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# Illinois Natural History Survey

## Abundance of Fishes in the Navigation Channels of the Mississippi and Illinois Rivers with Implications for Estimation of Entrainment Mortality Caused by Towboats

July 1, 1995 through December 31, 1998

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FINAL REPORT

Submitted to
Office of Resource Conservation
Illinois Department of Natural Resources
600 N. Grand Ave., West
Springfield, IL 62706

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**FINAL REPORT**

Submitted to the Office of Resource Conservation, Illinois Department of Natural Resources

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**Abstract**

Expansion of the capacity of the Upper Mississippi River System to support commercial navigation is being deliberated. This proposed expansion created the need to develop information on potential effects of commercial navigation on fishes of the Upper Mississippi River System. Our study objectives were to: 1) quantify the distribution and abundance of early life stages of fish for later incorporation into models of losses of adult-fish equivalents, production foregone and recruitment foregone; 2) develop methods to estimate abundance and entrainment mortality of juvenile and adult fishes in navigation channels; and 3) estimate abundance of juvenile and adult fishes in the navigation channels of Pool 26 of the Mississippi River and in the lower Illinois River for later incorporation into models to estimate entrainment mortality of juvenile and adult fishes. Total densities of larval fishes in the navigation channels generally did not exceed 3 fish/$m^3$ and tended to be greater in the lower Illinois River than in nearby Pool 26 of the Mississippi River. Larvae of common carp *Cyprinus carpio* and catostomids predominated in May but were replaced by clupeids, primarily gizzard shad *Dorosoma cepedianum* in June. Finally, freshwater drum *Aplodinotus grunniens* larvae predominated ichthyoplankton drift in late June and early July. Total minimal densities of fish longer than 10 cm total length averaged 157 and 177 fish/ha during 1996 and 1997, respectively, in the lower Illinois River, and 109 and 55, respectively in Pool 26 of the Mississippi River. The assemblage of these larger fishes was dominated by freshwater drum, gizzard shad, channel catfish *Ictalurus punctatus*, and smallmouth buffalo *Ictiobus bubalus*. Additionally, shovelnose sturgeon *Scaphirhynchus platorynchus* were common the upper portion of Pool 26, but totally absent from the Illinois River. The core assemblage of larval fish taxa and larger fish species

present in Pool 26 of the Mississippi River and in the lower Illinois River was similar between years, but substantial variability in seasonal timing of appearance and in observed density of these fishes in the navigation channel exists. However, due to the short duration of the study, we cannot determine the potential magnitude of year-to-year changes in the density and seasonal appearance of fishes in the navigation channel, leaving substantial uncertainty as to how representative our estimates of fish density might be. Nevertheless, this study has clearly demonstrated that substantial numbers, biomass, and diversity of all life stages of fish occurs in the main channel of large floodplain rivers such as the Upper Mississippi River and the lower Illinois River. We believe that this habitat type must be more strongly considered in future management efforts of large floodplain rivers potentially affected by commercial navigation.

## Introduction

Large rivers of the United States are managed by multiple agencies for multiple uses, including commercial navigation. Commercial vessels such as towboats entrain large volumes of water through their propellers, which may exceed 2.5 m in diameter. Fish that pass through those propellers may be injured or killed by shear stress, impact or pressure changes. Although mortality of eggs and larval fishes that pass through hydropower turbines is well known (Hesse et al. 1982; Englert and Boreman 1988; Cada 1990), little is known about mortality of early life stages of riverine fishes caused by entrainment through towboat propellers. Larval fish are present across all aquatic areas of the Upper Mississippi and the Illinois Rivers, including the navigation channels (Holland and Sylvester 1983; Holland-Bartels et al. 1995), and are therefore at risk of entrainment through by towboats. Holland (1986) studied short-term changes in distribution and catch of early-life stages of fish associated with towboat passage in Pools 7 and 8 of the Mississippi River and noted significant damage to eggs, but found no consistent effects on catches of age-0 and small adult fishes. Odom et al. (1992) attempted to estimate entrainment mortality of larval fishes by deploying plankton nets before and after barge-passage, but concluded that net and handling induced mortality may have masked any effects of towboats.

Mortality of larger fish caused by entrainment through towboat propellers has not previously been quantified, but has been reported anecdotally. In large open channels many fish may escape entrainment by avoiding oncoming tows. For instance, some fishes avoid large vessels in the marine environment (Neproshin 1978; Misund and Aglen 1992; Soria et al. 1996). Furthermore, Todd et al. (1989) observed radio-tagged channel catfish *Ictalurus punctatus* move in response to oncoming towboats in the Illinois River. Lowery et al. (1987) used hydroacoustic sensing to monitor the responses of fishes to tow passages in the Cumberland River and found that some moved away from passing tows. The strength of this avoidance reaction seemed to vary with direction of tow travel (up- versus downbound) and whether or not the barges were loaded. However, some fish may not avoid entrainment. The magnitude, seasonal timing and spatial variation in tow-induced entrainment mortality of large riverine fishes is completely unknown.

An expansion of commercial navigation capacity is being considered for the Mississippi and Illinois Rivers above Lock and Dam 26 near St. Louis. Estimates of entrainment mortality and effects on fish populations are needed by decision makers including the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service. The goals of this study in Pool 26 of the Mississippi River and in the lower Illinois River were to: 1) quantify the distribution and abundance of early life stages of fish for later incorporation into models of losses of adult-fish equivalents, production foregone and recruitment foregone; 2) develop methods to estimate abundance and entrainment mortality of juvenile and adult fishes in navigation channels of large rivers; and 3) estimate abundance of juvenile and adult fishes in the navigation channels for later incorporation into models to estimate entrainment mortality of juvenile and adult fishes.

## Methods

With the exception of additions and modifications described below, methods of sampling and data management conformed to Long Term Resource Monitoring protocols (Gutreuter et al. 1995). Water temperature, Secchi depth, and surface current velocity were measured and recorded before each fish sampling event. Surface current velocity was measured at 30-cm depth by using a Marsh-McBirney™ Flow-Mate 2000 current meter. All names of fishes used in this report (Appendix A) conform to Robins et al. (1991).

*Larval fish sampling.*

We collected larval fishes every other week during May 1-August 1, 1996 at up to 10 main channel sites (River Miles 203.2, 207.1, 211.2, 213.6, 215.7, 223.0, 225.8, 230.5, 233.5, and 240.2) on the Mississippi River and four sites (River Miles 4.5, 9.3, 13.5, and 18.7) on the Illinois River. All sampling sites were located in the center of the navigation channel and chosen such that the risk of a towboat appearing suddenly from around a blind bend was minimized. Sampling occurred in an upstream direction with paired 1-m diameter, 500-$\mu$m mesh ichthyoplankton nets mounted from a boom attached to the bow of a boat and pushed near the surface of the water alongside the boat at speed of 1.0-1.5 m/s. Each push lasted about 10 minutes (exact time recorded in seconds by stopwatch), after which larval fishes and drifting debris were preserved in 10% formalin or 95% ethanol. Sampling throughout a 24-hour period was not conducted because two crew leaders were not available during 1996.

In 1997, larval fish sampling occurred in five locations, one on the lower Illinois River at River Mile 13.5, two on the Mississippi River above its confluence with the Illinois River at River Miles 223.0 and 233.5, and two on the Mississippi River below its confluence with the Illinois River at River Miles 208.5 and 215.7. These locations were selected so that 1) they were sites used in 1996 and 2) spatial distribution of larvae across main channel, side channel, and backwater habitats could be assessed. We followed a sampling protocol similar to that in 1996 at these sites, except that we 1) also sampled side channel and backwater sites, 2) sampled all sites for about 6 minutes instead of 10 minutes to reduce the volume of extraneous debris and speed sample processing, and 3) sampled backwater sites with a 0.5-m diameter ichthyoplankton net due to their lack of depth compared to main channel and side channel sites.

All fishes were identified, following the keys of Auer (1982) and Holland-Bartels et al. (1990), to the lowest possible taxonomic category (most often to family or genus) given the amount of time needed to process and count samples. As many as 100 larval fish of each taxon were randomly selected from each net tow within a paired sample and their individual total lengths were measured to the nearest 0.1 mm total length (TL) by using a drawing tube attached to a microscope and a computerized digitizing program. To estimate abundance of larval fishes at each sampling site and date, we used the simple mean density from the two paired nets.

*Sampling small and 'adult' fishes by trawling.*

We used bottom trawls to sample fishes in the navigation channels. Bottom trawls were chosen because most channel-dwelling fishes of the Upper Mississippi River System are primarily epibentic in their vertical distribution. Further, we sought to measure the quantity of fish that might be killed by entrainment through towboat propellers, which presented particular problems. This study was conducted under the philosophy that where uncertainty was unavoidable or where assumptions were required, we would reasonably avoid underestimation of impact. Fish killed by entrainment, and particularly those severed by propellers might have ruptured gas bladders and be negatively buoyant, tending to settle to the bottom. Therefore sampling high in the water column might tend to underestimate impacts, and we sampled the water immediately above the bottom.

We sampled small (2.5-15.0 cm TL) primarily epibentic fishes in the navigation channel by using a beam trawl (described below). The beam trawl was deployed at up to eight sites (from among River Miles 203.2, 207.1, 211.2, 213.6, 215.7, 223, 227.1, 233.5, and 238.2) on Pool 26 and three sites (River Miles 5.5, 9.3, and 13.5) on the lower Illinois River. The beam trawl was deployed approximately 45 m behind the trawler and towed upstream at speeds of approximately 4 km/h (2.5 mi/h) relative to the ground for a nominal duration of 10 minutes in July when small fishes were relatively common and for 20 minutes in September when many of these fishes had grown to larger sizes and were likely less vulnerable to the gear. A flowmeter was placed in the mouth of the net to determine the amount of water passing through the net mouth. All fishes > 2.5 cm were identified, measured, weighed, and immediately released, whereas small fishes < 2.5 cm were identified in the laboratory.

We used a rockhopper bottom trawl (described below) to sample 'adult' fish, here loosely defined as fish longer than 10 cm TL, in the navigation channel. Sampling occurred during August-December 1996 and March-October 1997 as equipment, weather, and flow rates permitted. Regular sampling sites in Pool 26 were located at River Miles 203.2, 207.2, 213.6, and 215.7, 223.0, 227.2, 230.5, 233.5, and 238.2 during 1996. We sampled at River Miles 211.2 and 225.8 once during the process of site selection, but did not include these sites as part of our regular sampling. Sampling sites during 1997 were the same as for 1996, except that the site at 230.5 was dropped after we lost a net there during April sampling and that sampling occasionally was done at river mile 240.2. Sampling sites in the Illinois River were located at River Miles 5.5, 9.3, 13.5, and 18.7 during both 1996 and 1997. We sampled at River Mile 16.5 only once during 1996. The primary criterion used to select sampling sites within the larger study areas was that we required an unobstructed view of the navigation channel in both directions so that we would not be surprised by the sudden approach of a tow and could maintain an unobstructed view of tows in the area. Our goal was to sample all of the sites listed above within a one-week time frame before starting another cycle of sampling.

We distinguish two types of trawling used in this study. We define ambient sampling as trawling done primarily to estimate ambient abundance of live fish in the navigation channel and to measure the background drift of injured and dead fish in the navigation channel. We define entrainment sampling as trawling conducted behind specific tows to provide the data necessary to estimate mortality caused by entrainment of fish through the propellers of towboats. Entrainment sampling also produces useful information on abundance of live fish. Due to time constraints, we performed entrainment sampling using only the rockhopper bottom trawl.

The sampling methods that follow immediately apply to both ambient and entrainment sampling. The rockhopper trawl was deployed approximately 30 m behind the trawler and towed at speeds of approximately 4 km/h (2.5 mi/h) relative to the ground for a nominal duration of 20 min. During 1997, when river conditions were favorable, an acoustic trawl monitoring system (see below) was used to measure the dimensions of the net mouth opening during trawling. This information permitted quantitative estimation the numbers of fish per square meter of river bottom. All fishes collected were identified, measured, weighed, and immediately released.

*In situ forensic examination of wounded and dead fish.*

For both ambient and entrainment sampling, we examined fish for injuries and recorded the characteristics of dead fish. We first determined the position of any wounds on the body, scoring wound position as some combination of dorsal, ventral, anterior, and posterior on the body of the fish. If no obvious wound was found on a fish, scoring for wound position was left blank. We then estimated the age of the wound as 1) fresh, obvious fresh wound with no signs of clotting, 2) recent, wound less than one day old, still a fresh-looking wound, but clotting had begun, 3) old, wound older than 24 h, including healed scars or wounds clearly not recently made, and 4) wound marks on a dead, decomposing fish. If a fish was dead when we brought it on board, we also estimated the time of death as 1) recent, within 1 h, gill filaments still red and eyes clear, 2) recent, within several hours, gill filaments pink, eyes clouded, or 3) not recent, over several hours dead, gill filaments white/grey, eyes cloudy, body stiff. Finally, we determined whether the wound could have been caused by a propeller. If a wound was cleanly cut, we assumed a propeller could have caused the wound, but if not, we assumed that a propeller did not.

*Trawling vessel.*

The trawling vessel used in this study is based on a Munson Hammerhead™ aluminum hull that is 7.31-m (24-ft) long and has a beam of 2.74 m (9 ft). A 0.61-m fantail afterdeck extends the total length to 7.92 m (26 ft). The trawler is powered by a 415-hp engine and the outdrive unit has a single 0.5-m (19.75 in) diameter propeller having a pitch of 0.48 m (19 in) or 3.26:1. The afterdeck is equipped with a custom aluminum trawling gantry supporting a pair of trawling blocks suspended approximately 0.5 m above the surface of the water. Accessory gear includes Raytheon marine radar. This trawler is small and light enough to be transported on a conventional boat trailer yet has some advanced trawling and safety features.

The trawling system consists of two trawling winches, an accessory net handling winch and accessory controls designed, manufactured and installed by Rapp-Hydema US, Seattle, Washington, nets and net-monitoring gear. Each trawling winch contained approximately 100 m of 6.4-mm (0.25 in) diameter galvanized steel combination wire. The trawling gantry, winches and cable were designed to sustain a total load of approximately 9 kN (2,000 lbs force). The hydraulic system was designed to maximize safety. When the trawl is under tow, the trawling winches are constantly active and the trawl is held in position by balancing the drag on the net with the pressure exerted by the winches. Therefore the winches automatically release cable when the net snags on an immovable object, thus preventing sudden and violent stops. In addition, the trawling winches are equipped with an emergency release that can be activated by the pilot to allow the winch drums to spool freely in the event of a severe snag. These features are critical in river trawling because of the frequency and severity of snags, the added difficulty of trawling in current, and the presence of commercial navigation. Trawl cable lengths are monitored by a Rapp-Hydema EMS 2000™ Warp Counter.

On the recommendations of a trawling expert, and based on our own preliminary tests, we conducted all trawling in the upstream direction to minimize risks to safety. Trawling upriver allows easier release of tension when snagged because it only requires reduction of throttle speed. Further, proper expansion of the doors and trawl, and therefore capture efficiency, relies on the speed of the trawl relative to the water. In the presence of current, obtaining a particular speed relative to the water requires lower speed relative to the ground when traveling upstream than when traveling downstream. Therefore trawling upstream results in less violent deceleration on immovable snags than does trawling downstream.

*Rockhopper bottom trawl.*

We relied primarily on a four-seam rockhopper bottom trawl (Figure 1) designed and manufactured by Wilcox Marine Supply, Mystic, Connecticut. Rockhopper trawls are designed to ride over the top of small obstacles and thereby reduce the frequency of snagging. The footrope of our nets had a length of 10.2 m (33.33 ft) and a headrope length of 8.0 m (26.25 ft). Mesh of the trawl mouth and cod end consisted on #21 nylon twine with a bar-measure mesh size of 2.54 cm (1 in); stretch-measure is 2x bar measure. The rockhopper consisted of 25-cm (10-in) diameter "cookies" cut from truck tire tread salvage threaded on the footrope and spaced approximately every 61 cm (2 ft) by 7.6-cm (3 in) cookies. Four 20-cm (8-in) diameter spherical trawl floats were equally spaced along the length of the headrope. The length of the cod end was approximately 2.4 m (8 ft), and the total length from the wings to the cod end was approximately 10.7 m (35 ft). The paired "V" doors were constructed of steel and measured 96 cm (38 in) long by 69 cm (27 in) high, and were attached to the trawl wings by 9.1-m (30-ft) long "straight leg" ground cables of 0.63-cm (0.25-in) galvanized steel combination wire.

The trawler was equipped with a Netmind™ (Northstar Technical Inc., Vancouver, British Columbia, Canada) hydroacoustic trawl monitoring system which provides a continuous stream of measurements of the distance between trawl wings (Figure 1) and the distance from the headrope to the bottom for the rockhopper bottom trawl. The Netmind system consists of a paravane receiver which is towed over the port side of the trawler, a trawl monitor which displays net dimensions, wingspread master and slave sensors which are placed in net pockets at the forward end of each wing, and a trawl height sensor which is attached to the headrope at the midpoint between the wings. When the sensors were installed in the net, one additional 20-cm diameter spherical trawl float was attached at the position of the headrope sensor, as per manufacturers specifications, to make that sensor neutrally buoyant. Wingspread sensors require no such buoyancy compensation. In tests, coefficients of mean variation of headrope height measurements were not greater than 3.6% and those for wingspread measurements were not greater than 1.7% (Table 1). Mean bias never exceeded 0.14 ft (4.3 cm). Because of the high cost of the sensors relative to the cost of rockhopper trawls, sensors were deployed in a subsample of the trawl samples to reduce the risk of loss. Despite that care, one set of sensors was lost with a trawl that became snagged under severe and threatening conditions.

*Beam trawl.*

We used a beam (frame) trawl manufactured by Wilcox Marine Supply, Mystic, Connecticut to sample small fishes. This trawl consisted of a heavy aluminum alloy frame containing bottom skids and a net made from 3.2-mm (0.125-in) "Ace" nylon mesh. This beam trawl has a rectangular opening when towed over level bottom that is 2.44-m (8-ft) wide and 1.52-m (5-ft) high, and has a surface area of 3.71 $m^2$ (40 $ft^2$).

*Measurement of rockhopper bottom trawl dimensions and estimation of area swept.*

Estimation of density (number/hectare) and biomass (kg/hectare) of epibentic fish requires measurement of the area swept by the rockhopper trawl. Estimation of entrainment mortality also requires estimation of volume strained by the rockhopper trawl. In turn, we required measurements of the wingspread of the rockhopper trawl and estimates of the surface area of the mouth of the trawl in the plane perpendicular to the direction of the trawler.

Measurements from the Netmind™ acoustic trawl monitoring system were recorded at approximately 1-min intervals during the course of 18 trawl hauls. For hauls of full duration of 20-min, this yielded 20 sets of recordings. The durations of some hauls were abbreviated because of snags or development of hazards. Further, signal interference or other factors occasionally caused measurements of headrope height and wingspread to be missed. In total, we obtained 265 recordings of headrope height and 258 recordings of wingspread during normal trawling operations.

To estimate the surface area of the projection of the mouth of the rockhopper trawl onto the vertical plane perpendicular to the towing direction, we modeled that projection of the mouth as a half-ellipse with major axis $w$ and minor axis $2h$ (Figure 1). That area is given by

$$\alpha = \frac{\pi}{4} h w. \tag{1}$$

For the 18 rockhopper bottom trawl hauls that were monitored by using the Netmind™ system, we computed the bottom area swept as the product of the length of the trawl haul and the mean wingspread from measurements recorded during the particular haul. Similarly, we estimated mouth areas as the means of areas computed from the individual measurements taken at 1-min intervals during the particular haul. For the hauls that were not monitored with the Netmind™ system, we computed the area swept as the length of the haul times the mean wingspread from all 258 measurements obtained during the 18 monitored hauls. Similarly, we estimated mouth areas of unmonitored hauls as the mean of the 258 areas computed from the 18 monitored hauls.

We measured the lengths of 41 trawl hauls by using the differences between radar measurements of a prominent stationary object made at the start and finish of the haul. From these we computed the mean and variance of trawl speed. The lengths of unmeasured trawl hauls were obtained as the product of trawl time and mean speed. The variances of these lengths were obtained as the products of the variance of speed and time squared (Hogg and Craig 1970).

*Statistical analyses of trawl catches.*

Let $C_{ijkm}$ denote the number of fish of a species caught in trawl sample $m$ from pool $i$, segment $j$ within pool $i$, during year $k$. To examine pattern in the trawl catch data, we began with the conventional catch equation $C = qfN$, where $q$ is the catchability coefficient, $f$ is fishing effort (min), and $N$ is abundance (Ricker 1975). This conventional catch equation provides the basis for our statistical model of catch given by

$$C_{ijkm} = f\exp(\lambda_0 + y_i + p_j + l_{j(k)} + \beta_1 t + \beta_2 t^2 + \beta_3 t^3) \qquad (2)$$

where we model $qN$ by

$$qN = \exp(\lambda_0 + y_i + p_j + l_{j(k)} + \beta_1 t + \beta_2 t^2 + \beta_3 t^3) \qquad (3)$$

where $\lambda_0$ is a free constant parameter, $y_i$ is the effect of year $i$, $p_j$ is the effect of pool $j$, $l_{j(k)}$ is the effect of longitudinal zone $l$ nested within pool $j$, $t$ is the effect of time measured as month of the year, and the $\beta_1 \ldots \beta_3$ are parameters for the linear, quadratic and cubic effects of time, respectively. Note that our goal here was not to distinguish $q$ from $N$, but rather to formulate a statistical model for effects of year, pool, location and month on catch that is consistent in form with the conventional catch equation. Because catch is an integer-valued random variable, it can be modeled naturally using the Poisson distribution given by

$$f(\mathbf{C}|\mu) = \frac{\exp(-\mu)\ \mu^{C_{ijk}}}{C_{ijk}!} \tag{4}$$

where $\mathbf{C}$ is the vector of catches $C_{ijk}$ and $\mu$ is the distribution mean. We assumed the conditional distribution of trawl catches was overdispersed Poisson having mean $\mu$ and variance $\phi\mu$, where $\phi$ is a multiplicative overdispersion parameter. This distribution reduces to the conventional Poisson distribution when $\phi \equiv 1$. We fitted equation (1) to the overdispersed Poisson distribution by using maximum quasilikelihood estimation (McCullagh and Nelder 1989) in the generalized linear model formalism. We modeled the Poisson mean $\mu$ as

$$\mu = f\exp(\lambda_0 + y_i + p_j + l_{j(k)} + \beta_1 t + \beta_2 t^2 + \beta_3 t^3) \tag{5}$$

The linear predictor $\eta$ corresponding to the logarithmic link function (McCullagh and Nelder 1989) is given by

$$\eta = \log(\mu) = \log(f) + \lambda_0 + y_i + p_j + l_{j(k)} + \beta_1 t + \beta_2 t^2 + \beta_3 t^3 \tag{6}$$

which can be viewed as an extension of an analysis of covariance to the Poisson distribution with offset $\log(f)$. This model assumes that catches are mutually independent. These models were fitted by using the SAS GENMOD procedure (SAS Institute 1997). We used likelihood ratio chi-square tests to assess the statistical significance of model parameters.

