----------------	-----------------	------------------------------	----------------------	---------------------	---------------------

SECTION B Supplies or Services and Prices

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0001		1	Lump Sum	SUM	\$141,278.21 NTE
	EVALUATION OF FISHERIES RESPONSE TO DREDGED MATERIAL PLACEMENT AT SENATE ISLAND (IWW RM 130.0 -- 133.IL) AND HOGBACK ISLAND/LONG ISLAND (UMR RM 331.7 - 333.5I) - YEAR 2. IN ACCORDANCE WITH THE ATTACHED SCOPE OF WORK AT A COST NOT TO EXCEED \$141,278.21.				

THIS IS YOUR OFFICIAL NOTICE TO PROCEED WITH THE WORK.

SECTION C Descriptions and Specifications

ACCOUNTING AND APPROPRIATION DATA

AB:	96X31210000 082428	25209852LF010315	NA 96114	000000000000
AMOUNT:	\$141,278.21			

SCOPE OF WORK

EVALUATION OF LARVAL FISH DIVERSITY AND RELATIVE ABUNDANCE WITHIN MAIN CHANNEL AND MAIN CHANNEL BOARDER HABITATS OF POOLS 16, 20 AND 22 OF THE UPPPER MISSISSIPPI RIVER

Contract No. DACW25-00-D-0005 Delivery Order No. 0010

April 2002

I. CONTRACT PROVISIONS IN FORCE

Provisions of the Scope of Work (SOW) in the main contract shall apply to this Work Order as required to fulfill the requirements of the main contract and to accomplish the work set out in the Specifications, below, and are not repeated here.

II. PROJECT OBJECTIVE AND LOCATION

The purpose of this project is to evaluate larval fish diversity and abundance within the planktonic drift of main channel and main channel boarder habitats of Pools 16, 20 and 22 of the UMR (Upper Mississippi River). Primary tasks to be performed include: (1) perform a series larval drift transect samples across main channel (MC) and main channel boarder (MCB) habitats of Pools 16, 20 and 22 of the Upper Mississippi River; and (2) prepare a short technical report describing results of the survey. MC and MCB habitats are defined as in the Habitat Needs Assessment for the Upper Mississippi River Technical Report (Corps of Engineers 2000).

III. REGULATORY REQUIREMENTS AND AUTHORITIES

- 3.1 This study is being conducted to fulfill regulatory requirements stipulated under the provisions of the National Environmental Policy Act of 1969 (NEPA) and associated regulations.
- 3.2 The Contractor shall be responsible for securing all applicable sampling permits from the State and federal Governments.

IV. BACKGROUND

The District (U.S. Army Corps of Engineers, Rock Island District) is directed by Congress to maintain a 2.75 meter (m) (9-foot) navigation channel on the UMR and IWW (Illinois Waterway). Maintenance of the navigation channel involves operating a series of Locks and Dams to maintain minimum pool elevations.

The Upper Mississippi River-Illinois Waterway System Navigation Study ('UMR-IWW System Navigation Study', 'Navigation Study') is a feasibility study addressing navigation improvement planning for the UMR and IWW navigation system for the years 2000-2050. The study assesses the need for navigation improvements at 29 lock and dam facilities (35 locks) on the UMR and 8 locks on the IWW and the impacts of providing these improvements.

Navigation improvements associated with the Navigation Study would likely result in an increase in commercial navigation traffic in the UMR and IWW. This increase in navigation traffic could result in adverse impacts to fisheries communities of the UMR and IWW. One way that fisheries communities may be adversely affected is through mortality of larval fish through propeller entrainment. To help characterize potential impacts from larval fish entrainment, the Corps has reviewed available data and pursued

additional larval fish sampling to characterize larval fish drift within the UMR and IWW (Corps of Engineers 1999). Work performed under this SOW shall further augment this effort.

V. STATEMENT OF WORK/SPECIFICATIONS

5.1 Sampling Sites. Eighteen (18) separate sampling sites shall be divided evenly among six (6) separate linear sampling transects in UMR Pools 16, 20 and 22.

5.1.1 One linear transect is located in the upstream and one in the downstream section of each Pool. The location of each transect (6 transects total) shall be at the location described below. Prior to the initial sampling event, the contractor has the flexibility to move the transects slightly upstream or downstream (i.e., half a river mile) to facilitate effective sampling (i.e., avoid shallow water, wing dams or other obstructions, tow traffic fleeting areas, etc.).