Because trawl samples were taken from particular areas though time, it is reasonable to expect that trawl catches may not be mutually independent, but rather may be serially correlated. To include this possibility, we also modeled the catches (equation 1) as realizations of an overdispersed Poisson distribution including a first-order autoregressive process [AR(1)] , and fitted this model by using population-averaged generalized estimating equations (Zeger et al. 1988). We fitted these models using the SAS GENMOD procedure (SAS Institute 1997) and assessed the statistical significance of model parameters based on normal-theory Z scores.

For some species, the Newton-Raphson iterations for maximization of the quasilikelihood or the iterative generalized estimating equation algorithms failed to converge. For these cases we fitted, by ordinary least-squares estimation, a corresponding Gaussian-errors (normal distribution theory) model given by

$$\log\left(\frac{C}{f} + 1\right) = \lambda_0 + y_i + p_j + l_{j(k)} + \beta_1 t + \beta_2 t^2 + \beta_3 t^3 \tag{7}$$

where $\epsilon$ is normally distributed random error.

*Estimation of density and biomass of live fish the navigation channels.*

We estimated the density (number per unit area) of fishes by dividing the catch from each sample by the area swept. We emphasize that this is a minimal estimate of density because some unknown fraction of live fish avoid capture by the trawl.

Biomass is the mass of live fish per unit area. For some fish, we made measurements of individual mass (g) in the field by using a spring-loaded scale. We measured individual lengths (mm) of all fish captured. For fish for which we measured only length $L$, we estimated mass $W$ by using the conventional weight-length equation

$$W = 10^a L^b \tag{8}$$

(Anderson and Gutreuter 1983). We used estimates of $a$ and $b$ (Table 2) obtained from ordinary least-squares regressions of $\log_{10}W$ on $\log_{10}L$ using data obtained by the Long Term Resource Monitoring Program of the Upper Mississippi River System (Gutreuter et al. 1995). Biomass was computed as total mass divided by area swept by the trawl $a$. This provides a minimal estimate of actual biomass because some unknown fraction of live fish avoid the trawl or are not retained in it.

## Results

*Estimation of densities of larval fishes.*

*Illinois River*—During 1996, larval fish density was lowest during July, averaging 0.96 larvae/$m^3$ and greatest during June, at 1.65 larvae/$m^3$ (Table 3). Nine larval taxa were identified in the navigation channel drift during May (Table 4), with common carp and clupeid, primarily *Dorosoma*, larvae the two dominant taxa. In June, eight larval taxa were present, with clupeid and common carp larvae again dominant (Table 4). Seven taxa occurred during July; freshwater drum larvae were more abundant than any other larval taxon by at least an order of magnitude (Table 4).

Larvae were sampled in main channel, side channel, and backwaters at one site in the Illinois River, during 1997. Once again, mean larval density in the main channel was greatest during June, at 4.13 larvae/$m^3$, and lowest during July, at 0.10 larvae/$m^3$ (Table 5). A similar pattern held in the side channel, where larval abundance peaked in June at a mean of 7.43/$m^3$ and was lowest in July at 0.03 larvae/$m^3$ (Table 5). Backwater larval fish densities were greatest during May (6.99 larvae/$m^3$) and lowest during June (1.70 larvae/$m^3$; Table 5).

Four to eight taxa were represented in the main channel during the sampling period (Table 6). Clupeid larvae were dominant during May, followed by freshwater drum in June and catostomids during July (Table 6). Three to seven larval taxa were present in the side channel, with freshwater drum dominant during May and June, and clupeid larvae dominant in July (Table 6). Taxonomic diversity was consistent at four or five taxa in the Illinois River backwater throughout the May-July sampling period (Table 6). Clupeid larvae predominated in the backwater during May but centrarchids were the dominant larvae during June and July (Table 6).

*Mississippi River*—In 1996, larval fish density was greatest during May, averaging 0.84 larvae/m$^3$ and least in June, averaging 0.54 larvae/m$^3$ (Table 7). Ten taxa were present in May, with common carp larvae the dominant taxon; clupeid, primarily *Dorosoma*, and catostomid larvae also were relatively abundant (Table 8). During June, eleven taxa occurred. Abundance of common carp larvae declined whereas clupeid and freshwater drum larvae increased, generating a larval assemblage with several important taxa represented (Table 8). Six larval taxa were represented during July; freshwater drum was the dominant taxon present (Table 8).

Sampling during 1997 included four paired main channel and side channel sites as well as one backwater. Main channel larval fish density was greatest during June, at 0.54 larvae/m$^3$ and least in April, at < 0.01 larvae/m$^3$ (Table 5). Side channel larvae exhibited a similar pattern of density, peaking in June at 1.25 larvae/m$^3$ but present at <0.01 larvae/m$^3$ in April (Table 5). Larvae were much more abundant in the backwater, generating 27.47 larvae/m$^3$ in June and 3.60 larvae/m$^3$ in May, the only two months in which larvae were collected in the backwater (Table 5). Larvae were not present in the backwater during April and we could not sample the backwater in July because the water level had receded sufficiently to prevent our nets from fishing.

Seven to nine larval taxa were present in the main channel during April-July (Table 9). No taxon was dominant in April, all larvae being present at trace levels. Percid, hiodontid, and catostomid larvae were prevalent during May, whereas freshwater drum, clupeid and catostomid larvae were most dense in June. Cyprinid larvae were most abundant in July (Table 9). In side channels, taxonomic diversity was highest during May and June, when nine and ten larval taxa occurred, respectively; only percid larvae were present in April (Table 10). Hiodontids and catostomids were most prevalent in May. Clupeid and freshwater drum larvae dominated the June samples, and cyprinid larvae comprised most of the larvae collected in July (Table 10). Seven and six larval taxa were present in the backwater during May and June, respectively (Table 11). Clupeid and centrarchid larvae were the two dominant taxa throughout the sampling period.

Larval fish present in the navigation channel of both rivers during both years exhibited a predictable pattern of appearance. Common carp larvae and some catostomids, primarily ictiobid larvae, were the first dominant larval group appearing during May. At the end of May and into June, clupeid larvae were the dominant representative in the larval drift. Finally, freshwater drum larvae dominated in late June and July. Percid larvae, primarily *Stizostedion* spp., occurred primarily during May but never approached dominant levels. Centrarchid and *Morone* larvae also appeared in relatively small numbers during late May through June.

Detailed summaries of volumes of river water strained during ichthyoplankton sampling are included in Appendix B. Density estimates (number/$m^3$) from each sample are included in Appendix C.

*Trawling performance.*

Trawl speed relative to the ground averaged 1.1 m/sec (4.0 km/hr) with standard deviation 0.2 m/sec (0.7 km/hr) over 43 measured hauls. Mean wingspread of the rockhopper trawl averaged 3.9 m with standard deviation 0.7 m over 258 measurements made during 18 trawl hauls monitored by using the hydroacoustic net measurement system.

*Catch and abundance of small fish captured with the beam trawl.*

In the Illinois River, catch per unit effort (CPUE; fish/hr trawling) averaged 120 fish per hour during September 1997 (Table 12). Seven species were captured by beam trawling in the Illinois River. Freshwater drum were most abundant, with estimated densities averaging 88.9 fish/ha, followed by gizzard shad and channel catfish (Table 13). Total estimated densities averaged 125 fish/ha and total biomass averaged 5.3 kg/ha. Detailed CPUE data, by month and river mile, are included in Appendix D.

In Pool 26 of the Mississippi River, total CPUE of small fish averaged 105.4 per hour in July but only 11.5 per hour in September 1997 (Table 12). A total of nine species were captured by beam trawling in Pool 26. Channel catfish were, by far, the most abundant species with estimated densities averaging 39.4 fish/ha, followed by freshwater drum and mooneye (Table 14). Total estimated densities of small fish in Pool 26 averaged 57.6 fish per ha in 1997, with an average estimated biomass of 1 kg/ha (Table 14).

The beam trawl captured primarily small fishes (Table 15) including juvenile channel catfish and freshwater drum which averaged 43 mm and 26 mm in length, respectively in the Mississippi River, and 70 mm and 93 mm respectively in the Illinois River. Occasionally large adult fish were captured in the beam trawl, and this reflected in the sometimes large standard deviations for length and the large mean weights, which are particularly sensitive to the presence of only a few large fish.

*Catch and abundance of 'adult' fishes captured by the rockhopper bottom trawl.*

During the course of this study, monthly mean estimated densities of all species combined varied by two orders of magnitude in the navigation channels of both the lower Illinois River and in Pool 26 of the Mississippi River (Figure 2). Total fish densities in the lower Illinois River averaged 157.3 (Table 16) and 177.7 fish/ha (Table 17) in 1996 and 1997, respectively. Corresponding mean estimated biomasses were 26.5 and 32.2 kg/ha. Total fish densities in Pool 26 of the Mississippi River averaged 109.0 (Table 18) and 55.5 fish/ha (Table 19) in 1996 and 1997, respectively. Corresponding mean estimated biomasses were 22.7 and 19.2 kg/ha. In our effort-adjusted catch model given by equations (2) and (4), total catch differed significantly between rivers (Table 20; $P$=0.01) and, in Pool 26, was 100exp($p_1$) = 52% of that in the lower Illinois River. All parameters for the cubic polynomial in month were statistically significant (Table 20) indicating that the seasonal rise and fall of total estimated densities apparent in Figure 4 is real. Our conclusions are unchanged by the relaxed assumption of autoregressive serial correlation in catches, and are therefore unlikely to be an artifact of a particular model choice. The extra-Poisson scale parameter indicated that the variance of our total catch data was approximately nine-fold greater than expected from the Poisson distribution.

Blue catfish densities peaked during late summer and fall, and were greater in the lower portion of Pool 26 than in the upper portion or in the Illinois River (Figure 3). Densities of blue catfish averaged 0.8 and 0.6 fish/ha during 1996 (Table 16) and 1977 (Table 17), respectively, in the navigation channel of the Illinois River, and averaged 2.0 (Table 18) and 1.3 fish/ha (Table 19) during those years in Pool 26. Effort-adjusted catches of blue catfish differed significantly between upper and lower Pool 26 ($P$<0.01), but did not differ significantly between years or rivers (Table 21). Catches tended to be $\exp(l_{1(1)})$ = 9.8 times greater in lower Pool 26 than in the upper segment. Catch did not change linearly with month, but the quadratic and cubic effects of month (Table 21) indicate that the seasonal peak in density during late summer and fall is real. Again, our results were invariant under the assumptions of serially independent and serially autoregressive catches.

Estimated densities of channel catfish appeared greater in the navigation channel of the Illinois River than in Pool 26 (Figure 4). Densities of channel catfish averaged 18.9 and 10.3 fish/ha during 1996 (Table 16) and 1977 (Table 17), respectively, in the navigation channel of the Illinois River, and averaged 8.8 (Table 18) and 7.1 fish/ha (Table 19) during those years in Pool 26. Average estimated biomasses ranged from 0.8 to 1.8 kg/ha (Tables 16-19) in these navigation channels. Effort-adjusted catch differed significantly ($P \leq 0.05$) between rivers, and in Pool 26 was $100\exp(p_1)$ = 24% of that from the lower Illinois River (Table 22). Catch also differed significantly between upper and lower Pool 26 ($P$<0.01), and was 3.5 times greater in the lower portion of that pool. Catches of channel catfish did not show any significant seasonal response (Table 22).

Monthly mean estimated densities of common carp tended to peak during fall (Figure 5). Mean estimated densities for each combination of river and year ranged from 0.4 to 4.2 fish/ha, and corresponding estimated biomasses ranged from 0.5 to 5.0 kg/ha (Tables 16-19). Effort-adjusted catches of common carp could not be fitted to our Poisson models, and therefore our analysis is based on equation (7). Log(CPUE) did not differ significantly between rivers, years or between locations in Pool 26 (Table 23). However, the parameter estimates for the cubic polynomial in month indicate the seasonal fall peak was real (all $P \leq 0.02$).

Monthly mean estimated densities of freshwater drum seemed to differ among river segments and showed a strong seasonal response with maxima during late fall (Figure 6). This species typically dominated density and biomass in our rockhopper bottom trawl samples (Tables 16-19), with mean annual density exceeding 122 fish/ha in the lower Illinois River during 1996. Effort-adjusted catches of freshwater drum differed significantly between rivers ($P<0.01$), and location within Pool 26 ($P \leq 0.01$), but not between years (Table 24). The quadratic seasonal response was marginally significant ($P<0.09$), and the cubic effect was clearly important ($P \leq 0.04$), indicating that the seasonal fall peak is real. Our results were again insensitive to model choice, and the variance of catch was 6.2 times greater than expected from the Poisson distribution.

Estimated densities of gizzard shad varied by two orders of magnitude during this study (Figure 7). Because this species is largely pelagic, our bottom trawl samples likely underestimate their true areal abundance. The Gaussian errors model indicated that log(CPUE) differed significantly between rivers, locations within Pool 26 and over seasons (Table 25).

Estimated densities of goldeye showed no consistent pattern over this study (Figure8). The Gaussian errors model showed marginally significant differences between rivers ($P=0.10$), between locations within Pool 26 ($P=0.08$), but showed no seasonal effect (Table 26). The closely related mooneye showed a somewhat similar pattern in estimated density, although their apparent abundance seemed to peak during 1996 (Figure 9). The Gaussian errors model for mooneye indicated that log(CPUE) differed significantly between years ($P<0.01$) and between locations in Pool 26 ($P<0.01$; Table 27). Like goldeye, mooneye showed no significant seasonal response (Table 27).

Estimated densities of shovelnose sturgeon differed greatly among river sections, and in upper Pool 26 averaged over 18 fish/ha in June 1997 (Figure 10). Log(CPUE) differed significantly between years and locations within Pool 26 (Table 28). This pattern reflects a strong preference for upper Pool 26, which tends to be more riverine than the other study areas. Seasonal effects were only marginally significant ($0.06 \geq P \geq 0.07$).

Estimated densities of smallmouth buffalo showed a strong seasonal pattern with peak abundance typically occurring during early fall (Figure 11). Effort-adjusted catches of smallmouth buffalo differed significantly between upper and lower Pool 26 ($P \leq 0.03$) but not between years or rivers (Table 29). The parameter estimates for the cubic polynomial in month indicated a significant seasonal effect (Table 29), and we conclude that the peaks in Figure 13 are real. Again, our results were insensitive to model choice.

The distribution of blue suckers (and other species) in our samples was sufficiently restricted that we did not attempt formal analyses of abundance. However, the blue sucker is an important species because of common perceptions about its status. We encountered blue suckers only in the upper portion of Pool 26, where catch rates frequently exceeded 1 fish/h of trawling effort (Figure 12). This is consistent with the fact that the blue sucker is a habitat specialist preferring areas of relatively swift current. Our results suggest that the blue sucker may not be uncommon in deep riverine channels of the Upper Mississippi River. Detailed summaries of

CPUE of all species captured by the rockhopper bottom trawl are included as Appendix Tables E1-E8.

A detailed analysis of species richness is well beyond the scope of this study, and would be difficult because the numbers of species observed is a nearly intractable (from a statistical perspective) increasing function of sampling effort (Bunge and Fitzpatrick 1993). Instead, we note informally the seasonal tendency for the mean numbers of species per trawl haul to peak during fall (Figure 13). These data and our underlying catches suggest that some species use the main channel only seasonally.

The rockhopper bottom trawl captured primarily large-bodied fish (Table 30). Black buffalo, common carp, flathead catfish, lake sturgeon, shortnose gar and shovelnose sturgeon captured by this gear averaged nearly 0.5 m or more in length.

*Incidence of injured and dead fish in ambient and entrainment sampling.*

While using the rockhopper trawl for entrainment sampling behind towboats, we collected three gizzard shad during 1996 that were most likely killed as a result of impact with the propellers of the preceding tows, but no killed or wounded fish were collected while entrainment sampling during 1997 (Table 31). The sizes of these gizzard shad strongly suggest they were spawned in 1996. While conducting ambient sampling using the rockhopper bottom trawl, we collected 27 fish that were either dead, wounded, or alive with wound scars in Pool 26 and the lower Illinois River during 1996 and 1997 (Table 32). Of these 27, one fish was a smallmouth buffalo, five were shovelnose sturgeon, and the rest were gizzard shad. The smallmouth buffalo and one shovelnose sturgeon were freshly wounded fish with serious injuries consistent with propeller wounding. Most gizzard shad had been dead for some time and were collected during November-March, suggesting that these fish had died during this period because of natural causes during the winter (Bodensteiner and Lewis 1994). No injured or dead fish were collected during the ambient beam trawling.

## Discussion

*Larval Fish Sampling.*

Larval fish had a distinct temporal component to their arrival in the main channel drift during both years. Ictiobid and common carp larvae dominated the larval assemblage through the end of May, to be replaced by shad larvae as the dominant taxon. Freshwater drum larvae were the last major taxon present in larval samples during both years. Peak larval diversity appears at about the end of May to early June. These results are consistent with other larval fish studies in the Upper Mississippi and Illinois Rivers, which also indicate that clupeid and freshwater drum larvae form a major component of main channel larval fish assemblages throughout the length of the Upper Mississippi River System (Holland and Sylvester 1983; Holland-Bartels et al. 1996).

Variability between years was evident, both in terms of larval density and composition of the larval assemblage. Larval densities were greater during 1996, possibly because of the more extensive flood that allowed more fishes to take advantage of the flood pulse (Junk et al. 1989). Cyprinid larvae were present in 1997, but not in 1996. Common carp larvae were much more numerous during 1996 than 1997, perhaps because of a larger flood more closely timed to the peak of carp spawning.

During 1997, larval density and composition varied across larval habitats. Larval densities were greatest in backwaters, intermediate in side channels, and lowest in the main channel. Centrarchids were dominant only in backwaters, although they appeared in small numbers at main channel and side channel sites. Conversely, freshwater drum larvae were dominant at main channel and side channel sites, rarely occurring in backwaters. Shad larvae were common across all aquatic areas, suggesting that adults of this taxon spawn successfully in all areas. In the Illinois River backwater, larval fish composition was less diverse than main channel and side channel habitats, supporting only four or five taxa, whereas up to eight taxa were collected in flowing water habitat. The Mississippi River backwater contained a more diverse larval fish assemblage than the Illinois River backwater, with six or seven taxa present, reflecting the greater diversity of large fishes collected by trawling in the Mississippi River, as compared to the lower Illinois River.

Main channel and side channel areas generally produced similar assemblages of larvae, whereas backwater areas supported a very different larval assemblage than channels. Backwaters were dominated by clupeid, primarily *Dorosoma* spp., and centrarchid larvae. Other taxa frequently present included brook silverside and *Gambusia* spp. larvae. Of these common backwater larval taxa, only clupeid larvae also were common in channels. Conversely, percid, *Morone*, freshwater drum, and common carp larvae were rarely or never found in backwaters. Thus, we might expect that effects of commercial navigation will be most severe on fishes whose larvae reside primarily in the flowing water habitats, especially the navigation channel, and minimal for fishes spawning primarily in backwaters

Most of the fishes commonly collected by rockhopper trawling were also encountered as larvae. However, larvae thought to be primarily benthic in nature were not sampled particularly well with our pelagic sampling regime. In particular, larvae of catfish and sturgeon were rare or absent from our larval samples, despite the abundance of adults our in trawl catches from the Mississippi River. The beam trawl used to collect small fishes does appear to be an effective gear to sample fishes with benthic early life stages, especially catfishes and freshwater drum.

Early life stages of shovelnose sturgeon or paddlefish were not collected by either of these gears, suggesting that 1) their abundance is extremely dilute within the system, 2) they use other riverine habitats for spawning and early life stages, or 3) the gears we used were not effective for larvae of these species. For species that we sampled poorly as larvae but well at older life stages, conclusions should not be drawn regarding the impact of commercial navigation on the larval stages until future research can generate quantitative estimates of their larval density and determine their spatial distribution.

Sampling of larval fishes in the navigation channel during two years reveals that dynamic shifts in both the abundance and composition of larvae occur among years. Peak density did not differ greatly between these years, but the timing of the peak did. Peak larval density occurred in May, 1996 in Pool 26 but in July in the Illinois River, whereas larval density peaked in both rivers during June, 1997. Larval density during 1996 was relatively constant during May-July; larval density peaked in June of 1997 in both rivers, at least an order of magnitude greater than larval density in any other month.