Transect	River Mile Transect Location
Pool 16 Upper	478.0
Pool 16 Low	462.2
Pool 20 Upper	360.4
Pool 20 Lower	344.5
Pool 22 Upper	323.0
Pool 22 Lower	304.0

5.1.2 At, or as close as practical to, each transect the Contractor shall establish one (1) sampling site within the MCB along the right side of the channel, one (1) MC sampling site within the MC, and one (1) sampling site within the MCB along the left side of the channel. The Contractor shall refer to the report referenced at Corps of Engineers 2000 for the definitions of MC and MCB.

5.1.3 The Contractor shall utilize the same sample sites, to the extent possible, for each sampling date in the Sampling Schedule, below.

5.1.4 Each sample collected shall be assigned a unique identification number.

5.2 Sampling Collection Technique: The Contractor shall perform larval fish sampling at each of the eighteen (18) separate sampling sites. The following specifications shall apply for larval fish sampling at each of the sampling sites:

5.2.1 Sampling Schedule: Sampling shall follow this schedule such that all sampling is conducted within +/- two days of the dates shown:

April	May	June	July
24 th	+*10 th	5 rd	17 th
	+*20 th	+*19 th	

5.2.2 Samples Collected: A total of 153 samples shall be collected as described below in para. 5.2.2.1 and 5.2.2.2.

5.2.2.1 Diurnal and Nocturnal Sampling: For each sampling date shown in Para. 5.2.1, one sample shall be collected at each of the eighteen (18) sampling sites between 0900 and 1600 hours (diurnal sampling). For every sampling date marked with an asterisk in Para. 5.2.1, the Contractor shall, in addition to the samples collected during the day, collect one nocturnal sample at all three sample sites of the upstream transect of each pool (9 sampling sites total). Samples shall be collected between 2000 hours and 2400 hours on the date of the diurnal sample. The only

deviation from these sample collection times are for the upper transect in Pool 16, as discussed in para. 5.2.2.2 below. There shall be no difference in sampling protocol between diurnal and nocturnal sampling.

5.2.2.2 Twenty four-hour Sampling: For every sampling date marked with a plus symbol in Para. 5.2.1, the Contractor shall collect samples at 6-hour intervals over the period of the day indicated. This sampling effort shall be conducted only along the three sample collection points of the upstream transect for Pool 16. Samples shall be collected at 0600, 1200, 1800 and 2400 hours. The sampling effort for the 24-hour sampling shall occur concurrently with that for diurnal and nocturnal sampling discussed in para 5.2.2.1. In other words, sampling along this transect for the dates indicated would result in one set of three samples for diurnal sampling, and one set of three samples for nocturnal sampling (as per para 5.2.2.1). The 24-hour sampling would result in the collection of two more sets of three samples at this location. However, collection of these samples shall be according to the collection times noted earlier in this paragraph. There shall be no difference in sampling protocol between 24-hour sampling and diurnal and nocturnal sampling.

5.2.3 Sampling Direction: Larval fish sampling at each site shall occur with net openings facing in an upstream direction.

5.2.4 Sampling with Paired Nets Combined As Single Sample: Sampling shall occur using two, 1-m diameter, 500- μ m mesh ichthyoplankton nets. Contents collected from the two nets at each sampling site shall be combined immediately upon collection and treated as a single sample.

5.2.5

5.2.5.1 Nets shall be as long as possible to minimize the pressure wave at the front of the net.

5.2.5.2 Net dimensions shall be constant throughout execution of this Scope of Work.

5.2.5.3 Nets shall be mounted from a boom attached to the bow of a boat and maintained so that the top of each net shall be approximately 10 cm below water surface.

5.2.6 Sample Water Volume Measurement/Flow Meter: Total water volume for each sample shall be recorded as calculated from a flow meter placed in the mouth of a sample net for the duration of collection of each sample.

5.2.6.1 Water entering the mouth of the net shall be maintained at velocities of approximately 1.0-1.5 meters/second.

5.2.6.2 In high flow conditions, particularly in the MC, it may be necessary to allow the boat to partially flow with the current while still maintaining net openings facing in an upstream direction.

5.2.7 Sample Collection Duration: Each sampling event at each individual sampling site shall last approximately 10 minutes (exact time shall be recorded to the nearest second by stopwatch).

5.2.8 Recordation of GPS Coordinates and Average River Depth:

5.2.8.1 The Contractor shall record GPS coordinates at the starting point of each sampling site for each sample collected.

5.2.8.2 Average River Depth at the sample collection site shall be recorded from measurements taken at the start, middle, and end of the sample run

5.2.9 **Sample Preservation:** Each sample's larval fishes and drifting debris shall be preserved in either 10% formalin or 95% ethanol.

5.2.10 **Sampling Log:** A sampling log shall be maintained to record the following information for each sample collected [Water quality parameters (**bold type**) shall be measured at a depth of 30 cm]:

5.2.10.1 unique identification number assigned to sample,

5.2.10.2 technician(s) collecting the sample,

5.2.10.3 GPS coordinates at starting point,

5.2.10.4 time and date of sample collection,

5.2.10.5 sample collection duration in seconds (start/end),

5.2.10.6 volume of water sampled,

5.2.10.7 Pre-Preservation Sample Volume (nearest 0.1 liter)-see Paras. 5.2.5 & 5.2.6,

5.2.10.8 Average River Depth at sample collection site from measurements at start, middle, and end of sample run,

5.2.10.9 **surface current velocity,**

5.2.10.10 **water temperature,**

5.2.10.11 **dissolved oxygen, and**

5.2.10.12 **total suspended solids (as measured in Nephelometric turbidity units (NTUs)).**

5.3 **Sample Evaluation** Sample Evaluation consists of sample sorting, fish identification, and fish measurement as set out below. Diurnal and Nocturnal samples shall be evaluated first. Additional samples collected as a part of the 24-hour sample shall be evaluated last.

5.3.1 **Sample Sorting:** Sample contents shall first be sorted to separate fish from other organic materials. Following sorting, the total number of fish for that sample shall be counted. Sorting and counting of samples shall be performed by Fisheries Interns.

5.3.2 **Fish Identification and Measurement:** This SOW allows for identification of up to 135,000 individual larval fish. Fish sorted from within each sample shall then be identified by the appropriate specialist(s), following the keys of Auer (1982) and Holland-Bartels et al. (1990), to the lowest possible taxonomic category (most often to family or genus). Twenty-five (25) larval fish of each taxon identified shall be randomly selected from each sample and their individual total lengths shall be measured to the nearest 0.1 mm. All fish from each taxon containing less than twenty-five (25) individuals within each sample shall be measured (total length) to the nearest 0.1 mm.

5.4 **Data analysis.**

5.4.1 **Measurement of Larval Fish Density.** Data analysis for this project, including that for the technical report (as discussed below), shall include calculation of larval fish density (total and by taxon).

5.4.1.1 Density shall be expressed as the number of individuals per cubic meter of water sampled ($D = \text{number}/\text{m}^3$).

5.4.1.2 Density shall be calculated and recorded for each sample.

5.4.2 **Data in Technical Report.**

5.4.2.1 The technical report shall summarize and discuss larval fish diversity and densities observed within and amongst the three pools sampled. The report also shall discuss diversity and densities observed over time (sampling dates); between different sampling periods (i.e., diurnal vs. nocturnal samples); and habitat types (i.e., MC vs. MCB).

5.4.2.2 Data shall be provided in a manner similar, but not limited, to that presented in Tables 7, 8, and 10, Table B and Table C of Exhibit 1.

5.4.2.3 The Contractor shall include the sample log as an Appendix to the Technical Report.

5.4.2.4 The technical report shall include no fewer than 12 tables.

5.5 **Quality Assurance/Quality Control.** Following Sample Evaluation, all samples shall be saved for future reference until acceptance of the final report by the Corps.

5.5.1 Samples shall be saved with at least one container for sorted and identified fish and one container for the remaining organic materials.

5.5.2 The District retains the right to modify the contract to request the shipment of any samples for external QA/QC review.

5.5.3 In the event of any external QA/QC, the choice of samples to be transmitted shall be determined by the Project Biologist.

VI. SPECIAL CONDITIONS

6.1. The Contractor shall carry a marine band radio and cell phone while conducting field work to facilitate communication with the Lockmasters and approaching towboats.

6.2. The marine band radio shall, at a minimum, be equipped with "safety and calling" channel 16 (frequency 156.8 mhz), operating channel 14 (frequency 156.7 mhz) and bridge to bridge" channel 13 (frequency 156.65 mhz).

6.3. When not being used to receive or transmit a message, the radio shall simultaneously monitor channels 13 and 16.

VII. REPORTS

7.1 **General:** The Contractor shall prepare a brief technical report describing the survey methodology and results of the investigation outlined in Section V, above. Reporting requirements in the main contract Scope of Work shall apply unless otherwise set out in the Scope of Work for this delivery order.

7.2 **Interim Reports:** Six Interim Reports are required.

7.2.1 Interim Reports shall be submitted by e-mail to the Corps Project Biologist within one calendar week following each sampling date in paragraph 5.2.1, above. A hard copy of Interim Reports shall be mailed to the COR.

7.2.2 Interim Reports shall consist of:

7.2.2.1 the Sampling Logs;

7.2.2.2 other information deemed relevant by the Contractor regarding the work accomplished.