Some major shifts in the composition of larvae also occurred between years. Cyprinid larvae were present only during 1997; these larvae were an important component of the late-season larval assemblage. Hiodontid and percid larvae also were a greater component of the larval assemblage during 1997 than in 1996. Conversely, common carp and freshwater drum larval abundance dropped substantially in 1997, compared to 1996, despite still being a major component of the larval assemblage. Given these major swings in larval composition and seasonal abundance, additional larval fish sampling would be required to determine the extent of year-to-year variability in abundance and composition of the larval fish assemblage in the Upper Mississippi and Illinois Rivers.

*Abundance of small fishes in the navigation channels.*

Results of our beam trawling are limited in scope due to the time constraints placed on the project associated with delays in initially making funding available and further complications following a mid-project temporary funding suspension. However, results reveal that the beam trawl, when fished on the bottom in the navigation channel, will be useful primarily during late June through September, when age-0 fishes in the main channel are small enough to be captured efficiently by the gear. As fish grow larger they avoid the gear, rendering it ineffective.

Age-0 channel catfish, freshwater drum, and mooneye were common near the bottom of the navigation channel of the Mississippi River, suggesting that this habitat is an important area for these young fish. Age-0 freshwater drum and gizzard shad were common near the bottom of the lower Illinois River main channel, whereas channel catfish, freshwater drum, and mooneye were most abundant in Pool 26. Because we did not sample higher in the water column, we do not know whether more pelagic species (e.g., skipjack herring, gizzard shad, and white bass) are efficiently sampled by this gear. However, from larval sampling and sampling with the rockhopper trawl, these fish are regularly collected in the main channel, so we would expect that they are present in the main channel at sizes between 25 and 100 mm.

Additional investigation of potential indirect effects of commercial navigation on small fishes residing in the main channel seems warranted. Due to the short duration of this study and restricted spatial extent, we do not believe that a complete picture of either 1) potential vulnerability of small fishes to entrainment mortality or 2) the abundance and distribution of small fishes has been developed. Given that small fish, primarily age-0 fishes growing after the spring and early summer spawning season, are abundant in the main channel, it also seems appropriate to determine to what extent these fishes may be behaviorally and energetically impacted.

*Abundance of adult fishes in the navigation channels and implications for estimation of entrainment mortality.*

Our results from rockhopper trawling indicate that the navigation channels of Pool 26 of the Mississippi River and the lower Illinois River provide important habitat for large riverine fishes. The fish species composition in our main-channel sites was quite different from that apparent from other aquatic areas in Pool 26 or the La Grange Pool of the Illinois River (Burkhardt et al. 1997). The navigation channel seems particularly important to riverine species such as the sturgeons, buffaloes, blue catfish and blue sucker, for examples, which are less commonly encountered in aquatic areas sampled by the Long Term Resource Monitoring Program (Burkhardt et al. 1997).

Although the catch rates, expressed as number of fish per hour of sampling effort, are comparable with those from other sampling gear in other habitat types associated with the Upper Mississippi River (Gutreuter 1997), our trawling swept larger sampling areas and therefore CPUE does not provide an adequate basis for comparison of abundance with other data. Our estimated biomass estimates are less than 10% of the biomass of the littoral fish community as measured by toxicant sampling in other areas of the Upper Mississippi River (Pitlo 1987).

However, we do not believe that this necessarily reflects a lesser importance of riverine channels as fish habitat. First, our biomass and density estimates are minimal because they do not include fishes that escaped our gear. Escapement is perhaps less likely in toxicant sampling because treated areas are enclosed with a barrier net. Avoidance of our bottom trawls is particularly important for pelagic fishes that were suspended above their tops. Our biomass estimates for pelagic species such as gizzard shad and white bass, for examples, are likely biased quite low. Second, channels comprise a large fraction of the aquatic area of the Upper Mississippi River System and seem to support greater abundances of some characteristically riverine fishes such as shovelnose sturgeon, blue sucker and blue catfish, than other aquatic areas. For these reasons the ecological importance of large deep channels may far exceed that reflected by simple comparisons of fish biomass with other aquatic areas.

Fishes, both in terms of biomass and species richness, were most abundant in the navigation channel during fall (September-November), coinciding with the time of year when large floodplain river hydrographs are low (Sparks 1995) and water temperatures are moderate. Nevertheless, several common fishes were present in the main channel throughout the year (e.g., shovelnose sturgeon, channel catfish, and gizzard shad), revealing that a considerable number of species and individuals do thrive in the extreme abiotic conditions present in the navigation channel.

Catch rates were generally lower during 1997 than in 1996. This may be due to what appears to be a relatively poor year in 1997 (compared to 1996) for recruitment of pelagic fishes including gizzard shad, mooneye, and freshwater drum, as well as for blue catfish and channel catfish. Young-of-year of these species were very abundant in our trawls during fall 1996, but occurred only occasionally during 1997. Without multiple years of sampling, we cannot fully describe the extent to which fish populations in the navigation channel may fluctuate on a yearly basis. In addition to shifts in reproductive success, flow rate and temperature shifts are likely to influence the magnitude and timing of any seasonal migration into the main channel. This annual variation is particularly important because the magnitude of entrainment mortality is likely an increasing function of population density and therefore is unlikely to remain constant through time. Additional sampling during at least 3-5 years would be needed to more completely determine the magnitude of temporal variation in the abundance of fishes in the navigation channel.

Our results also suggest that the navigation infrastructure affects the distribution of fishes. The locks and dams create both tailwater areas having relatively high current velocities and lower-gradient impounded areas of navigation channels. Fishes adapted to survive in swifter current (e.g., shovelnose sturgeon and blue sucker) were distributed almost exclusively above the control point in Pool 26, whereas channel-dwelling fishes preferring lower current velocities (e.g., blue and channel catfish) were most abundant in the lower portion of Pool 26 and in the lower Illinois River. Thus the locks and dams may have created, or at least may be maintaining, important physical heterogeneity at the spatial scale of pools. This effect is potentially important in the assessment of effects of navigation because is suggests that stratified estimation of entrainment mortality may improve precision for spatially restricted species such as shovelnose sturgeon. However, we did not attempt that given our distribution of samples, and therefore our estimates are averages over all study areas.

Abundance of several species differed between Pool 26 of the Mississippi River and our study section on the lower Illinois River. This difference suggests that variation among other navigation pools of the Upper Mississippi River System may also be important, and is consistent with results obtained from the Long Term Resource Monitoring Program of the Upper Mississippi River System (LTRMP). Fish assemblage composition differed significantly among the six LTRMP study reaches during 1990 (Gutreuter 1992). For many species, including gizzard shad and smallmouth buffalo, linear trends in relative abundance from 1990-1994 also differed significantly among reaches (Gutreuter 1997). Because entrainment mortality is likely and increasing function of abundance, these results suggest that entrainment mortality may also differ among navigation pools. However, our entrainment sampling was insufficient to resolve any such effect.

We can hardly overstate the difficulties of trawling in these navigation channels. Gear loss and damage were routine due to the forces inherent in trawling and the hazards of the main channel. Therefore equipment repair and the resulting sampling delays were common. Any future work should better accommodate the occurrence of these hazards through a longer timetable and a larger reserve of contingency gear.

We recognize the capabilities of some fish to avoid approaching vessels (Lowery et al. 1987; Todd et al. 1989; Soria et al. 1996). However, we know too little about the acoustic emissions of riverine tows and the behavioral responses of channel-dwelling fishes. More detailed study could produce estimates of the fractions of resident fish that successfully avoid tows, and these would assist interpretation of estimates of entrainment mortality. Further, investigation of sound emissions and behavioral responses might possibly lead to development of emitting hydrophones to maximize the avoidance response and thereby minimize the risks of entrainment. However, avoidance reactions incur bioenergetic costs because movement requires energy. This cost can presently be quantified by using electromyelographic transmitters which monitor the activity of fish muscle in situ. Another approach to indirect estimation of longer-term avoidance effects is estimation of abundance of fish in paired areas of navigation channel and large riverine side channels which are approximately similar to the navigation channel except for the occurrence of tow traffic.

*Summary.*

Results from this study have quantified the abundance and composition of larval fishes in the navigation channel, as well as side channel and backwater areas, for the purpose of providing these data for input into models of losses of adult-fish equivalents, production foregone, and recruitment foregone. We also have developed methods to estimate abundance and entrainment mortality of juvenile and adult fishes in navigation channels of large rivers. Our current estimates of the abundance of all life stages of fish suggest that substantial year-to-year variability in timing of appearance in the navigation channel and in density of fishes does occur, but the duration of the current study was not sufficient to determine to what extent this variability will affect the potential impacts of estimates of entrainment mortality on river fish populations. This work has provided a much clearer picture of the fish assemblage that uses the navigation channel and has demonstrated that fishes are frequent users of main channel habitat. However, substantial variability exists around these advances, suggesting the need for additional refinement as river managers seek to determine the potential impacts of commercial navigation on fishes using the navigation channel.

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Table 1. Accuracy and precision of Netmind™ acoustic trawl monitoring sensors. Ten measurements were made at each fixed distance. The coefficient of mean variation is the standard error (SE)/mean, and mean bias the difference between measurement means and actual distances. Measurements were made in a test tank by Northstar Technical, Vancouver, British Columbia, Canada (J. Hall, personal communication). All measurements were made in feet (1 ft = 0.3048 m).

| Actual distance (ft) | Measurement means (SE) | Coefficient of mean variation (%) | Mean bias (ft) |
|---|---|---|---|
| Headrope height | | | |
| 3 | 3.06 (0.11) | 3.6 | 0.06 |
| 6 | 5.91 (0.05) | 0.8 | -0.09 |
| 9 | 9.02 (0.08) | 0.9 | 0.02 |
| Wingspread | | | |
| 9 | 8.93 (0.15) | 1.7 | -0.07 |
| 12 | 12.10 (0.12) | 1.0 | 0.10 |
| 15 | 14.86 (0.15) | 1.0 | -0.14 |
| 18 | 17.95 (0.18) | 1.0 | -0.05 |
| 21 | 21.05 (0.16) | 0.8 | 0.05 |
| 24 | 24.04 (0.19) | 0.8 | 0.04 |
| 27 | 26.87 (0.20) | 0.8 | -0.13 |

Table 2. Parameter estimates for conversion of fish lengths *L* (mm) to weights *L* (g). Estimates were obtained from ordinary least-squares regressions of $\log_{10}$(weight) on $\log_{10}$(length) obtained by the Long Term Resource Monitoring Program of the Upper Mississippi River. Weight is given by $W = 10^a L^b$.

| Common name | *a* | *b* |
|---|---|---|
| Bigmouth buffalo | -5.0259 | 3.09248 |
| Black buffalo | -4.5351 | 2.86949 |
| Black crappie | -5.1740 | 3.15754 |
| Blue catfish | -4.7467 | 2.86173 |
| Blue sucker | -5.2630 | 3.06332 |
| Channel catfish | -4.8697 | 2.90154 |
| Common carp | -4.7180 | 2.93829 |
| Flathead catfish | -4.8603 | 2.95780 |
| Freshwater drum | -5.0166 | 3.03092 |
| Gizzard shad | -4.9405 | 2.97189 |
| Goldeye | -4.9496 | 2.97128 |
| Highfin carpsucker | -4.7740 | 2.95227 |
| Lake sturgeon | -4.6474 | 2.78062 |
| Mooneye | -5.3446 | 3.13296 |
| Quillback | -4.7555 | 2.93778 |
| River carpsucker | -4.9245 | 3.01383 |
| Sauger | -5.6274 | 3.21970 |
| Shorthead redhorse | -4.8011 | 2.92351 |
| Shortnose gar | -5.5697 | 3.03535 |
| Shovelnose sturgeon | -5.2691 | 2.86491 |
| Silver chub | -4.9915 | 2.96721 |
| Skipjack herring | -4.8758 | 2.90371 |
| Smallmouth bass | -4.8701 | 2.99699 |
| Smallmouth buffalo | -4.9549 | 3.04769 |
| Speckled chub | -4.3945 | 2.54206 |
| White bass | -5.0174 | 3.04664 |

Table 3. Mean larval fish density expressed as number/$m^3$ (1 SE) for all taxa collected from the navigation channel of the lower Illinois River during May through July 1996.

| | Mean larval fish density (1 SE) number per $m^3$ | | |
|---|---|---|---|
| River mile | May | June | July |
| 4.5 | 3.09 (2.15) | 2.34 (0.83) | 0.14 |
| 9.3 | 0.90 (0.43) | 1.39 (0.98) | 1.02 |
| 13.5 | 1.09 (0.18) | 1.68 (1.01) | 0.71 |
| 18.7 | 1.45 (0.88) | 1.17 (0.30) | 2.00 |

Table 4. Mean larval fish density expressed as number/m³ (1 SE) for each taxon collected from the navigation channel of the Illinois River during May-July 1996.

| Fish taxon | River mile | Mean larval fish density (1 SE) number per m³ | | |
|---|---|---|---|---|
| | | May | June | July |
| Channel catfish | 13.5 | 0 | 0 | <0.01 |
| Common carp | 4.5 | 2.94 (0.002) | 0.62 (0.48) | 0.01 |
| | 9.3 | 0.80 (0.52) | 0.54 (0.46) | 0 |
| | 13.5 | 0.87 (0.37) | 0.45 (0.42) | <0.01 |
| | 18.7 | 1.23 (1.02) | 0.41 (0.33) | 0.01 |
| Freshwater drum | 4.5 | 0.04 (0.04) | 0.08 (0.03) | 0.08 |
| | 9.3 | 0.02 (0.02) | 0.08 (0.04) | 0.90 |
| | 13.5 | 0.02 (0.02) | 0.06 (0.05) | 0.58 |
| | 18.7 | 0.01 (0.01) | 0.05 (0.01) | 1.88 |
| Lepisosteidae | 13.5 | <0.01 (<0.01) | 0 | 0 |
| | 18.7 | <0.01 (<0.01) | <0.01 (<0.01) | 0 |
| Mosquitofish | 4.5 | <0.01 (<0.01) | 0 | 0 |
| Clupeidae | 4.5 | 0.05 (0.05) | 1.61 (1.25) | 0.04 |
| | 9.3 | 0.05 (0.05) | 0.07 (0.05) | 0.06 |
| | 13.5 | 0.14 (0.14) | 1.15 (0.55) | 0.08 |
| | 18.7 | 0.13 (0.13) | 0.69 (0.03) | 0.07 |
| Catostomidae | 4.5 | 0.04 (0.04) | 0.01(0.01) | 0.01 |
| | 9.3 | 0.01 (0.003) | 0.01 (0.01) | 0.06 |
| | 13.5 | 0.03 (0.003) | 0.01(0.01) | 0.01 |
| | 18.7 | 0.05 (0.02) | 0.01 (0.01) | 0.02 |

Table 4 continued...

| Fish taxon | River mile | Mean larval fish density (1 SE) number per m³ May | June | July |
|---|---|---|---|---|
| Centrarchidae | 4.5 | 0.01 (0.01) | 0.02 (0.02) | 0 |
| | 9.3 | 0.01 (0.01) | 0.01 (0.01) | 0 |
| | 13.5 | 0.03 (0.03) | <0.01(<0.01) | 0 |
| | 18.7 | 0.02 (0.02) | <0.01 (<0.01) | <0.01 |
| *Morone* | 4.5 | <0.01(<0.01) | 0.01 (0.01) | 0.01 |
| | 9.3 | <0.01 (<0.01) | 0.01 (0.01) | <0.01 |
| | 13.5 | 0.01 (0.01) | 0.01 (0.004) | <0.01 |
| | 18.7 | 0.01 (0.01) | <0.01(<0.01) | 0 |
| Percidae | 18.7 | <0.01<(0.01) | 0 | 0 |
| Unidentified | 4.5 | 0.01(0.01) | <0.01 (<0.01) | <0.01 |
| | 9.3 | <0.01 (<0.01) | 0.08 (0.08) | <0.01 |
| | 13.5 | <0.01 (<0.01) | 0.01 (0.01) | 0.01 |
| | 18.7 | 0.01 (0.01) | <0.01 (<0.01) | 0.02 |

Table 5. Mean larval fish density expressed as number/m$^3$ (1 SE) for all larval taxa collected from main channel, side channel, and backwater habitats in Pool 26 of the Mississippi River and the lower Illinois River during April-July 1997. DNS= did not sample.

| River mile | Habitat type | Mean larval fish density (1 SE) number per m$^3$ April | May | June | July |
|---|---|---|---|---|---|
| | Illinois River | | | | |
| 13.5 | Main channel | DNS | 0.68 (0.35) | 4.13 (0.87) | 0.10 (0.050) |
| 13.5 | Side channel | DNS | 0.55 (0.29) | 7.43 (5.43) | 0.03 (0.01) |
| 9.3 | Backwater | DNS | 6.99 (4.76) | 1.70 (0.83) | 5.30 (2.18) |
| | Mississippi River | | | | |
| 208.5 | Main channel | 0.001 (0.001) | 0.07 | 0.89 (0.52) | 0.05 (0.02) |
| | Side channel | 0 | 0.12 | 2.10 (0.75) | 0.14 |
| 215.7 | Main channel | 0.004 (0.003) | 0.01 | 0.46 (0.04) | 0.05 (0.03) |
| | Side channel | 0 | 0.10 | 2.47 | 0.15 (0.12) |
| 223.0 | Main channel | 0.001 (0.001) | 0.06 (0.01) | 0.24 (0.23) | 0.09 (0.01) |
| | Side channel | 0.001 (0.001) | 0.07 (0.05) | 0.28 (0.25) | 0.13 (0.06) |
| | Backwater | 0 | 3.60 (2.99) | 27.47 (1.19) | DNS |
| 233.5 | Main channel | <0.01 (<0.02) | 0.06 (0.01) | 0.58 (0.57) | 0.10 (0.01) |
| | Side channel | 0 | 0.04 (0.02) | 0.18 (0.17) | 0.22 (0.10) |

Table 6. Mean larval fish densities (1 SE) expressed as number/m³ collected from main channel (MC; river mile 13.5), side channel (SC; river mile 13.5), and backwater (BW; river mile 9.3) habitat types in the Illinois River during May-July 1997.

| | | Mean larval fish density (1 SE) number/m³ | | |
|---|---|---|---|---|
| Fish taxon | Habitat type | May | June | July |
| Brook silverside | BW | <0.01(<0.01) | 0.22(0.21) | 0.59(0.08) |
| Common carp | MC | <0.01(<0.01) | 0.19(0.13) | 0 |
| | SC | <0.01(<0.01) | 0.08(0.02) | 0 |
| | BW | 0 | <0.01(<0.01) | 0 |
| Freshwater drum | MC | 0.12(0.12) | 3.37(0.49) | 0 |
| | SC | 0.51(0.41) | 7.02(5.13) | <0.01(<0.01) |
| | BW | 0 | 0 | 0 |
| Mosquitofish | MC | 0 | <0.01(<0.01) | 0 |
| | SC | 0 | 0 | 0 |
| | BW | 0.01(0.001) | 0 | 0.02(0.02) |
| Cyprinidae | MC | 0 | <0.01(<0.01) | 0.01(0.01) |
| | SC | <0.01(<0.01) | 0.01(0.01) | <0.01(<0.01) |
| | BW | 0 | 0 | 0 |
| Clupeidae | MC | 0.47(0.40) | 0.06(0.02) | 0.04(0.01) |
| | SC | 0.30(0.28) | 0.03(0.02) | 0.02(0.01) |
| | BW | 6.93(4.77) | 0.44(0.28) | <0.01(<0.01) |
| Catostomidae | MC | 0 | 0.49(0.48) | 0.05(0.05) |
| | SC | <0.01(<0.01) | 0.24(0.24) | 0 |
| | BW | 0.01(0.001) | 0 | 0 |
| Centrarchidae | MC | 0 | <0.01(<0.01) | <0.01(<0.01) |

Table 6 continued...

| Fish taxon | Habitat type | Mean larval fish density (1 SE) number/$m^3$ | | |
|---|---|---|---|---|
| | | May | June | July |
| Centrarchidae | SC | 0 | <0.01(<0.01) | 0 |
| | BW | 0.03(0.03) | 1.03(0.89) | 4.63(2.12) |
| *Morone* | MC | 0.08(0.05) | <0.01(<0.01) | 0 |
| | SC | 0.01(0.01) | <0.01(<0.01) | 0 |
| | BW | 0 | 0 | 0 |
| Unidentified | MC | 0.01(0.01) | 0.01(0.01) | 0 |
| | SC | 0.01(0.003) | 0.04(0.001) | 0 |
| | BW | 0.02(0.01) | 0.01(0.01) | 0 |

Table 7. Mean larval fish density expressed as number/$m^3$ for all taxa combined collected from the navigation channel of Pool 26 of the Mississippi River during May-July, 1996. DNS= did not sample.

| | Mean larval fish density (1 SE) number/$m^3$ | | |
|---|---|---|---|
| River mile | May | June | July |
| 203.2 | 0.98 (0.71) | 0.63 (0.56) | 0.59 |
| 207.1 | 2.38 | 0.30 (0.18) | 0.51 |
| 208.5 | 1.11 (0.27) | 0.39 | 1.02 |
| 211.2 | 0.46 (0.18) | 0.23 | 0.55 |
| 213.5 | 1.02 | 0.75 | 0.82 |
| 215.7 | 0.56 | 1.40 (0.70) | 0.86 |
| 223.0 | 0.22 (0.06) | 0.30 | 0.20 |
| 225.8 | 0.26 | 0.20 (0.17) | 0.39 |
| 230.5 | DNS | 0.75 (0.72) | DNS |
| 233.5 | 0.54 | 0.48 (0.45) | 0.46 |
| 240.2 | DNS | DNS | 0.70 |

Table 8. Mean larval fish density expressed as number/m³ collected from the navigation channel in Pool 26 of the Mississippi River during May-July 1996.

| Fish taxon | River mile | Mean larval fish density (1 SE) number per m³ May | June | July |
|---|---|---|---|---|
| Bowfin | 203.2 | 0 | <0.01 (<0.01) | 0 |
| Ictiobidae | 203.2 | 0 | 0.02 (0.02) | 0 |
| | 207.1 | 0 | 0.01 (0.01) | 0 |
| | 208.5 | 0.10(0.10) | 0.01 | 0 |
| | 211.2 | 0.01 (0.01) | 0.01 | 0 |
| | 213.5 | 0 | 0.02 | 0 |
| | 215.7 | 0 | <0.01 (<0.01) | 0 |
| | 230.5 | DNS | 0.01 (0.003) | DNS |
| Common carp | 203.2 | 0.91 (0.76) | 0.29 (0.27) | <0.01 |
| | 207.1 | 2.28 | 0.14 (0.09) | <0.01 |
| | 208.5 | 0.67 (0.64) | 0.18 | <0.01 |
| | 211.2 | 0.32 (0.12) | 0 | 0 |
| | 213.5 | 0.97 | 0.13 | 0.01 |
| | 215.7 | 0.50 | 0.28 (0.13) | <0.01 |
| | 223.0 | 0.19 (0.05) | 0.01 | 0 |
| | 225.8 | 0.22 | 0.02 (0.01) | 0 |
| | 230.5 | DNS | 0.02 (0.001) | DNS |
| | 233.5 | 0.44 | 0.02 (0.01) | <0.01 |
| | 240.2 | DNS | DNS | <0.01 |

Table 8 continued...

| Fish taxon | River mile | Mean larval fish density (1 SE) number per $m^3$ | | |
|---|---|---|---|---|
| | | May | June | July |
| Freshwater drum | 203.2 | 0.00 | 0.01 (0.01) | 0.57 |
| | 207.1 | 0 | 0.01 (0.01) | 0.45 |
| | 208.5 | <0.01 (<0.01) | 0.01 | 0.97 |
| | 211.2 | <0.01 | 0 | 0.54 |
| | 213.5 | 0 | 0.01 | 0.71 |
| | 215.7 | 0 | 0.14 (0.14) | 0.84 |
| | 223.0 | 0 | 0.28 | 0.20 |
| | 225.8 | 0 | 0.18 (0.18) | 0.39 |
| | 230.5 | DNS | 0.71 (0.71) | DNS |
| | 233.5 | 0 | 0.45 (0.45) | 0.46 |
| | 240.2 | DNS | DNS | 0.70 |
| Lepisosteidae | 203.2 | <0.01 (<0.01) | 0 | 0 |
| | 207.1 | 0 | <0.02 (<0.02) | 0 |
| | 213.5 | 0 | <0.01 | 0 |
| | 225.8 | 0 | <0.01 | 0 |
| | 230.5 | DNS | <0.01 (<0.01) | DNS |
| | 233.5 | 0 | <0.01 (<0.01) | 0 |
| Hiodontidae | 203.2 | <0.01 (<0.01) | 0 | 0 |
| | 207.1 | 0 | <0.01 (<0.01) | 0 |
| | 208.5 | 0 | <0.01 | 0 |
| | 211.2 | 0 | <0.01 | 0 |

Table 8 continued...

| Fish taxon | River mile | Mean larval fish density (1 SE) number per m³ | | |
|---|---|---|---|---|
| | | May | June | July |
| Hiodontidae | 215.7 | <0.01 | 0 | 0 |
| | 223.0 | 0 | <0.01 | 0 |
| | 230.5 | DNS | <0.01 (<0.01) | DNS |
| | 233.5 | 0 | <0.01 (<0.01) | 0 |
| Percidae | 203.2 | <0.01 (<0.01) | <0.01 (<0.01) | 0 |
| | 207.1 | 0.01 | 0 | 0 |
| | 208.5 | <0.01 (<0.01) | 0 | 0 |
| | 213.5 | <0.01 | 0 | 0 |
| | 215.7 | 0.01 | <0.01 (<0.01) | 0 |
| | 223.0 | 0.01 (0.01) | 0 | 0 |
| | 225.8 | 0.01 | 0 | 0 |
| | 233.5 | 0.01 | 0 | 0 |
| Clupeidae | 203.2 | 0.03 (0.03) | 0.28 (0.24) | 0.02 |
| | 207.1 | 0.08 | 0.12 (0.07) | 0.05 |
| | 208.5 | 0.29 (0.29) | 0.18 | 0.03 |
| | 211.2 | 0.02 (0.02) | 0.11 | <0.01 |
| | 213.5 | 0 | 0.57 | 0.10 |
| | 215.7 | 0 | 0.89 (0.35) | 0.01 |
| | 223.0 | 0 | 0.01 | 0 |
| | 225.8 | 0.01 (<0.01) | 0 | 0 |
| | 230.5 | DNS | <0.01 (<0.01) | DNS |

Table 8 continued...

| Fish taxon | River mile | Mean larval fish density (1 SE) number per m³ | | |
|---|---|---|---|---|
| | | May | June | July |
| | 233.5 | 0 | <0.01 (<0.01) | 0 |
| Catostomidae | 203.2 | 0.03 (0.02) | 0 | <0.01 |
| | 207.1 | 0 | 0.01 (0.01) | 0.01 |
| | 208.5 | 0.04 (0.04) | 0 | 0.02 |
| | 211.2 | 0 | 0 | 0.01 |
| | 213.5 | 0.05 | 0 | <0.01 |
| | 215.7 | 0.04 | 0.07 (0.07) | <0.01 |
| | 223.0 | 0.03 (0.003) | <0.01 | 0 |
| | 225.8 | 0.03 | <0.01 (<0.01) | 0 |
| | 233.5 | 0.08 | 0.01 (0.003) | 0 |
| Centrarchidae | 203.2 | <0.01 (<0.01) | <0.01 (<0.01) | 0 |
| | 207.1 | 0 | 0.01 (0.01) | 0 |
| | 208.5 | 0 | 0.01 | <0.01 |
| | 211.2 | 0 | 0.01 | 0 |
| | 213.5 | 0 | 0.01 | 0 |
| | 230.5 | DNS | <0.01 (<0.01) | DNS |
| | 233.5 | <0.01 | 0 | 0 |
| *Morone* | 203.2 | 0 | 0.01 (0.01) | 0 |
| | 207.1 | 0 | <0.01 (<0.01) | 0 |
| | 208.5 | 0.01 (0.01) | <0.01 | <0.01 |
| | 213.5 | 0 | <0.01 | 0 |

Table 8 continued...

| Fish taxon | River mile | Mean larval fish density (1 SE) number per m³ | | |
|---|---|---|---|---|
| | | May | June | July |
| *Morone* | 215.7 | 0 | <0.01 (<0.01) | 0 |
| | 233.5 | 0 | <0.01 | 0 |
| Unidentified | 203.2 | 0.01 (0.01) | <0.01 (<0.01) | <0.01 |
| | 207.1 | 0 | <0.01 (<0.01) | 0 |
| | 208.5 | 0 | <0.01 | <0.01 |
| | 211.2 | 0 | 0 | <0.01 |
| | 213.5 | 0 | <0.01 | <0.01 |
| | 215.7 | 0 | 0.01 (0.01) | 0 |
| | 223.0 | <0.01 | <0.01 | 0 |
| | 225.8 | 0 | 0.01 (0.01) | 0 |
| | 230.5 | DNS | <0.01 (<0.01) | DNS |
| | 233.5 | 0 | <0.01 (<0.01) | 0.01 |
| | 240.2 | DNS | DNS | <0.01 |

Table 9. Mean larval fish density expressed as number/m³ (1 SE) for each taxon collected in main channel habitat of Pool 26 of the Mississippi River during April-July 1997.

| Fish taxon | River mile | Mean larval fish density (1 SE) number/m³ | | | |
|---|---|---|---|---|---|
| | | April | May | June | July |
| Common carp | 208.5 | 0 | <0.01 | <0.01 (<0.01) | <0.01 (<0.01) |
| | 215.7 | <0.01(<0.01) | 0 | <0.01 (<0.01) | 0 |
| | 223.0 | 0 | <0.01 (<0.01) | <0.01 (<0.01) | 0 |
| | 233.5 | 0 | 0 | <0.01 (<0.01) | 0 |
| Freshwater drum | 208.5 | 0 | 0 | 0.62 (0.53) | 0 |
| | 215.7 | <0.01 (<0.01) | 0 | 0.33 (0.06) | <0.01 (<0.01) |
| | 223.0 | 0 | 0 | 0.16 (0.16) | <0.01 (<0.01) |
| | 233.5 | <0.01 (<0.01) | 0 | 0.50 (0.50) | 0.01 (0.004) |
| Lepisosteidae | 223.0 | 0 | 0 | 0 | <0.01 (<0.01) |
| Hiodontidae | 208.5 | 0 | 0 | <0.01 (<0.01) | 0 |
| | 215.7 | <0.01 (<0.01) | <0.01 | <0.01 (<0.01) | 0 |
| | 223.0 | 0 | 0.01 (0.01) | 0 | 0 |
| | 233.5 | 0 | 0.02 (0.02) | 0 | <0.01 (<0.01) |
| Mosquitofish | 208.5 | 0 | 0 | 0 | 0 |
| | 215.7 | <0.01 (<0.01) | 0 | 0 | <0.01 (<0.01) |
| | 223.0 | 0 | 0 | 0 | 0 |
| | 233.5 | 0 | <0.01 (<0.01) | 0 | <0.01 (<0.01) |
| Cyprinidae | 208.5 | 0 | 0 | 0 | 0.04 (0.01) |
| | 215.7 | 0 | 0 | 0 | 0.04 (0.02) |
| | 223.0 | 0 | 0 | 0.01 (0.01) | 0.07 (0.02) |

Table 9 continued...

| Fish taxon | River mile | Mean larval fish density (1 SE) number/m³ | | | |
|---|---|---|---|---|---|
| | | April | May | June | July |
| Cyprinidae | 233.5 | 0 | <0.01 (<0.01) | 0.01 (0.01) | 0.08 (0.02) |
| Clupeidae | 208.5 | 0 | 0 | 0.14 (0.07) | <0.01 (<0.01) |
| | 215.7 | 0 | <0.01 | 0.06 (0.05) | <0.01 (<0.01) |
| | 223.0 | 0 | 0 | 0.02 (0.02) | 0.01 (0.01) |
| | 233.5 | 0 | 0 | 0.01 (0.01) | <0.01 (<0.01) |
| Catostomidae | 208.5 | 0 | 0.05 | 0.12 (0.09) | 0.01 (0.002) |
| | 215.7 | <0.01 (<0.01) | 0 | 0.07 (0.06) | 0.01 (0.01) |
| | 223.0 | 0 | 0.03 (0.01) | 0.05 (0.04) | 0.01 (0.001) |
| | 233.5 | 0 | 0.02 (0.01) | 0.05 (0.04) | 0.01 (0.002) |
| Centrarchidae | 208.5 | 0 | 0 | 0 | <0.01 (<0.01) |
| | 215.7 | 0 | 0 | 0 | 0 |
| | 223.0 | 0 | <0.01 (<0.01) | 0 | 0 |
| | 233.5 | 0 | 0 | 0 | <0.01 (<0.01) |
| Percidae | 208.5 | <0.01 (<0.01) | 0.02 | 0 | 0 |
| | 215.7 | 0 | 0 | 0 | 0 |
| | 223.0 | <0.01 | 0.09 (0.01) | 0 | 0 |
| | 233.5 | 0 | 0.01 (0.002) | <0.01 (<0.01) | 0 |
| *Morone* | 208.5 | 0 | 0 | 0 | 0 |
| | 215.7 | 0 | 0 | 0 | 0 |
| | 223.0 | 0 | <0.01 (<0.01) | 0 | 0 |
| | 233.5 | 0 | 0 | <0.01 (<0.01) | 0 |

Table 9 continued...

| Fish taxon | River mile | Mean larval fish density (1 SE) number/m³ April | May | June | July |
|---|---|---|---|---|---|
| Unidentified | 208.5 | 0 | <0.01 | 0 | 0 |
| | 215.7 | 0 | 0 | 0 | 0 |
| | 223.0 | 0 | 0 | <0.01 (<0.01) | 0 |
| | 233.5 | 0 | 0 | 0 | 0 |

Table 10. Mean larval fish density expressed as number/m³ (1 SE) of each species collected in side channel habitat in Pool 26 of the Mississippi River during April-July 1997.

| Common name | River mile | Mean larval fish density (1 SE) number/m³ | | | |
|---|---|---|---|---|---|
| | | April | May | June | July |
| Common carp | 208.5 | 0 | <0.01 | 0.03 (0.02) | 0 |
| | 215.7 | 0 | 0.01 | 0.01 | 0 |
| | 223.0 | 0 | <0.01 (<0.01) | <0.01 (<0.01) | 0 |
| | 233.5 | 0 | <0.01 (<0.01) | 0.01 (0.004) | 0 |
| Freshwater drum | 208.5 | 0 | 0 | 1.91 (0.83) | 0.01 |
| | 215.7 | 0 | 0 | 0.08 | <0.01 (<0.01) |
| | 223.0 | 0 | <0.01 (<0.01) | 0.14 (0.14) | 0.01 (0.001) |
| | 233.5 | 0 | 0 | 0.13 (0.13) | 0.01 (0.004) |
| Lepisosteidae | 223.0 | 0 | <0.01 (<0.01) | 0 | 0 |
| Hiodontidae | 208.5 | 0 | 0 | <0.01 (<0.01) | <0.01 |
| | 215.7 | 0 | 0.02 | 0 | 0 |
| | 223.0 | 0 | 0.02 (0.02) | <0.01 (<0.01) | <0.01 (<0.01) |
| | 233.5 | 0 | 0.01 (0.01) | 0 | 0 |
| Cyprinidae | 208.5 | 0 | 0 | 0 | 0.05 |
| | 215.7 | 0 | 0 | 0.05 | 0.16 (0.10) |
| | 223.0 | 0 | 0 | <0.01 (<0.01) | 0.09 (0.05) |
| | 233.5 | 0 | <0.01 (<0.01) | <0.01 (<0.01) | 0.20 (0.10) |
| Clupeidae | 208.5 | 0 | 0 | 0.11 (0.08) | 0.05 |
| | 215.7 | 0 | 0.02 | 2.21 | <0.01 (<0.01) |

Table 10 continued...

| Common name | River mile | Mean larval fish density (1 SE) number/m³ April | May | June | July |
|---|---|---|---|---|---|
| | 223.0 | 0 | <0.01 (<0.01) | 0.02 (0.02) | 0.01 (0.01) |
| | 233.5 | 0 | <0.01 (<0.01) | 0.02 (0.02) | <0.01 (<0.01) |
| Catostomidae | 208.5 | 0 | 0.07 | 0.03 (0.02) | 0.03 |
| | 215.7 | 0 | 0.04 | 0.10 | 0 |
| | 223.0 | 0 | 0.03 (0.02) | 0.10 (0.09) | 0.02 (0.01) |
| | 233.5 | 0 | 0.02 (0.02) | 0.02 (0.02) | 0.01 (0.004) |
| Centrarchidae | 208.5 | 0 | 0 | <0.01 (<0.01) | 0 |
| | 215.7 | 0 | 0.01 | 0.01 | 0 |
| | 223.0 | 0 | 0.01 (0.01) | 0 | <0.01 (<0.01) |
| | 233.5 | 0 | <0.01 (<0.01) | <0.01 (<0.01) | 0 |
| Percidae | 208.5 | 0 | 0.04 | <0.01 (<0.01) | 0 |
| | 215.7 | 0 | 0.01 | 0 | 0 |
| | 223.0 | <0.01 (<0.01) | <0.01 (<0.01) | 0 | 0 |
| | 233.5 | 0 | 0.01 (0.01) | 0 | 0 |
| *Morone* | 208.5 | 0 | 0 | 0.01 (0.001) | 0 |
| | 215.7 | 0 | <0.01 | 0 | 0 |
| | 223.0 | 0 | <0.01 (<0.01) | <0.01 (<0.01) | 0 |
| | 233.5 | 0 | 0 | <0.01 (<0.01) | 0 |
| Unidentified | 208.5 | 0 | <0.01 | 0 | 0 |
| | 215.7 | 0 | 0 | 0.01 | <0.01 (<0.01) |
| | 223.0 | 0 | <0.01 (<0.01) | 0.02 (0.01) | <0.01 (<0.01) |
| | 233.5 | 0 | <0.01 (<0.01) | <0.01 (<0.01) | <0.01 (<0.01) |

Table 11. Mean larval fish density expressed as number/$m^3$ (1 SE) of each taxon collected from backwater habitat (river mile 222.2) in the Mississippi River during April-June 1997.

| Fish taxon | Mean larval fish density (1 SE) number/$m^3$ | | |
|---|---|---|---|
| | April | May | June |
| Bighead carp | 0 | 0 | <0.01 (<0.01) |
| Brook silverside | 0 | 0 | <0.01(<0.01) |
| Common carp | 0 | 0.03 (0.03) | 0 |
| Freshwater drum | 0 | <0.01 (<0.01) | 0 |
| Mosquitofish | 0 | 0 | 0.73 (0.73) |
| Cyprinidae | 0 | 0.01 (0.01) | 0.07 (0.03) |
| Percidae | 0 | 0.01 (0.01) | 0 |
| Clupeidae | 0 | 3.01 (2.50) | 14.62 (13.63) |
| Centrarchidae | 0 | 0.49 (0.44) | 12.04 (11.67) |
| *Morone* | 0 | 0.010 (0.004) | 0 |
| Unidentified | 0 | 0.020(0.02) | 0 |

Table 12. Mean monthly CPUE (1 SE) expressed as number of fish per hour of trawling for all small fish collected by bottom frame trawl in the lower Illinois River and in Pool 26 of the Mississippi River during July and September 1997. DNT = did not trawl.

| | Mean CPUE (1 SE) number/h | |
|---|---|---|
| River | July | September |
| Illinois | DNT | 120.0 (25.0) |
| Mississippi | 105.4 (18.0) | 11.5 (4.6) |

Table 13. Minimal density and biomass estimates of fishes captured by the beam trawl in the lower Illinois River during 1997. Sample size is denoted by N and S.E. is the standard error of the mean.

| | | Density (no./ha) | | | Biomass (kg/ha) | | |
|---|---|---|---|---|---|---|---|
| Species | N | Median | Mean | S.E. | Median | Mean | S.E. |
| Blue catfish | 3 | 0 | 1.4 | 1.4 | 0 | 0 | 0 |
| Channel catfish | 3 | 8.3 | 9.7 | 1.4 | 0 | 0 | 0 |
| Common carp | 3 | 0 | 2.8 | 2.8 | 0 | 0 | 0 |
| Freshwater drum | 3 | 95.8 | 88.9 | 11.4 | 1.1 | 1.3 | 0.7 |
| Gizzard shad | 3 | 4.2 | 16.7 | 14.6 | 0 | 0.1 | 0.1 |
| Goldeye | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mooneye | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| River carpsucker | 3 | 0 | 1.4 | 1.4 | 0 | 1.5 | 1.5 |
| Shovelnose sturgeon | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Skipjack herring | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Smallmouth buffalo | 3 | 4.2 | 4.2 | 0 | 2.2 | 2.3 | 0.3 |
| Unidentified Lepomis | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| White bass | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total fish | 3 | 112.5 | 125 | 26 | 3.1 | 5.3 | 2.2 |

Table 14. Minimal density and biomass estimates of fishes captured by the beam trawl in Pool 26 of the Mississippi River during 1997. Sample size is denoted by N and S.E. is the standard error of the mean.

| | | Density (no./ha) | | | Biomass (kg/ha) | | |
|---|---|---|---|---|---|---|---|
| Species | N | Median | Mean | S.E. | Median | Mean | S.E. |
| Blue catfish | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| Channel catfish | 15 | 9.4 | 39.4 | 12.8 | 0 | 0.8 | 0.7 |
| Common carp | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| Freshwater drum | 15 | 0 | 8.7 | 5.5 | 0 | 0 | 0 |
| Gizzard shad | 15 | 0 | 0.3 | 0.3 | 0 | 0 | 0 |
| Goldeye | 15 | 0 | 1.5 | 0.7 | 0 | 0.1 | 0.1 |
| Mooneye | 15 | 0 | 6.5 | 2.5 | 0 | 0 | 0 |
| River carpsucker | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| Shovelnose sturgeon | 15 | 0 | 0.4 | 0.4 | 0 | 0 | 0 |
| Skipjack herring | 15 | 0 | 0.2 | 0.2 | 0 | 0 | 0 |
| Smallmouth buffalo | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unidentified Lepomis | 15 | 0 | 0.3 | 0.3 | 0 | 0 | 0 |
| White bass | 15 | 0 | 0.4 | 0.4 | 0 | 0.1 | 0.1 |
| Total fish | 15 | 31.2 | 57.6 | 15.7 | 0.1 | 1 | 0.7 |

Table 15. Mean, standard deviation (S.D.) and sample size (N) of lengths and weights of fishes captured by beam trawling.

| | Pool 26, Mississippi River | | | | | | Illinois River | | |
|---|---|---|---|---|---|---|---|---|---|
| | Length (mm) | | | Weight (g) | | | Length (mm) | | |
| Species | Mean | S.D. | N | Mean | S.D. | N | Mean | S.D. | N |
| Blue catfish | | | | | | | 101 | | 1 |
| Channel catfish | 43 | 63 | 87 | 133 | 466 | 14 | 70 | 25 | 7 |
| Common carp | | | | | | | 14 | 1 | 2 |
| Freshwater drum | 36 | 52 | 18 | 74 | 97 | 2 | 93 | 71 | 37 |
| Gizzard shad | 92 | | 1 | 8 | | 1 | 79 | 23 | 12 |
| Goldeye | 168 | 126 | 4 | 196 | 66 | 2 | | | |
| Mooneye | 71 | 50 | 16 | 23 | 2 | 4 | | | |
| River carpsucker | | | | | | | 438 | | 1 |
| Shovelnose sturgeon | 93 | | 1 | | | | | | |
| Skipjack herring | 107 | | 1 | 9 | | 1 | | | |
| Smallmouth buffalo | | | | | | | 333 | 24 | 3 |
| Unidentified Lepomis | 13 | | 1 | | | | | | |
| White bass | 233 | | 1 | 155 | | 1 | | | |