7.3 Draft and Final Reports: Ten (10) copies of the draft report are required. Thirty (30) copies of the final report are required.

7.4 Scope of Work a Mandatory Report Appendix: This delivery order Scope of Work shall be included as a report appendix.

VIII. SCHEDULE

8.1 Project Schedule - The following Project Schedule shall apply:

<u>Tasks</u>	<u>Date</u>
Date of Award	Block 3 of Form DD Form 1155
Interim Report Submittals	Within one calendar week following each sampling date
Progress Phone Conference	27 May 02
Complete Field Work	17 July 02
Final Field Data*	Sept 30 2002
Draft Report Submittal	15 Nov 02
Final Report Submittal	15 Jan 03

* Final Field Data includes all data collected through this SOW, including sorting and identification of all larval fish within all samples. This includes completion of all QA/QC checks for both sample sorting and fish identification. All data must have passed final QA/QC review.

8.2 Payment Schedule – The payment schedule shall be as follows:

PAYMENT SCHEDULE	
<u>Tasks</u>	<u>Percent of Contract Amount*</u>
1) 50% field work completion	20
2) 100% field work completion	20
3) Sample Sorting (including sample QA/QC) completed for 77 samples collected	20
4) Sample Sorting (including sample QA/QC) completed for remaining 76 samples collected	20
5) draft report submittal	10
6) final report acceptance by Corps	10

*These percentages are applied to the contract amount MINUS the Required Fish Identification Costs (as defined at Para. 8.3, below).

8.3 Fish Identification Payment Schedule.

8.3.1 Fish Identification costs shall be billed on the number of individual fish identified and measured, as per 5.3.2.

- 8.3.2 Billing may occur at any time the number of samples from which all fish have been positively identified and measured (as per 5.3.2), reaches 40 samples, the last billing excepted.
- 8.3.3 In no case shall the number of fish identified exceed the 135,000 fish. Should larval fish counts exceed 135,000 individual fish, the contract shall be modified to complete any remaining sample identification.
- 8.3.4 The final data from Fish Identification for all samples making up the fish billed, including QA/QC of the fish identification, must be furnished to the Project Biologist at the time of billing.

IX. COORDINATION

- 9.1 Elliott Stefanik is the Project Biologist for this work. He may be reached by phone: 309/794-5285, FAX: 309/794-5157, or E-mail: Elliott.L.Stefanik@usace.army.mil.
- 9.2 Ronald E. Pulcher is the Contracting Officer's Representative (COR) for this work. He may be reached by email ronald.e.pulcher@usace.army.mil, PH: 309/794-5384, FAX: 309/794-5157, or US mail at Corps of Engineers, PO Box 2004, Rock Island, Illinois 61204-2004.
- 9.3 The Project Biologist shall be notified by the Contractor at least 48 hours prior to the commencement of field work within each Pool.
- 9.4 Lockmasters at Lock and Dams 15, 16, 19, 20, 21 and 22 shall be notified by the Contractor at least 24 hours prior to the commencement of fieldwork. Each Lockmaster also shall be contacted the day(s) of the survey to assure that they know the location of the survey team while on site. The phone number for Lock and Dam 15 is 309/794-5266. The phone number for Lock and Dam 16 is 309/537-3191. The phone number for Lock and Dam 19 is 319/524-2631. The phone number for Lock and Dam 20 is 573/288-3320. The phone number for Lock and Dam 21 is 217/222-0918. The phone number for Lock and Dam 22 is 573/221-0294.
- 9.5 It is the Contractor's responsibility to contact the Project Biologist or other Corps personnel to determine current field conditions regarding water levels and other conditions that might affect initiation or completion of the survey.

X. EXHIBITS

I. Corps of Engineers. 1999. *Abundance of Fishes in the Navigation Channels of the Mississippi and Illinois Rivers and Entrainment mortality of adult fish caused by towboats*. Prepared for the U.S. Army Corps of Engineers, St. Paul, Rock Island and St. Louis Districts. ENV Report 29, December 1999.

XI. REFERENCES

Auer, N.A. 1982. *Identification of larval fishes of the Great Lakes basin with emphasis on the Lake Michigan drainage*. Great Lakes Fishery Commission, Special Publication 82-3, Ann Arbor, Michigan.

Corps of Engineers. 2000. *Habitat Needs Assessment for the Upper Mississippi River System: Technical Report*. Prepared for the U.S. Army Corps of Engineers, St. Louis District, St. Louis, Missouri. October, 2000.