Table 16. Minimal density and biomass estimates of fishes captured by the rockhopper trawl in the lower Illinois River during 1996. Sample size is denoted by N and S.E. is the standard error of the mean.

| | | Density (no./ha) | | | Biomass (kg/ha) | | |
|---|---|---|---|---|---|---|---|
| Species | N | Median | Mean | S.E. | Median | Mean | S.E. |
| Bighead carp | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bigmouth buffalo | 21 | 0 | 0.5 | 0.3 | 0 | 0.4 | 0.2 |
| Black buffalo | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| Black crappie | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| Blue catfish | 21 | 0 | 0.8 | 0.4 | 0 | 0 | 0 |
| Blue sucker | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| Channel catfish | 21 | 8.2 | 18.9 | 6.1 | 0.7 | 1.8 | 0.7 |
| Common carp | 21 | 2.7 | 3.1 | 0.8 | 2.2 | 4 | 1.2 |
| Flathead catfish | 21 | 0 | 0.4 | 0.3 | 0 | 0.1 | 0.1 |
| Freshwater drum | 21 | 32.3 | 122.3 | 34.9 | 6.8 | 15.9 | 4.4 |
| Gizzard shad | 21 | 1.9 | 3.6 | 1.4 | 0 | 0.2 | 0.1 |
| Goldeye | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| Highfin carpsucker | 21 | 0 | 0.2 | 0.2 | 0 | 0.1 | 0.1 |
| Lake sturgeon | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mooneye | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| Quillback | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| River carpsucker | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sauger | 21 | 0 | 0.5 | 0.3 | 0 | 0.2 | 0.1 |
| Shorthead redhorse | 21 | 0 | 0.2 | 0.1 | 0 | 0.1 | 0.1 |
| Shortnose gar | 21 | 0 | 0.1 | 0.1 | 0 | 0.1 | 0.1 |
| Shovelnose sturgeon | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| Silver chub | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| Skipjack herring | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| Smallmouth buffalo | 21 | 1.6 | 5.4 | 2.2 | 1.1 | 3.7 | 1.7 |
| Speckled chub | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| White bass | 21 | 0 | 1.3 | 0.6 | 0 | 0 | 0 |
| Total fish | 21 | 83.5 | 157.3 | 41.1 | 15.7 | 26.5 | 6.3 |

Table 17. Minimal density and biomass estimates of fishes captured by the rockhopper trawl in the lower Illinois River during 1997. Sample size is denoted by N and S.E. is the standard error of the mean.

| Species | N | Density (no./ha) | | | Biomass (kg/ha) | | |
|---|---|---|---|---|---|---|---|
| | | Median | Mean | S.E. | Median | Mean | S.E. |
| Bighead carp | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bigmouth buffalo | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| Black buffalo | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| Black crappie | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| Blue catfish | 16 | 0 | 0.6 | 0.4 | 0 | 0.1 | 0 |
| Blue sucker | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| Channel catfish | 16 | 5.1 | 10.3 | 3.6 | 0.4 | 0.8 | 0.2 |
| Common carp | 16 | 0.9 | 3.9 | 1.7 | 1.5 | 5 | 1.9 |
| Flathead catfish | 16 | 0 | 0.6 | 0.3 | 0 | 1 | 0.5 |
| Freshwater drum | 16 | 60.6 | 89.7 | 21.9 | 12.9 | 15.7 | 4.5 |
| Gizzard shad | 16 | 0.8 | 59.4 | 55.6 | 0 | 1 | 0.8 |
| Goldeye | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| Highfin carpsucker | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lake sturgeon | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mooneye | 16 | 0 | 0.2 | 0.2 | 0 | 0 | 0 |
| Quillback | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| River carpsucker | 16 | 0 | 0.4 | 0.2 | 0 | 0.3 | 0.2 |
| Sauger | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| Shorthead redhorse | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| Shortnose gar | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| Shovelnose sturgeon | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| Silver chub | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| Skipjack herring | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| Smallmouth buffalo | 16 | 7.1 | 12.4 | 4.2 | 3.7 | 8.3 | 2.9 |
| Speckled chub | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| White bass | 16 | 0 | 0.2 | 0.2 | 0 | 0 | 0 |
| Total fish | 16 | 119 | 177.7 | 53.6 | 28.1 | 32.2 | 6.8 |

Table 18. Minimal density and biomass estimates of fishes captured by the rockhopper trawl in Pool 26 of the Mississippi River during 1996. Sample size is denoted by N and S.E. is the standard error of the mean.

| Species | N | Density (no./ha) | | | Biomass (kg/ha) | | |
|---|---|---|---|---|---|---|---|
| | | Median | Mean | S.E. | Median | Mean | S.E. |
| Bighead carp | 65 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bigmouth buffalo | 65 | 0 | 2 | 0.9 | 0 | 1.4 | 0.6 |
| Black buffalo | 65 | 0 | 0.1 | 0.1 | 0 | 0.2 | 0.2 |
| Black crappie | 65 | 0 | 0 | 0 | 0 | 0 | 0 |
| Blue catfish | 65 | 0 | 2 | 0.7 | 0 | 0.1 | 0 |
| Blue sucker | 65 | 0 | 0.1 | 0.1 | 0 | 0 | 0 |
| Channel catfish | 65 | 3.8 | 8.8 | 2 | 0.1 | 1.2 | 0.3 |
| Common carp | 65 | 0 | 4.2 | 1.5 | 0 | 3.1 | 1.1 |
| Flathead catfish | 65 | 0 | 0.3 | 0.1 | 0 | 0.6 | 0.2 |
| Freshwater drum | 65 | 4 | 27.9 | 5.9 | 0.3 | 4 | 0.7 |
| Gizzard shad | 65 | 0 | 42.1 | 19 | 0 | 0.5 | 0.1 |
| Goldeye | 65 | 0 | 0.2 | 0.1 | 0 | 0 | 0 |
| Highfin carpsucker | 65 | 0 | 0.1 | 0.1 | 0 | 0 | 0 |
| Lake sturgeon | 65 | 0 | 0.3 | 0.1 | 0 | 0.7 | 0.3 |
| Mooneye | 65 | 0 | 5 | 2.9 | 0 | 0.1 | 0.1 |
| Quillback | 65 | 0 | 0.5 | 0.1 | 0 | 0.3 | 0.1 |
| River carpsucker | 65 | 0 | 0.2 | 0.1 | 0 | 0.2 | 0.1 |
| Sauger | 65 | 0 | 0.6 | 0.2 | 0 | 0.3 | 0.1 |
| Shorthead redhorse | 65 | 0 | 0.5 | 0.2 | 0 | 0.3 | 0.1 |
| Shortnose gar | 65 | 0 | 0 | 0 | 0 | 0 | 0 |
| Shovelnose sturgeon | 65 | 0 | 4.2 | 1 | 0 | 2 | 0.4 |
| Silver chub | 65 | 0 | 0.1 | 0 | 0 | 0 | 0 |
| Skipjack herring | 65 | 0 | 0 | 0 | 0 | 0 | 0 |
| Smallmouth buffalo | 65 | 2 | 9.4 | 2 | 2.2 | 7.6 | 1.4 |
| Speckled chub | 65 | 0 | 0 | 0 | 0 | 0 | 0 |
| White bass | 65 | 0 | 0.5 | 0.2 | 0 | 0 | 0 |
| Total fish | 65 | 39.1 | 109 | 23.4 | 13.8 | 22.7 | 3.1 |

Table 19. Minimal density and biomass estimates of fishes captured by the rockhopper trawl in Pool 26 of the Mississippi River during 1997. Sample size is denoted by N and S.E. is the standard error of the mean.

| Species | N | Density (no./ha) | | | Biomass (kg/ha) | | |
|---|---|---|---|---|---|---|---|
| | | Median | Mean | S.E. | Median | Mean | S.E. |
| Bighead carp | 49 | 0 | 0.1 | 0.1 | 0 | 0 | 0 |
| Bigmouth buffalo | 49 | 0 | 0.5 | 0.2 | 0 | 0.6 | 0.3 |
| Black buffalo | 49 | 0 | 0.1 | 0.1 | 0 | 0.1 | 0.1 |
| Black crappie | 49 | 0 | 0 | 0 | 0 | 0 | 0 |
| Blue catfish | 49 | 0 | 1.3 | 0.5 | 0 | 0.5 | 0.2 |
| Blue sucker | 49 | 0 | 0.1 | 0.1 | 0 | 0.1 | 0.1 |
| Channel catfish | 49 | 1.5 | 7.1 | 2 | 0 | 1.4 | 0.4 |
| Common carp | 49 | 0 | 0.4 | 0.2 | 0 | 0.5 | 0.3 |
| Flathead catfish | 49 | 0 | 0.3 | 0.1 | 0 | 0.7 | 0.4 |
| Freshwater drum | 49 | 1.9 | 23.3 | 7.2 | 0.2 | 2 | 0.6 |
| Gizzard shad | 49 | 0 | 3.6 | 1.4 | 0 | 0.2 | 0 |
| Goldeye | 49 | 0 | 0.3 | 0.1 | 0 | 0.1 | 0 |
| Highfin carpsucker | 49 | 0 | 0.3 | 0.1 | 0 | 0.2 | 0.1 |
| Lake sturgeon | 49 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mooneye | 49 | 0 | 1.1 | 0.4 | 0 | 0 | 0 |
| Quillback | 49 | 0 | 2.1 | 0.9 | 0 | 1.3 | 0.5 |
| River carpsucker | 49 | 0 | 2.4 | 1.1 | 0 | 2.2 | 1 |
| Sauger | 49 | 0 | 0.5 | 0.2 | 0 | 0.2 | 0.1 |
| Shorthead redhorse | 49 | 0 | 0.2 | 0.1 | 0 | 0.1 | 0.1 |
| Shortnose gar | 49 | 0 | 0 | 0 | 0 | 0 | 0 |
| Shovelnose sturgeon | 49 | 0 | 4.1 | 1.2 | 0 | 2 | 0.6 |
| Silver chub | 49 | 0 | 0 | 0 | 0 | 0 | 0 |
| Skipjack herring | 49 | 0 | 0.2 | 0.1 | 0 | 0 | 0 |
| Smallmouth buffalo | 49 | 1.9 | 7.5 | 2.3 | 0.9 | 6.9 | 1.9 |
| Speckled chub | 49 | 0 | 0.2 | 0.2 | 0 | 0 | 0 |
| White bass | 49 | 0 | 0.1 | 0.1 | 0 | 0 | 0 |
| Total fish | 49 | 15.2 | 55.5 | 13.5 | 4.6 | 19.2 | 4.5 |

Table 20. Analysis of rockhopper trawl catches for all species combined.

| Parameter | Poisson model | | | Poisson autoregressive model | | |
|---|---|---|---|---|---|---|
| | Estimate | S.E. | *P*-value | Estimate | S.E. | *P*-value |
| Intercept $\lambda_0$ | 7.908 | 4.744 | 0.100 | 9.218 | 5.983 | 0.12 |
| Year $y_1$, 1996 | 0.343 | 0.252 | 0.89 | -0.045 | 0.357 | 0.90 |
| Year $y_2$, 1997 | 0 | 0 | | 0 | 0 | |
| Pool $p_1$, Pool 26 | -0.653 | 0.260 | 0.01 | -0.728 | 0.376 | 0.05 |
| Pool $p_2$, Illinois River | 0 | 0 | | 0 | 0 | |
| Location in pool $l_{1(1)}$ (lower 26) | 0.008 | 0.266 | 0.97 | -0.020 | 0.396 | 0.96 |
| Location in pool $l_{1(2)}$ (upper 26) | 0 | 0 | | 0 | 0 | |
| Location in pool $l_{2(3)}$ (all Ill. R.) | 0 | 0 | | 0 | 0 | |
| Month $\beta_1$ | -4.833 | 1.996 | 0.02 | -5.44 | 2.54 | 0.03 |
| Month (quadratic) $\beta_2$ | 0.800 | 0.265 | <0.01 | 0.876 | 0.340 | 0.01 |
| Month (cubic) $\beta_3$ | -0.038 | 0.011 | <0.01 | -0.040 | 0.014 | <0.01 |
| Scale $\phi$ | 8.890 | | | 8.89 | | |

Table 21. Analysis of rockhopper trawl catches for blue catfish.

| Parameter | Poisson model | | | Poisson autoregressive model | | |
|---|---|---|---|---|---|---|
| | Estimate | S.E. | *P*-value | Estimate | S.E. | *P*-value |
| Intercept $\lambda_0$ | 6.685 | 16.37 | 0.68 | 6.735 | 16.51 | 0.68 |
| Year $y_1$, 1996 | 0.123 | 0.340 | 0.72 | 0.123 | 0.344 | 0.72 |
| Year $y_2$, 1997 | 0 | 0 | | 0 | 0 | |
| Pool $p_1$, Pool 26 | -0.732 | 0.671 | 0.28 | -0.728 | 0.679 | 0.28 |
| Pool $p_2$, Illinois River | 0 | 0 | | 0 | 0 | |
| Location in pool $l_{1(1)}$ (lower 26) | 2.278 | 0.542 | <0.01 | 2.274 | 0.548 | <0.01 |
| Location in pool $l_{1(2)}$ (upper 26) | 0 | 0 | | 0 | 0 | |
| Location in pool $l_{2(3)}$ (all Ill. R.) | 0 | 0 | | 0 | 0 | |
| Month $\beta_1$ | -9.016 | 6.021 | 0.13 | -9.039 | 6.075 | 0.14 |
| Month (quadratic) $\beta_2$ | 1.552 | 0.737 | 0.04 | 1.555 | 0.744 | 0.04 |
| Month (cubic) $\beta_3$ | -0.075 | 0.030 | 0.01 | -0.0752 | 0.030 | 0.01 |
| Scale $\phi$ | 1.469 | | | 1.469 | | |

Table 22. Analysis of rockhopper trawl catches for channel catfish.

| Parameter | Poisson model | | | Poisson autoregressive model | | |
|---|---|---|---|---|---|---|
| | Estimate | S.E. | *P*-value | Estimate | S.E. | *P*-value |
| Intercept $\lambda_0$ | 0.122 | 4.279 | 0.98 | 0.174 | 4.363 | 0.97 |
| Year $y_1$, 1996 | 0.385 | 0.312 | 0.22 | 0.382 | 0.320 | 0.23 |
| Year $y_2$, 1997 | 0 | 0 | | 0 | 0 | |
| Pool $p_1$, Pool 26 | -1.425 | 0.394 | <0.01 | -1.424 | 0.404 | <0.01 |
| Pool $p_2$, Illinois River | 0 | 0 | | 0 | 0 | |
| Location in pool $l_{1(1)}$ (lower 26) | 1.246 | 0.376 | <0.01 | 1.243 | 0.387 | <0.01 |
| Location in pool $l_{1(2)}$ (upper 26) | 0 | 0 | | 0 | 0 | |
| Location in pool $l_{2(3)}$ (all Ill. R.) | 0 | 0 | | 0 | 0 | |
| Month $\beta_1$ | -1.476 | 1.808 | 0.41 | -1.499 | 1.845 | 0.42 |
| Month (quadratic) $\beta_2$ | 0.279 | 0.241 | 0.25 | 0.282 | 0.246 | 0.25 |
| Month (cubic) $\beta_3$ | -0.014 | 0.010 | 0.16 | -0.014 | 0.010 | 0.16 |
| Scale $\phi$ | 3.211 | | | 3.211 | | |

Table 23. Analysis of rockhopper trawl catches for common carp.

| Parameter | Gaussian errors model | | |
|---|---|---|---|
| | Estimate | S.E. | $P$-value |
| Intercept $\lambda_0$ | 0.536 | 0.259 | 0.04 |
| Year $y_1$, 1996 | -0.043 | 0.030 | 0.15 |
| Year $y_2$, 1997 | 0 | 0 | |
| Pool $p_1$, Pool 26 | -0.013 | 0.030 | 0.65 |
| Pool $p_2$, Illinois River | 0 | 0 | |
| Location in pool $l_{1(1)}$ (lower 26) | -0.036 | 0.026 | 0.17 |
| Location in pool $l_{1(2)}$ (upper 26) | 0 | 0 | |
| Location in pool $l_{2(3)}$ (all Ill. R.) | 0 | 0 | |
| Month $\beta_1$ | -0.280 | 0.119 | 0.02 |
| Month (quadratic) $\beta_2$ | 0.044 | 0.017 | 0.01 |
| Month (cubic) $\beta_3$ | -0.002 | 0.001 | <0.01 |

Table 24. Analysis of rockhopper trawl catches for freshwater drum.

| Parameter | Poisson model | | | Poisson autoregressive model | | |
|---|---|---|---|---|---|---|
| | Estimate | S.E. | *P*-value | Estimate | S.E. | *P*-value |
| Intercept $\lambda_0$ | 2.720 | 7.202 | 0.70 | 3.591 | 7.726 | 0.64 |
| Year $y_1$, 1996 | 0.175 | 0.263 | 0.50 | 0.199 | 0.299 | 0.50 |
| Year $y_2$, 1997 | 0 | 0 | | 0 | 0 | |
| Pool $p_1$, Pool 26 | -2.061 | 0.371 | <0.01 | -2.067 | 0.426 | <0.01 |
| Pool $p_2$, Illinois River | 0 | 0 | | 0 | 0 | |
| Location in pool $l_{1(1)}$ (lower 26) | 1.091 | 0.387 | <0.01 | 1.072 | 0.446 | 0.01 |
| Location in pool $l_{1(2)}$ (upper 26) | 0 | 0 | | 0 | 0 | |
| Location in pool $l_{2(3)}$ (all Ill. R.) | 0 | 0 | | 0 | 0 | |
| Month $\beta_1$ | -2.841 | 2.680 | 0.29 | -3.218 | 2.900 | 0.27 |
| Month (quadratic) $\beta_2$ | 0.550 | 0.328 | 0.09 | 0.601 | 0.358 | 0.09 |
| Month (cubic) $\beta_3$ | -0.028 | 0.013 | 0.03 | -0.030 | 0.014 | 0.04 |
| Scale $\phi$ | 6.23 | | | 6.23 | | |

Table 25. Analysis of rockhopper trawl catches for gizzard shad.

| Parameter | Gaussian errors model | | |
|---|---|---|---|
| | Estimate | S.E. | *P*-value |
| Intercept $\lambda_0$ | 2.119 | 0.979 | 0.03 |
| Year $y_1$, 1996 | -0.013 | 0.114 | 0.91 |
| Year $y_2$, 1997 | 0 | 0 | |
| Pool $p_1$, Pool 26 | 0.128 | 0.112 | 0.03 |
| Pool $p_2$, Illinois River | 0 | 0 | |
| Location in pool $l_{1(1)}$ (lower 26) | -0.191 | 0.098 | 0.05 |
| Location in pool $l_{1(2)}$ (upper 26) | 0 | 0 | |
| Location in pool $l_{2(3)}$ (all Ill. R.) | 0 | 0 | |
| Month $\beta_1$ | -1.117 | 0.451 | 0.01 |
| Month (quadratic) $\beta_2$ | 0.169 | 0.063 | 0.01 |
| Month (cubic) $\beta_3$ | -0.007 | 0.003 | 0.01 |
| Scale $\phi$ | | | |

Table 26. Analysis of rockhopper trawl catches for goldeye.

| Parameter | Gaussian errors model | | |
|---|---|---|---|
| | Estimate | S.E. | *P*-value |
| Intercept $\lambda_0$ | -0.003 | 0.032 | 0.92 |
| Year $y_1$, 1996 | -0.006 | 0.004 | 0.10 |
| Year $y_2$, 1997 | 0 | 0 | |
| Pool $p_1$, Pool 26 | 0.004 | 0.004 | 0.26 |
| Pool $p_2$, Illinois River | 0 | 0 | |
| Location in pool $l_{1(1)}$ (lower 26) | 0.006 | 0.003 | 0.08 |
| Location in pool $l_{1(2)}$ (upper 26) | 0 | 0 | |
| Location in pool $l_{2(3)}$ (all Ill. R.) | 0 | 0 | |
| Month $\beta_1$ | -0.001 | 0.015 | 0.93 |
| Month (quadratic) $\beta_2$ | ~0 | 0.0001 | 0.85 |
| Month (cubic) $\beta_3$ | ~0 | <0.001 | 0.85 |

Table 27. Analysis of rockhopper trawl catches for mooneye.

| Parameter | Gaussian errors model | | |
|---|---|---|---|
| | Estimate | S.E. | $P$-value |
| Intercept $\lambda_0$ | 0.206 | 0.306 | 0.50 |
| Year $y_1$, 1996 | 0.009 | 0.036 | 0.80 |
| Year $y_2$, 1997 | 0 | 0 | |
| Pool $p_1$, Pool 26 | 0.087 | 0.035 | 0.01 |
| Pool $p_2$, Illinois River | 0 | 0 | |
| Location in pool $l_{1(1)}$ (lower 26) | -0.065 | 0.030 | 0.03 |
| Location in pool $l_{1(2)}$ (upper 26) | 0 | 0 | 0 |
| Location in pool $l_{2(3)}$ (all Ill. R.) | 0 | 0 | 0 |
| Month $\beta_1$ | -0.149 | 0.141 | 0.29 |
| Month (quadratic) $\beta_2$ | 0.024 | 0.020 | 0.22 |
| Month (cubic) $\beta_3$ | -0.001 | 0.001 | 0.18 |

Table 28. Analysis of rockhopper trawl catches for shovelnose sturgeon.

| Parameter | Gaussian errors model | | |
|---|---|---|---|
| | Estimate | S.E. | *P*-value |
| Intercept $\lambda_0$ | -0.415 | 0.230 | 0.07 |
| Year $y_1$, 1996 | -0.005 | 0.027 | 0.85 |
| Year $y_2$, 1997 | 0 | 0 | |
| Pool $p_1$, Pool 26 | 0.166 | 0.026 | <0.01 |
| Pool $p_2$, Illinois River | 0 | 0 | |
| Location in pool $l_{1(1)}$ (lower 26) | -0.144 | 0.022 | <0.01 |
| Location in pool $l_{1(2)}$ (upper 26) | 0 | 0 | |
| Location in pool $l_{2(3)}$ (all Ill. R.) | 0 | 0 | |
| Month $\beta_1$ | 0.197 | 0.106 | 0.06 |
| Month (quadratic) $\beta_2$ | -.028 | 0.015 | 0.06 |
| Month (cubic) $\beta_3$ | 0.001 | 0.001 | 0.07 |

Table 29. Analysis of rockhopper trawl catches for smallmouth buffalo.

| Parameter | Poisson model | | | Poisson autoregressive model | | |
|---|---|---|---|---|---|---|
| | Estimate | S.E. | *P*-value | Estimate | S.E. | *P*-value |
| Intercept $\lambda_0$ | 4.322 | 6.220 | 0.49 | 3.343 | 7.716 | 0.66 |
| Year $y_1$, 1996 | -0.139 | 0.253 | 0.58 | -0.110 | 0.333 | 0.74 |
| Year $y_2$, 1997 | 0 | 0 | | 0 | 0 | |
| Pool $p_1$, Pool 26 | -0.372 | 0.336 | 0.27 | -0.295 | 0.456 | 0.52 |
| Pool $p_2$, Illinois River | 0 | 0 | | 0 | 0 | |
| Location in pool $l_{1(1)}$ (lower 26) | 0.800 | 0.284 | <0.01 | 0.809 | 0.379 | 0.03 |
| Location in pool $l_{1(2)}$ (upper 26) | 0 | 0 | | 0 | 0 | |
| Location in pool $l_{2(3)}$ (all Ill. R.) | 0 | 0 | | 0 | 0 | |
| Month $\beta_1$ | -5.167 | 2.597 | 0.05 | -4.794 | 3.285 | 0.13 |
| Month (quadratic) $\beta_2$ | 0.936 | 0.350 | 0.01 | 0.884 | 0.427 | 0.04 |
| Month (cubic) $\beta_3$ | -0.047 | 0.015 | 0.01 | -0.045 | 0.018 | 0.04 |
| Scale $\phi$ | 2.767 | | | 2.767 | | |

Table 30. Mean, standard deviation (S.D.) and sample size (N) of lengths and weights of fishes captured by rockhopper trawling.

| | Pool 26, Mississippi River | | | | | | Illinois River | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length (mm) | | | Weight (g) | | | Length (mm) | | | Weight (g) | | |
| Species | Mean | S.D. | N | Mean | S.D. | N | Mean | S.D. | N | Mean | S.D. | N |
| Bighead carp | 77 | | 1 | | | | | | | | | |
| Bigmouth buffalo | 362 | 64 | 66 | 746 | 561 | 33 | 349 | 35 | 5 | 600 | 45 | 4 |
| Black buffalo | 438 | 75 | 7 | | | | | | | | | |
| Black crappie | 248 | | 1 | | | | | | | | | |
| Blue catfish | 198 | 106 | 100 | 233 | 654 | 46 | 167 | 72 | 12 | 53 | 66 | 4 |
| Blue sucker | 358 | 144 | 5 | 601 | 613 | 4 | | | | | | |
| Channel catfish | 217 | 114 | 440 | 172 | 309 | 268 | 202 | 81 | 209 | 94 | 107 | 121 |
| Common carp | 383 | 52 | 124 | 786 | 294 | 61 | 452 | 63 | 60 | 1480 | 954 | 21 |
| Flathead catfish | 487 | 163 | 17 | 3128 | 1908 | 9 | 427 | 135 | 8 | 786 | 1147 | 4 |
| Freshwater drum | 207 | 81 | 1001 | 167 | 268 | 536 | 221 | 91 | 947 | 196 | 231 | 318 |
| Gizzard shad | 151 | 55 | 324 | 64 | 88 | 199 | 134 | 57 | 113 | 35 | 80 | 60 |
| Goldeye | 258 | 23 | 14 | 164 | 47 | 12 | | | | | | |
| Highfin carpsucker | 339 | 51 | 9 | 609 | 145 | 5 | 312 | 11 | 2 | | | |
| Lake sturgeon | 707 | 112 | 10 | 2371 | 1657 | 7 | | | | | | |
| Mooneye | 155 | 20 | 118 | 42 | 18 | 70 | 142 | | 1 | | | |
| Quillback | 358 | 76 | 60 | 709 | 405 | 15 | | | | | | |
| River carpsucker | 399 | 58 | 75 | 1206 | 568 | 15 | 403 | 20 | 3 | | | |
| Sauger | 369 | 62 | 29 | 520 | 224 | 16 | 303 | 120 | 5 | 316 | 273 | 3 |
| Shorthead redhorse | 380 | 97 | 17 | 867 | 300 | 12 | 334 | 43 | 2 | | | |
| Shortnose gar | 594 | 56 | 2 | 948 | | 1 | 666 | | 1 | 1250 | | 1 |
| Shovelnose sturgeon | 520 | 101 | 234 | 620 | 330 | 124 | | | | | | |
| Silver chub | 136 | 30 | 2 | 52 | | 1 | | | | | | |
| Skipjack herring | 98 | 4 | 4 | | | | | | | | | |

Table 30 continued...

| | Pool 26, Mississippi River | | | | | | Illinois River | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length (mm) | | | Weight (g) | | | Length (mm) | | | Weight (g) | | |
| Species | Mean | S.D. | N | Mean | S.D. | N | Mean | S.D. | N | Mean | S.D. | N |
| Smallmouth buffalo | 363 | 80 | 467 | 1010 | 1146 | 256 | 346 | 46 | 140 | 829 | 754 | 31 |
| Speckled chub | 51 | 8 | 4 | 3 | 1 | 3 | | | | | | |
| White bass | 161 | 42 | 18 | 53 | 49 | 11 | 105 | 14 | 11 | 15 | 5 | 8 |

Table 31. Information on dead and wounded fish, for which injuries could be attributed to entrainment through the propellers of the preceding towboat, collected during entrainment sampling behind towboats passing upstream or downstream during 1996. No dead or wounded fish were collected while sampling for entrainment during 1997. See text for criteria for attribution of injuries to entrainment.

| Date | River | River mile | Species | Length (mm) |
|---|---|---|---|---|
| Oct 2 | Mississippi | 203.2 | Gizzard shad | 119 |
| Oct 2 | Mississippi | 203.2 | Gizzard shad | 124 |
| Nov 6 | Mississippi | 238.2 | Gizzard shad | 122 |

Table 32. Dead and wounded fish collected during ambient sampling with the rockhopper trawl to determine background occurrence of dead and wounded fish during 1996 and 1997 in Pool 26 of the Upper Mississippi River and the lower 20 miles of the Illinois River. ***Bold*** entries are fish with fresh injuries consistent with propeller wounding—see text for explanation of diagnostic criteria. NA means fish were not measured.

| Date | River | River mile | Species | Length (mm) |
|---|---|---|---|---|
| | | | 1996 | |
| ***Oct 22*** | ***Mississippi*** | ***215.7*** | ***Shovelnose sturgeon*** | ***590*** |
| ***Oct 31*** | ***Illinois*** | ***9.3*** | ***Gizzard shad*** | ***310*** |
| Nov 22 | Mississippi | 203.2 | Gizzard shad | 125 |
| Dec 10 | Illinois | 18.7 | Gizzard shad | NA |
| Dec 10 | Illinois | 18.7 | Gizzard shad | NA |
| Dec 10 | Illinois | 18.7 | Gizzard shad | NA |
| Dec 10 | Illinois | 18.7 | Gizzard shad | NA |
| Dec 10 | Illinois | 18.7 | Gizzard shad | 107 |
| Dec 10 | Illinois | 18.7 | Gizzard shad | NA |
| ***Dec 10*** | ***Illinois*** | ***5.5*** | ***Smallmouth buffalo*** | ***518*** |
| Dec 10 | Illinois | 5.5 | Gizzard shad | 107 |
| | | | 1997 | |
| Mar 24 | Mississippi | 213.6 | Gizzard shad | NA |
| Mar 24 | Mississippi | 213.6 | Gizzard shad** | NA |
| Mar 24 | Mississippi | 213.6 | Gizzard shad | NA |
| Mar 24 | Mississippi | 213.6 | Gizzard shad | NA |
| Mar 25 | Mississippi | 207.1 | Gizzard shad | NA |
| Mar 25 | Mississippi | 207.1 | Gizzard shad | NA |
| Mar 25 | Mississippi | 207.1 | Gizzard shad | NA |

Continued...

Table 32 continued.

| Date | River | River mile | Species | Length (mm) |
|---|---|---|---|---|
| | | | 1997 | |
| Mar 26 | Mississippi | 233.5 | Gizzard shad | NA |
| Mar 26 | Mississippi | 230.5 | Gizzard shad | NA |
| Mar 26 | Mississippi | 277.2 | Shovelnose sturgeon | 615 |
| Mar 26 | Mississippi | 223.0 | Gizzard shad | NA |
| Mar 26 | Mississippi | 223.0 | Gizzard shad | NA |
| Mar 26 | Mississippi | 223.0 | Gizzard shad | NA |
| June 19 | Mississippi | 238.5 | Shovelnose sturgeon | 505 |
| June 19 | Mississippi | 238.5 | Shovelnose sturgeon | 505 |
| June 19 | Mississippi | 238.5 | Shovelnose sturgeon | 295 |

** Injury was consistent with a propeller strike, but this fish had been dead for at least several hours (gill filaments white or grey, eyes cloudy, and/or rigor mortis).

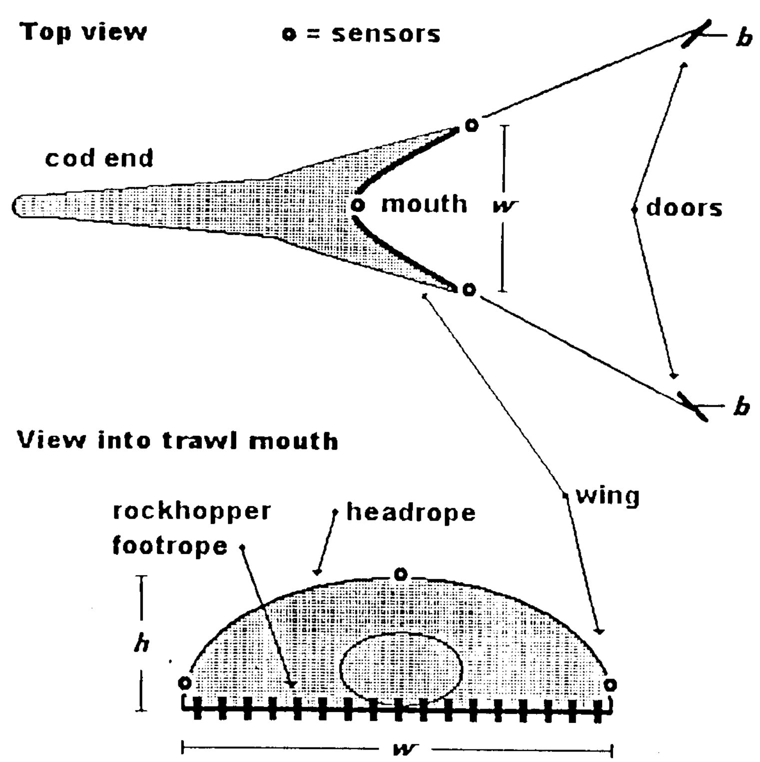


Figure 1. *Upper diagram:* Schematic representation of the 10.2-m rockhopper bottom trawl as viewed from above. Drawing is not to scale. Towing cables from the trawler are attached to the doors at points $b$. Under tow, the doors spread the wings and footrope. *Lower diagram:* View into the trawl mouth from between the doors. Headrope height is $h$ and linear distance between the wings is $w$. Positions of the acoustic sensors are as indicated. See text for details.

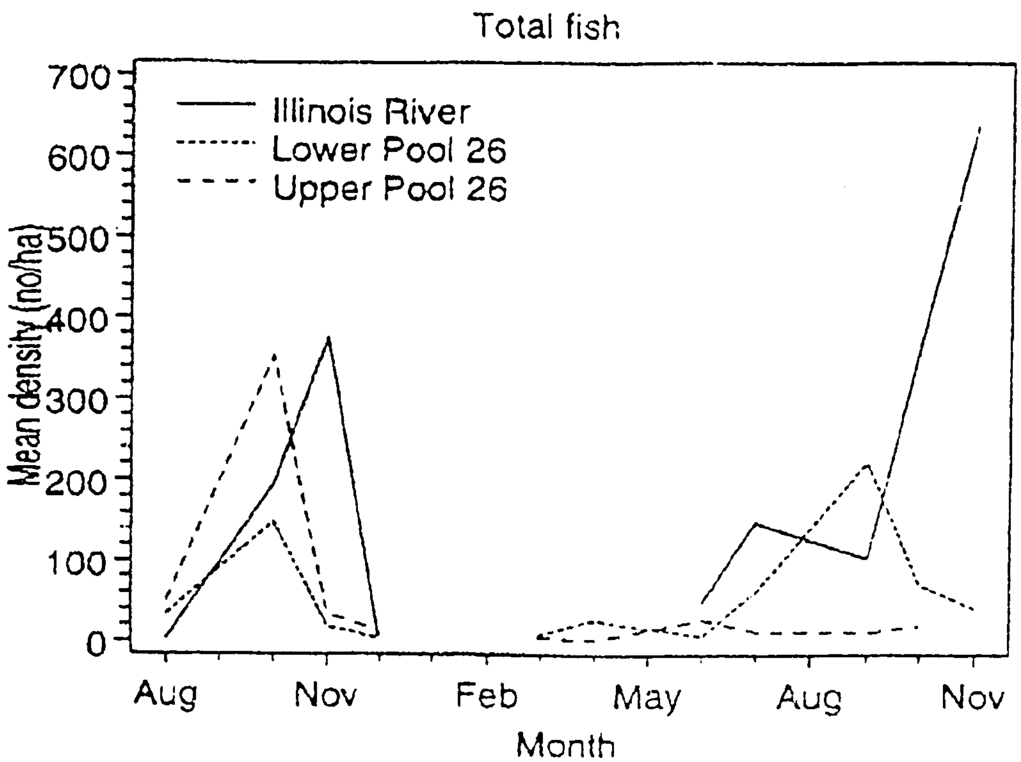


Figure 2. Minimal mean densities of fish of all species combined estimated from rockhopper bottom trawling in the navigation channels of the lower Illinois River and Pool 26 of the Upper Mississippi River. Upper Pool 26 is that segment between River Mile 218 and Lock and Dam 25, and the lower pool is from River Mile 218 to Lock and Dam 26.

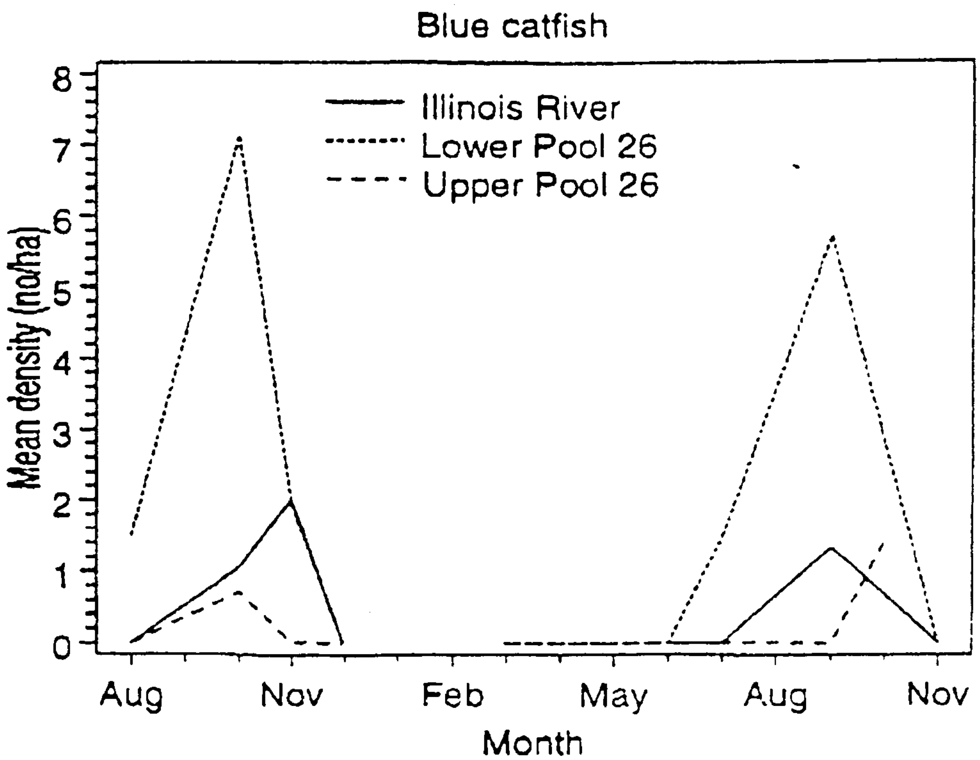


Figure 3. Minimal mean densities of blue catfish estimated from rockhopper bottom trawling in the navigation channels of the lower Illinois River and Pool 26 of the Upper Mississippi River. Upper Pool 26 is that segment between River Mile 218 and Lock and Dam 25, and the lower pool is from River Mile 218 to Lock and Dam 26.

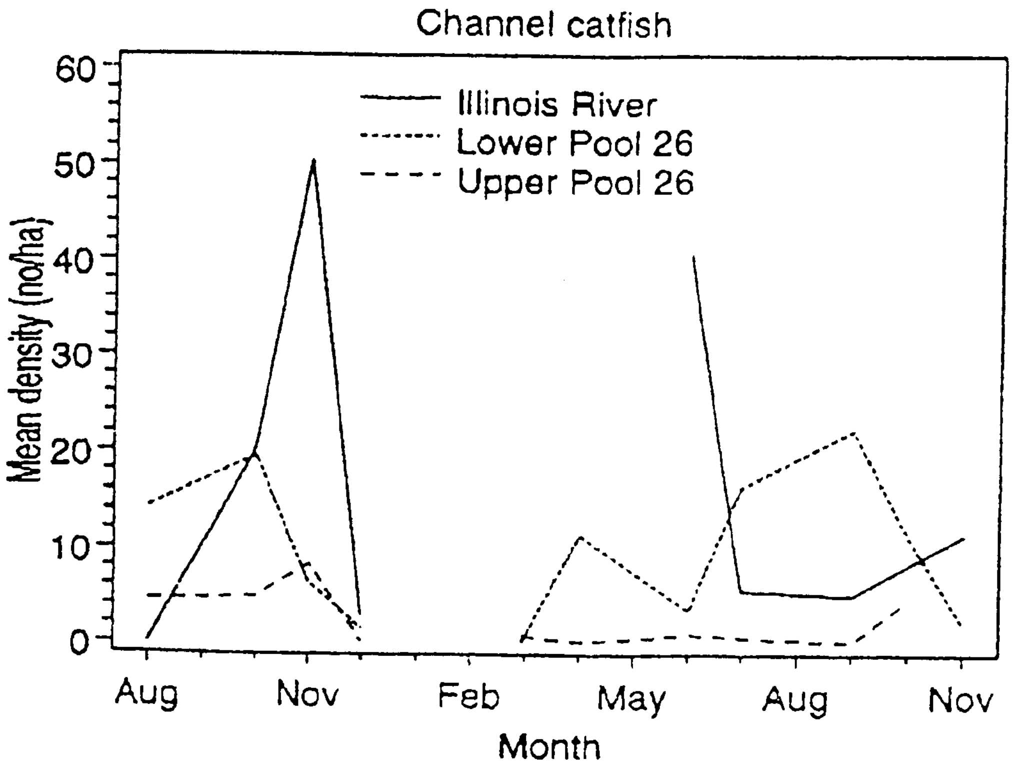


Figure 4. Minimal mean densities of channel catfish estimated from rockhopper bottom trawling in the navigation channels of the lower Illinois River and Pool 26 of the Upper Mississippi River. Upper Pool 26 is that segment between River Mile 218 and Lock and Dam 25, and the lower pool is from River Mile 218 to Lock and Dam 26.