Corps of Engineers. 1999. *Abundance of Fishes in the Navigation Channels of the Mississippi and Illinois Rivers and Entrainment mortality of adult fish caused by towboats*. Prepared for the U.S. Army Corps of Engineers, St. Paul, Rock Island and St. Louis Districts. ENV Report 29, December 1999.

Holland-Bartels, L., S. Littlejohn, and M. Hutson. 1990. A guide to larval fishes of the Upper Mississippi River. Minnesota Extension Service, University of Minnesota, St. Paul. 107 pp.

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT			1 CONTRACT ID CODE	PAGE OF PAGES	
			J	1	2
2 AMENDMENT/MODIFICATION NO. 01	3 EFFECTIVE DATE 29-Oct-2002	4 REQUISITION/PURCHASE REQ. NO. 965147-2064-6552		5 PROJECT NO (if applicable)	
6 ISSUED BY CODE DACW25 CONTRACTING DIVISION CLOCK TOWER BUILDING PO BOX 2004 ROCK ISLAND IL 61204-2004		7 ADMINISTERED BY (If other than item 6) CODE DACW25 MICHAEL HOH (309)794-5628 CLOCK TOWER BLDG PO BOX 2004 ROCK ISLAND IL 61204-2004			
8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code) HARDING ESE, INC. DANNY J. LAVERGNE 1819 DENVER WEST DR., STE 400 GOLDEN CO 80401			9A. AMENDMENT OF SOLICITATION NO.		
			9B. DATED (SEE ITEM 11)		
			X	10A. MOD. OF CONTRACT/ORDER NO. DACW25-00-D-0005-0010	
			X	10B. DATED (SEE ITEM 13) 07-Jun-2000	
CODE 3X857	FACILITY CODE 3X857				
11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS					
<input type="checkbox"/> The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer <input type="checkbox"/> is extended, <input type="checkbox"/> is not extended. Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.					
12. ACCOUNTING AND APPROPRIATION DATA (If required) See Schedule					
13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.					
A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.					
B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).					
X C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF: 52.212-4					
D. OTHER (Specify type of modification and authority)					
E. IMPORTANT: Contractor <input checked="" type="checkbox"/> is not, <input type="checkbox"/> is required to sign this document and return _____ copies to the issuing office.					
14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.) SEE PAGE 2					
Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.					
15A. NAME AND TITLE OF SIGNER (Type or print)			16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) CYNTHIA J PLEASANT / CONTRACTING OFFICER TEL: 309-794-5239 EMAIL: Cynthia.J.Pleasant@usace.army.mil		
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY <i>Cynthia J Pleasant</i> (Signature of Contracting Officer)		16C. DATE SIGNED 29-Oct-2002	

EXCEPTION TO SF 30
APPROVED BY OIRM 11-84

30-105-04

STANDARD FORM 30 (Rev. 10-83)
Prescribed by GSA
FAR (48 CFR) 53.243

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

The following items are applicable to this modification:

MODIFICATION VERBIAGE

THIS MODIFICATION IS ISSUED TO CHANGE THE SCOPE OF WORK TO ALLOW ADDITIONAL NUMBER OF LARVAL FISH TO BE IDENTIFIED, AND TO INCREASE THE TOTAL DOLLAR AMOUNT OF THE ORDER.

1. UNDER PARAGRAPH 5.3.2, CHANGE THE AMOUNT FOR INDIVIDUAL LARVAL FISH TO BE IDENTIFIED TO READ 149,707 VICE 135,000.

2. UNDER PARAGRAPH 8.2, PLEASE FIND CHANGES BELOW TO BE INCORPORATED INTO THE SCOPE OF WORK:

- a. Final Field data submission changed to 1 November 2002
- b. Draft Report Submittal changed to 29 November 2002
- c. Final Report Submittal changed to 29 January 2003

3. UNDER PARAGRAPH 9.1, CHANGE TO READ AS FOLLOWS:

a. RICHARD FRISTIK IS THE PROJECT BIOLOGIST FOR THIS WORK. HE MAY BE REACHED BY PHONE: 309/794-5308, FAX: 309/794-5157, OR E-MAIL: richard.fristik@usace.army.mil.

PREVIOUS CONTRACT AMOUNT.....	\$141,278.21
INCREASE DUE TO THIS MODIFICATION.....	\$ 4,706.24
REVISED CONTRACT AMOUNT.....	\$145,984.45

ESTIMATED QUANTITIES – THE QUANTITIES INDICATED ARE ESTIMATES ONLY. THE CONTRACTING OFFICER MAY INCREASE OR DECREASE AS NEEDED. THE CONTRACTOR WILL BE PAID ON THE BASIS OF ACTUAL WORK PERFORMED.