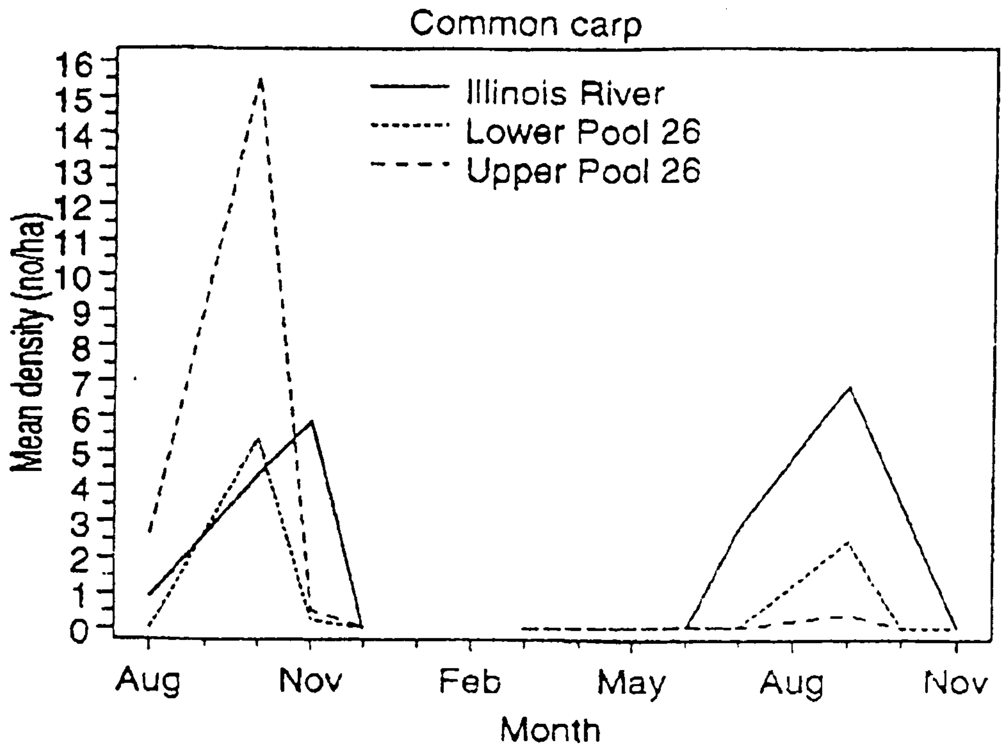


Figure 5. Minimal mean densities of common carp estimated from rockhopper bottom trawling in the navigation channels of the lower Illinois River and Pool 26 of the Upper Mississippi River. Upper Pool 26 is that segment between River Mile 218 and Lock and Dam 25, and the lower pool is from River Mile 218 to Lock and Dam 26.

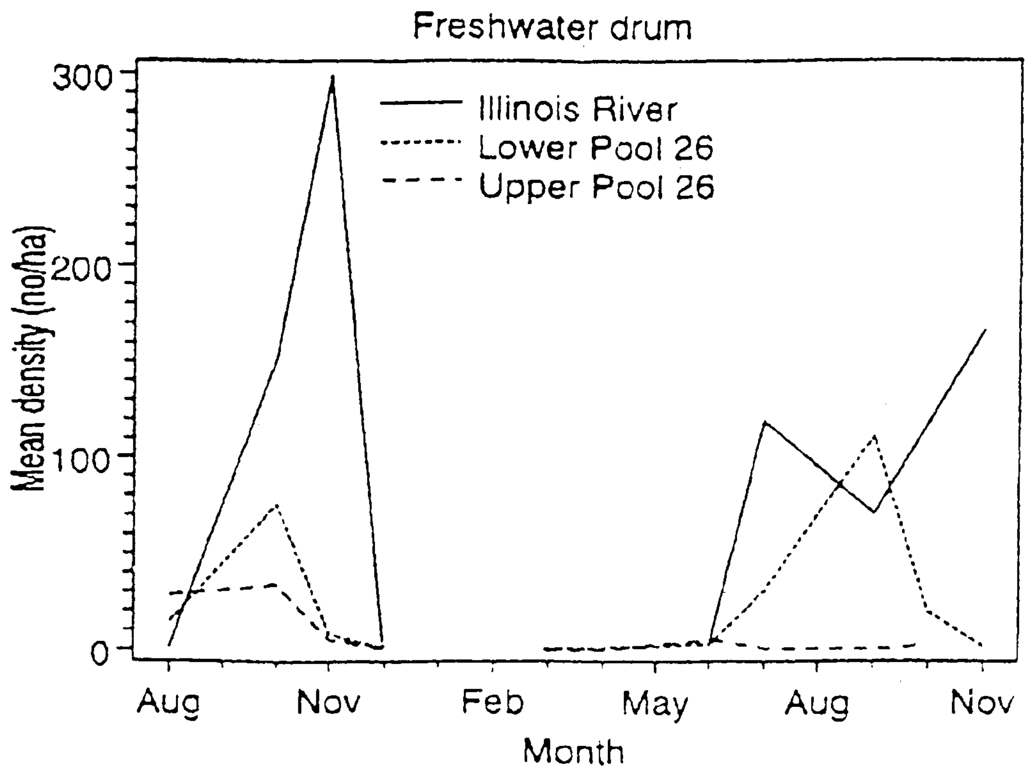


Figure 6. Minimal mean densities of freshwater drum estimated from rockhopper bottom trawling in the navigation channels of the lower Illinois River and Pool 26 of the Upper Mississippi River. Upper Pool 26 is that segment between River Mile 218 and Lock and Dam 25, and the lower pool is from River Mile 218 to Lock and Dam 26.

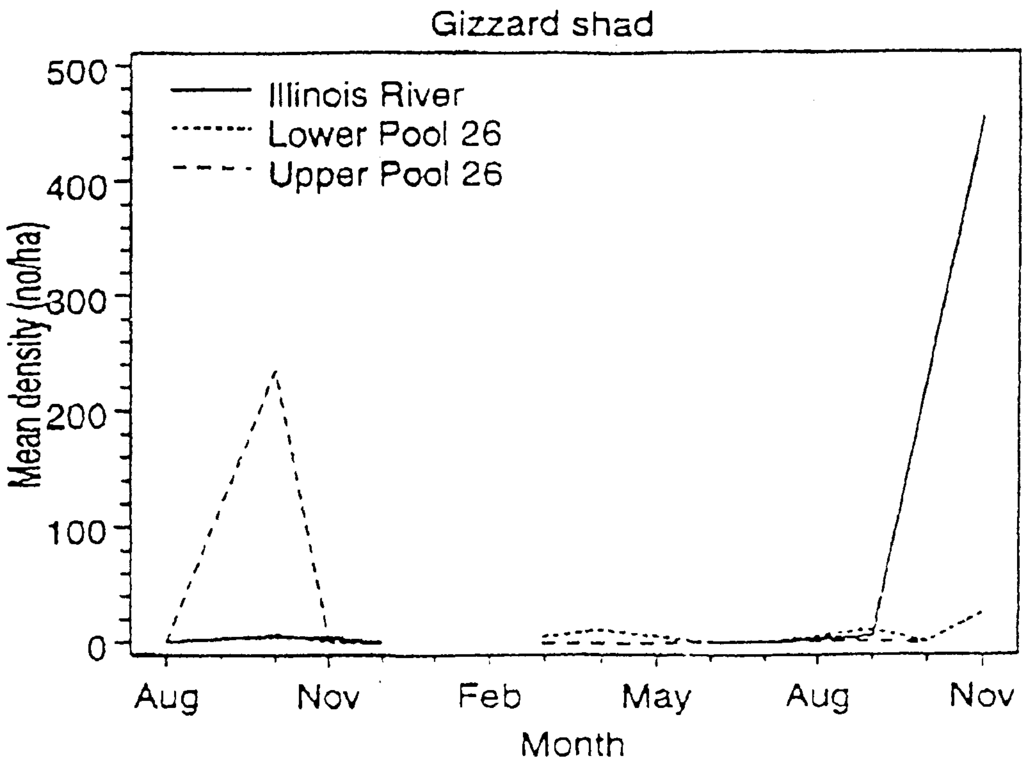


Figure 7. Minimal mean densities of gizzard shad estimated from rockhopper bottom trawling in the navigation channels of the lower Illinois River and Pool 26 of the Upper Mississippi River. Upper Pool 26 is that segment between River Mile 218 and Lock and Dam 25, and the lower pool is from River Mile 218 to Lock and Dam 26.

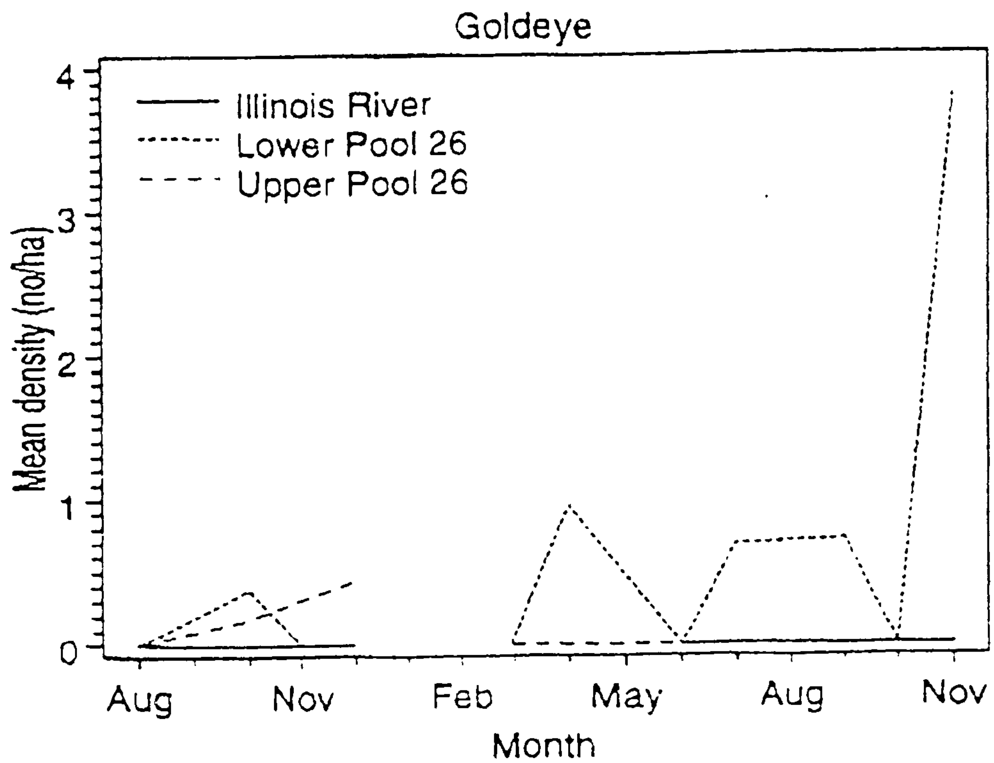


Figure 8. Minimal mean densities of goldeye estimated from rockhopper bottom trawling in the navigation channels of the lower Illinois River and Pool 26 of the Upper Mississippi River. Upper Pool 26 is that segment between River Mile 218 and Lock and Dam 25, and the lower pool is from River Mile 218 to Lock and Dam 26.

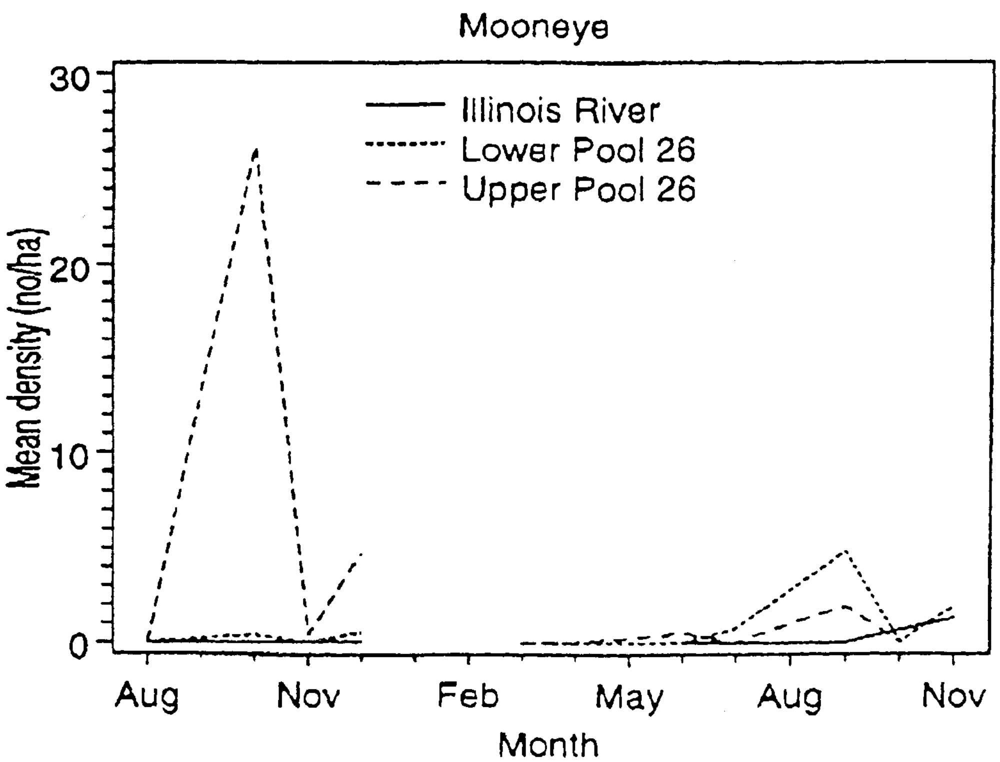


Figure 9. Minimal mean densities of mooneye estimated from rockhopper bottom trawling in the navigation channels of the lower Illinois River and Pool 26 of the Upper Mississippi River. Upper Pool 26 is that segment between River Mile 218 and Lock and Dam 25, and the lower pool is from River Mile 218 to Lock and Dam 26.

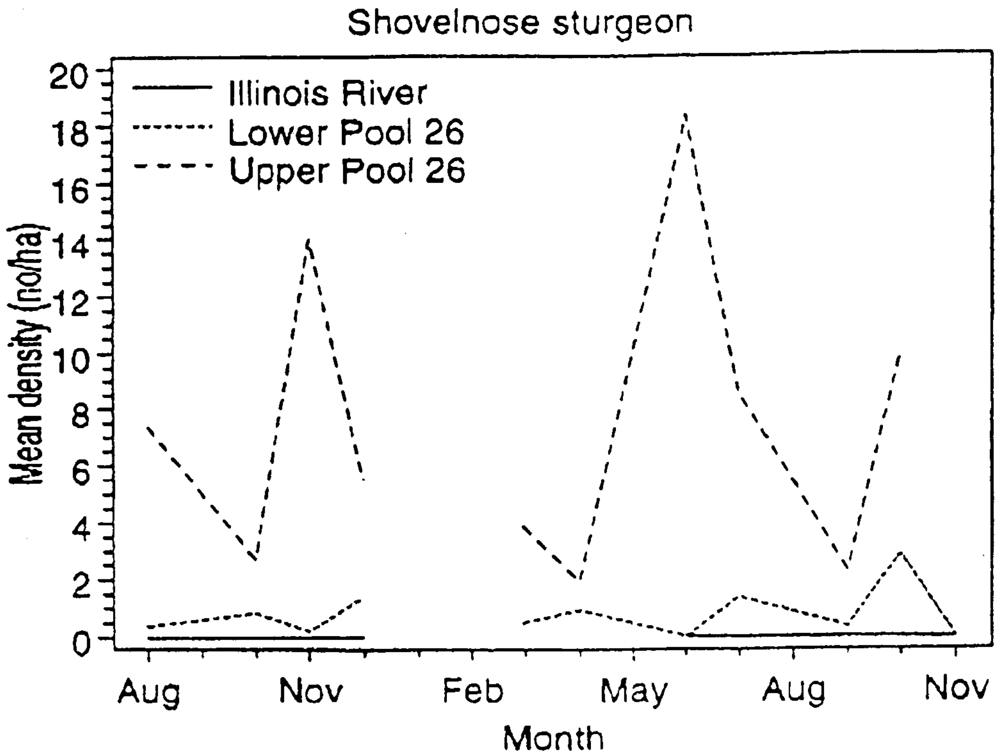


Figure 10. Minimal mean densities of shovelnose sturgeon estimated from rockhopper bottom trawling in the navigation channels of the lower Illinois River and Pool 26 of the Upper Mississippi River. Upper Pool 26 is that segment between River Mile 218 and Lock and Dam 25, and the lower pool is from River Mile 218 to Lock and Dam 26.

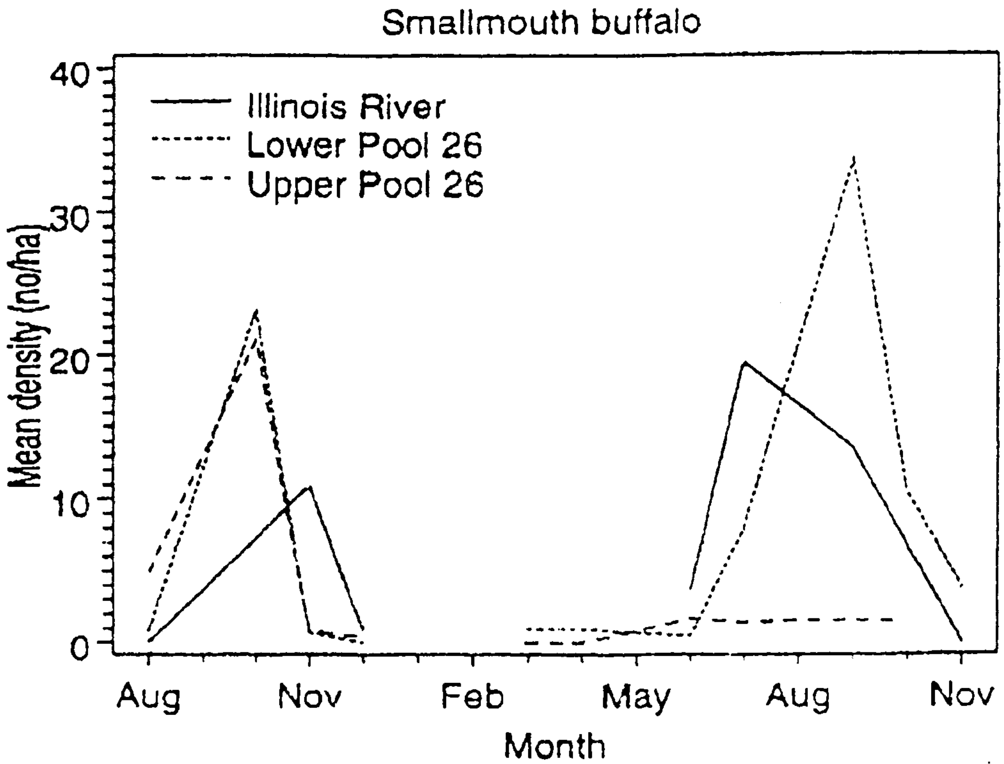


Figure 11. Minimal mean densities of smallmouth buffalo estimated from rockhopper bottom trawling in the navigation channels of the lower Illinois River and Pool 26 of the Upper Mississippi River. Upper Pool 26 is that segment between River Mile 218 and Lock and Dam 25, and the lower pool is from River Mile 218 to Lock and Dam 26.

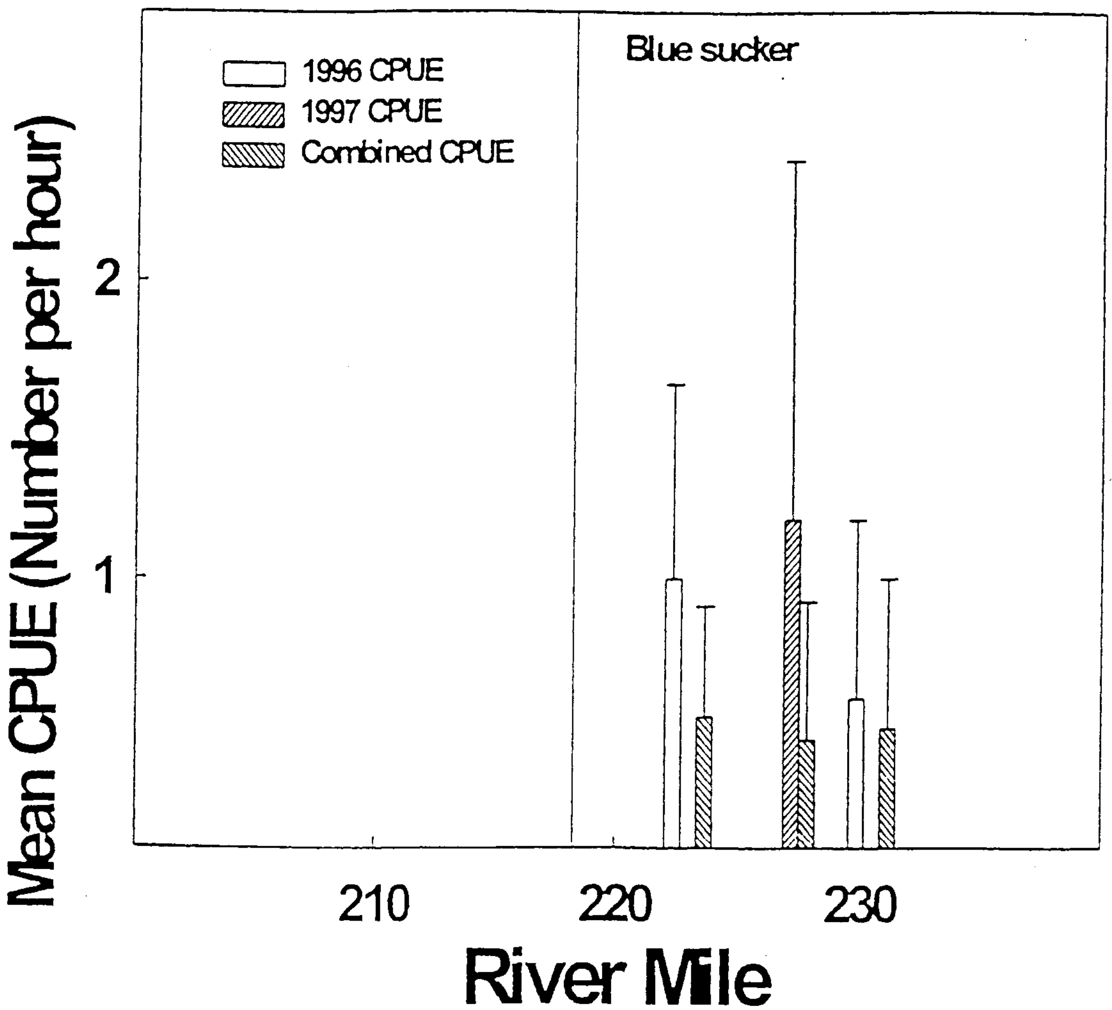


Figure 12. Catch per unit effort (CPUE) of blue sucker captured by rockhopper bottom trawling in the navigation channel of Pool 26 of the Upper Mississippi River.

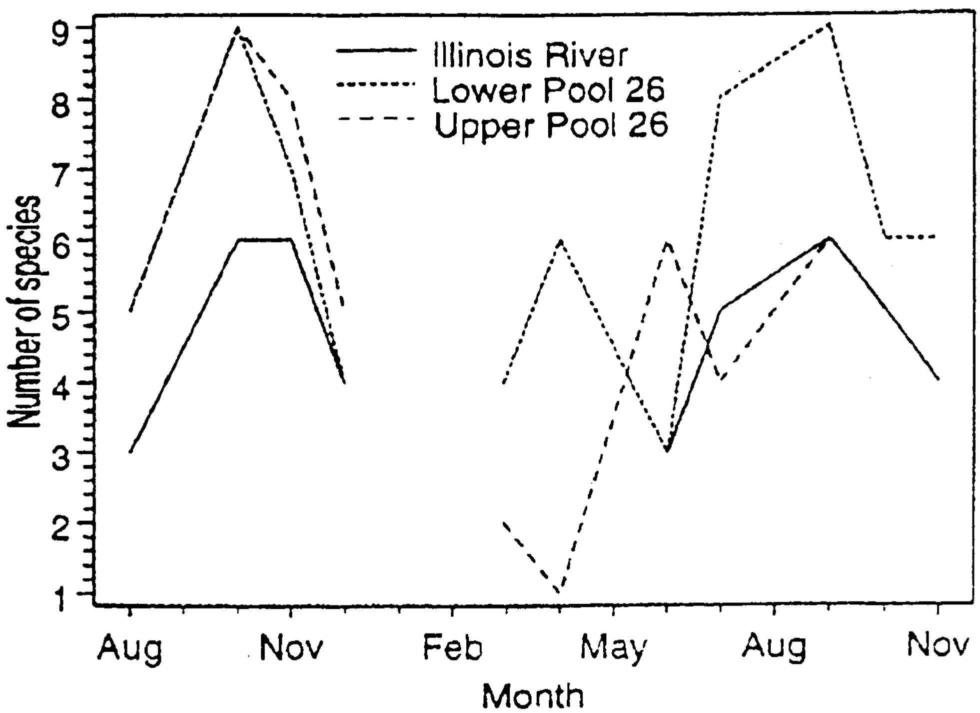


Figure 13. Mean number of species per haul of the rockhopper bottom trawl in the Illinois River and Pool 26 of the Mississippi River, 1996-1997.

Appendix A. List of common and scientific names of fishes encountered during studies of potential effects of navigation in Pool 26 of the Mississippi River and in the lower 26 km of the Illinois River.

| Common name | Scientific name |
|---|---|
| Lake sturgeon | *Acipenser fulvescens* |
| Shovelnose sturgeon | *Scaphirhynchus platorynchus* |
| Shortnose gar | *Lepisosteus platostomus* |
| Goldeye | *Hiodon alosoides* |
| Mooneye | *Hiodon tergisus* |
| Skipjack herring | *Alosa chrysochloris* |
| Gizzard shad | *Dorosoma cepedianum* |
| Common carp | *Cyprinus carpio* |
| Bighead carp | *Hypopthalmichthys nobilis* |
| Speckled chub | *Macrhybopsis aestivalis* |
| Silver chub | *Macrhybopsis storeriana* |
| River carpsucker | *Carpiodes carpio* |
| Quillback | *Carpiodes cyprinus* |
| Highfin carpsucker | *Carpiodes velifer* |
| Blue sucker | *Cycleptus elongatus* |
| Smallmouth buffalo | *Ictiobus bubalus* |
| Bigmouth buffalo | *Ictiobus cyprinellus* |
| Black buffalo | *Ictiobus niger* |
| Shorthead redhorse | *Moxostoma macrolepidotum* |
| Blue catfish | *Ictalurus furcatus* |
| Channel catfish | *Ictalurus punctatus* |
| Flathead catfish | *Pylodictis olivaris* |
| White bass | *Morone chrysops* |
| Black crappie | *Pomoxis nigromaculatus* |
| Sauger | *Stizostedion canadense* |
| Freshwater drum | *Aplodinotus grunniens* |

Appendix B. Mean volume ($m^3$) of water filtered at each sampling site for estimation of larval fish densities. IR= Illinois River and 26= Pool 26 of the Mississippi River. N = number of tows at each site used to calculate the mean volume of water sampled.

| Month | Day | Year | Stratum | River | Mile | N | Mean | ± 1 SE |
|---|---|---|---|---|---|---|---|---|
| 5 | 13 | 96 | Main channel | IR | 9.3 | 1 | 333.94 | |
| 5 | 13 | 96 | Main channel | IR | 13.5 | 2 | 310.86 | 57.80 |
| 5 | 13 | 96 | Main channel | IR | 18.7 | 2 | 257.96 | 13.60 |
| 5 | 14 | 96 | Main channel | 26 | 223.0 | 2 | 312.08 | 19.96 |
| 5 | 14 | 96 | Main channel | 26 | 225.8 | 1 | 311.94 | |
| 5 | 14 | 96 | Main channel | IR | 4.5 | 2 | 376.47 | 6.56 |
| 5 | 15 | 96 | Main channel | 26 | 203.2 | 2 | 347.07 | 15.98 |
| 5 | 15 | 96 | Main channel | 26 | 207.1 | 2 | 243.30 | 118.74 |
| 5 | 15 | 96 | Main channel | 26 | 211.2 | 2 | 334.64 | 18.25 |
| 5 | 15 | 96 | Main channel | 26 | 215.7 | 2 | 350.84 | 13.71 |
| 5 | 16 | 96 | Main channel | 26 | 208.5 | 2 | 353.21 | 6.32 |
| 5 | 16 | 96 | Main channel | 26 | 213.5 | 2 | 347.37 | 10.01 |
| 5 | 17 | 96 | Main channel | 26 | 223.0 | 1 | 443.17 | |
| 5 | 17 | 96 | Main channel | 26 | 227.5 | 2 | 463.01 | 6.78 |
| 5 | 17 | 96 | Main channel | 26 | 233.5 | 2 | 545.58 | 25.16 |
| 5 | 28 | 96 | Main channel | 26 | 203.2 | 1 | 348.16 | |
| 5 | 29 | 96 | Main channel | 26 | 208.5 | 1 | 328.58 | |
| 5 | 29 | 96 | Main channel | 26 | 211.2 | 2 | 358.52 | 12.49 |
| 5 | 30 | 96 | Main channel | IR | 4.5 | 2 | 361.54 | 14.17 |
| 5 | 30 | 96 | Main channel | IR | 9.3 | 2 | 392.66 | 2.42 |
| 5 | 30 | 96 | Main channel | IR | 13.5 | 2 | 426.73 | 1.51 |
| 5 | 30 | 96 | Main channel | IR | 18.7 | 2 | 397.92 | 9.94 |
| 6 | 3 | 96 | Main channel | 26 | 203.2 | 2 | 366.63 | 21.25 |
| 6 | 3 | 96 | Main channel | 26 | 207.1 | 2 | 397.92 | 2.97 |
| 6 | 3 | 96 | Main channel | 26 | 208.5 | 2 | 360.51 | 0.73 |
| 6 | 3 | 96 | Main channel | 26 | 211.2 | 2 | 426.37 | 4.27 |
| 6 | 3 | 96 | Main channel | 26 | 213.5 | 2 | 426.26 | 11.34 |
| 6 | 4 | 96 | Main channel | 26 | 215.7 | 2 | 401.61 | 11.16 |
| 6 | 4 | 96 | Main channel | IR | 4.5 | 2 | 398.95 | 2.40 |
| 6 | 4 | 96 | Main channel | IR | 9.3 | 2 | 380.91 | 7.96 |
| 6 | 4 | 96 | Main channel | IR | 13.5 | 2 | 387.06 | 7.00 |
| 6 | 4 | 96 | Main channel | IR | 18.7 | 2 | 391.39 | 2.35 |
| 6 | 5 | 96 | Main channel | 26 | 225.8 | 2 | 385.10 | 5.08 |
| 6 | 5 | 96 | Main channel | 26 | 227.5 | 2 | 435.25 | 10.37 |
| 6 | 5 | 96 | Main channel | 26 | 230.5 | 2 | 422.63 | 6.63 |
| 6 | 5 | 96 | Main channel | 26 | 233.5 | 2 | 435.80 | 0.47 |

Appendix B continued.

| Month | Day | Year | Stratum | River | Mile | N | Mean | ± 1 SE |
|---|---|---|---|---|---|---|---|---|
| 6 | 17 | 96 | Main channel | 26 | 203.2 | 2 | 313.05 | 25.72 |
| 6 | 17 | 96 | Main channel | 26 | 207.1 | 2 | 337.49 | 3.72 |
| 6 | 20 | 96 | Main channel | 26 | 215.7 | 1 | 561.37 | |
| 6 | 20 | 96 | Main channel | IR | 4.5 | 2 | 663.63 | 12.88 |
| 6 | 20 | 96 | Main channel | IR | 9.3 | 2 | 572.48 | 12.76 |
| 6 | 20 | 96 | Main channel | IR | 13.5 | 2 | 522.85 | 88.60 |
| 6 | 20 | 96 | Main channel | IR | 18.7 | 2 | 737.39 | 48.56 |
| 6 | 21 | 96 | Main channel | 26 | 223.0 | 2 | 541.94 | 63.22 |
| 6 | 21 | 96 | Main channel | 26 | 225.8 | 2 | 625.59 | 7.31 |
| 6 | 21 | 96 | Main channel | 26 | 230.5 | 2 | 636.03 | 8.22 |
| 6 | 21 | 96 | Main channel | 26 | 233.5 | 2 | 533.82 | 30.97 |
| 7 | 1 | 96 | Main channel | 26 | 207.1 | 2 | 533.68 | 10.77 |
| 7 | 1 | 96 | Main channel | 26 | 211.2 | 1 | 578.52 | |
| 7 | 1 | 96 | Main channel | 26 | 213.5 | 2 | 541.45 | 16.05 |
| 7 | 2 | 96 | Main channel | 26 | 203.2 | 2 | 548.12 | 10.25 |
| 7 | 2 | 96 | Main channel | 26 | 208.5 | 1 | 577.08 | |
| 7 | 3 | 96 | Main channel | 26 | 223.0 | 2 | 492.07 | 13.80 |
| 7 | 3 | 96 | Main channel | 26 | 225.8 | 1 | 504.05 | |
| 7 | 3 | 96 | Main channel | 26 | 233.5 | 2 | 474.87 | 5.28 |
| 7 | 3 | 96 | Main channel | 26 | 240.2 | 1 | 570.46 | |
| 7 | 5 | 96 | Main channel | 26 | 215.7 | 2 | 536.71 | 2.95 |
| 7 | 5 | 96 | Main channel | IR | 4.5 | 2 | 327.39 | 53.23 |
| 7 | 5 | 96 | Main channel | IR | 9.3 | 2 | 399.22 | 7.06 |
| 7 | 5 | 96 | Main channel | IR | 13.5 | 2 | 395.38 | 39.21 |
| 7 | 5 | 96 | Main channel | IR | 18.7 | 2 | 371.45 | 15.72 |
| 4 | 23 | 97 | Main channel | 26 | 208.5 | 2 | 460.26 | 6.12 |
| 4 | 23 | 97 | Main channel | 26 | 215.7 | 2 | 485.77 | 9.67 |
| 4 | 23 | 97 | Main channel | 26 | 233.0 | 2 | 481.08 | 19.09 |
| 4 | 23 | 97 | Side channel | 26 | 208.5 | 2 | 428.82 | 10.09 |
| 4 | 23 | 97 | Side channel | 26 | 215.7 | 2 | 427.22 | 7.28 |
| 4 | 23 | 97 | Side channel | 26 | 222.6 | 2 | 391.10 | 78.89 |
| 4 | 29 | 97 | Main channel | 26 | 208.5 | 2 | 384.72 | 5.67 |
| 4 | 29 | 97 | Main channel | 26 | 215.7 | 2 | 1050.64 | 396.75 |
| 4 | 29 | 97 | Main channel | 26 | 222.6 | 2 | 401.57 | 12.34 |
| 4 | 29 | 97 | Main channel | 26 | 233.5 | 2 | 427.39 | 14.20 |
| 4 | 29 | 97 | Side channel | 26 | 208.5 | 2 | 410.96 | 7.45 |
| 4 | 29 | 97 | Side channel | 26 | 215.7 | 2 | 1039.18 | 419.97 |
| 4 | 29 | 97 | Side channel | 26 | 222.6 | 2 | 456.24 | 9.40 |
| 4 | 29 | 97 | Side channel | 26 | 233.5 | 2 | 392.81 | 4.97 |

Appendix B continued.

| Month | Day | Year | Stratum | River | Mile | N | Mean | ± 1 SE |
|---|---|---|---|---|---|---|---|---|
| 5 | 1 | 97 | Side channel | IR | 13.5 | 2 | 312.91 | 23.56 |
| 5 | 2 | 97 | Backwater | 26 | 222.0 | 2 | 81.85 | 5.52 |
| 5 | 13 | 97 | Main channel | 26 | 208.5 | 2 | 350.11 | 9.97 |
| 5 | 13 | 97 | Main channel | 26 | 223.0 | 2 | 331.67 | 30.45 |
| 5 | 13 | 97 | Main channel | 26 | 233.5 | 1 | 338.39 | |
| 5 | 13 | 97 | Side channel | 26 | 208.5 | 2 | 341.80 | 3.87 |
| 5 | 13 | 97 | Side channel | 26 | 222.6 | 2 | 872.68 | 530.68 |
| 5 | 13 | 97 | Side channel | 26 | 233.2 | 2 | 380.45 | 2.00 |
| 5 | 16 | 97 | Backwater | 26 | 222.0 | 2 | 188.20 | 112.80 |
| 5 | 16 | 97 | Backwater | IR | 9.3 | 2 | 74.78 | 4.80 |
| 5 | 19 | 97 | Main channel | IR | 13.5 | 2 | 229.46 | 14.36 |
| 5 | 19 | 97 | Side channel | IR | 13.5 | 2 | 243.79 | 15.11 |
| 5 | 27 | 97 | Main channel | IR | 13.5 | 1 | 429.71 | |
| 5 | 28 | 97 | Backwater | 26 | 222.0 | 2 | 85.80 | 0.23 |
| 5 | 28 | 97 | Backwater | IR | 9.3 | 2 | 117.25 | 2.99 |
| 5 | 29 | 97 | Side channel | IR | 13.5 | 2 | 457.43 | 46.16 |
| 5 | 30 | 97 | Main channel | 26 | 215.7 | 1 | 332.23 | |
| 5 | 30 | 97 | Main channel | 26 | 223.0 | 2 | 393.97 | 40.39 |
| 5 | 30 | 97 | Main channel | 26 | 233.5 | 1 | 443.87 | |
| 5 | 30 | 97 | Side channel | 26 | 215.7 | 1 | 395.92 | |
| 5 | 30 | 97 | Side channel | 26 | 222.6 | 2 | 336.23 | 35.72 |
| 5 | 30 | 97 | Side channel | 26 | 233.5 | 2 | 427.76 | 22.73 |
| 6 | 10 | 97 | Main channel | IR | 13.5 | 2 | 459.93 | 23.15 |
| 6 | 10 | 97 | Side channel | IR | 13.5 | 2 | 478.41 | 5.20 |
| 6 | 11 | 97 | Backwater | 26 | 222.0 | 2 | 75.91 | 0.73 |
| 6 | 11 | 97 | Backwater | IR | 9.3 | 2 | 120.36 | 23.52 |
| 6 | 12 | 97 | Main channel | 26 | 208.5 | 2 | 447.58 | 23.42 |
| 6 | 12 | 97 | Main channel | 26 | 215.7 | 2 | 433.14 | 2.56 |
| 6 | 12 | 97 | Main channel | 26 | 223.0 | 2 | 434.65 | 27.97 |
| 6 | 12 | 97 | Main channel | 26 | 233.5 | 1 | 403.09 | |
| 6 | 12 | 97 | Side channel | 26 | 208.5 | 2 | 425.40 | 14.42 |
| 6 | 12 | 97 | Side channel | 26 | 222.6 | 2 | 436.72 | 17.53 |
| 6 | 12 | 97 | Side channel | 26 | 233.5 | 2 | 432.37 | 33.48 |
| 6 | 24 | 97 | Backwater | 26 | 222.0 | 2 | 81.53 | 1.49 |
| 6 | 24 | 97 | Backwater | IR | 9.3 | 1 | 54.61 | |
| 6 | 25 | 97 | Main channel | IR | 13.5 | 2 | 536.17 | 11.32 |
| 6 | 25 | 97 | Side channel | IR | 13.5 | 2 | 411.97 | 6.24 |
| 6 | 26 | 97 | Main channel | 26 | 208.5 | 2 | 423.09 | 66.58 |
| 6 | 26 | 97 | Main channel | 26 | 215.7 | 2 | 408.22 | 77.06 |

Appendix B continued.

| Month | Day | Year | Stratum | River | Mile | N | Mean | ± 1 SE |
|---|---|---|---|---|---|---|---|---|
| 6 | 26 | 97 | Main channel | 26 | 223.0 | 2 | 345.06 | 82.44 |
| 6 | 26 | 97 | Main channel | 26 | 233.5 | 2 | 318.62 | 104.23 |
| 6 | 26 | 97 | Side channel | 26 | 208.5 | 2 | 468.69 | 50.81 |
| 6 | 26 | 97 | Side channel | 26 | 215.7 | 2 | 417.52 | 50.29 |
| 6 | 26 | 97 | Side channel | 26 | 222.6 | 2 | 390.35 | 110.83 |
| 6 | 26 | 97 | Side channel | 26 | 233.5 | 2 | 270.27 | 147.71 |
| 7 | 8 | 97 | Main channel | 26 | 208.5 | 2 | 441.64 | 111.25 |
| 7 | 8 | 97 | Main channel | 26 | 215.7 | 2 | 473.63 | 39.38 |
| 7 | 8 | 97 | Main channel | 26 | 223.0 | 1 | 547.13 | |
| 7 | 8 | 97 | Main channel | 26 | 233.5 | 2 | 461.98 | 41.57 |
| 7 | 8 | 97 | Side channel | 26 | 208.5 | 1 | 421.91 | |
| 7 | 8 | 97 | Side channel | 26 | 215.7 | 2 | 482.71 | 73.51 |
| 7 | 8 | 97 | Side channel | 26 | 222.6 | 2 | 478.30 | 50.81 |
| 7 | 8 | 97 | Side channel | 26 | 233.5 | 2 | 453.06 | 47.15 |
| 7 | 9 | 97 | Backwater | IR | 9.3 | 2 | 73.46 | 1.00 |
| 7 | 10 | 97 | Main channel | IR | 13.5 | 1 | 491.67 | |
| 7 | 10 | 97 | Side channel | IR | 13.5 | 2 | 548.11 | 201.37 |
| 7 | 22 | 97 | Main channel | 26 | 208.5 | 2 | 511.88 | 28.08 |
| 7 | 22 | 97 | Main channel | 26 | 215.7 | 2 | 510.19 | 22.76 |
| 7 | 22 | 97 | Main channel | 26 | 223.0 | 2 | 493.38 | 30.59 |
| 7 | 22 | 97 | Main channel | 26 | 233.5 | 2 | 485.55 | 27.47 |
| 7 | 22 | 97 | Side channel | 26 | 215.7 | 2 | 287.94 | 92.62 |
| 7 | 22 | 97 | Side channel | 26 | 222.6 | 2 | 490.24 | 37.94 |
| 7 | 22 | 97 | Side channel | 26 | 233.5 | 1 | 476.44 | |
| 7 | 23 | 97 | Main channel | IR | 13.5 | 2 | 491.18 | 24.49 |
| 7 | 23 | 97 | Side channel | IR | 13.5 | 2 | 374.85 | 138.59 |
| 7 | 25 | 97 | Backwater | IR | 9.3 | 2 | 78.61 | 3.06 |

Appendix C. Number of larval fish of each taxon collected from all sampled sites during 1996 and 1997. N=number of tows counted at each site.

| Month | Day | Year | Stratum | River | Mile | Taxon | N | Mean | + 1 SE |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 13 | 96 | Main channel | IR | 9.3 | Common carp | 1 | 440.00 | |
| 5 | 13 | 96 | Main channel | IR | 9.3 | Catostomidae | 1 | 4.00 | |
| 5 | 13 | 96 | Main channel | IR | 13.5 | Common carp | 2 | 384.50 | 28.50 |
| 5 | 13 | 96 | Main channel | IR | 13.5 | Catostomidae | 2 | 8.50 | 4.50 |
| 5 | 13 | 96 | Main channel | IR | 18.7 | Common carp | 2 | 580.50 | 294.50 |
| 5 | 13 | 96 | Main channel | IR | 18.7 | Catostomidae | 2 | 17.00 | 8.00 |
| 5 | 13 | 96 | Main channel | IR | 18.7 | Percidae | 2 | 1.50 | 1.50 |
| 5 | 13 | 96 | Main channel | IR | 18.7 | Unidentified | 2 | 2.50 | 2.50 |
| 5 | 14 | 96 | Main channel | 26 | 223.0 | Common carp | 2 | 74.50 | 9.50 |
| 5 | 14 | 96 | Main channel | 26 | 223.0 | Catostomidae | 2 | 9.50 | 4.50 |
| 5 | 14 | 96 | Main channel | 26 | 223.0 | Percidae | 2 | 3.50 | 1.50 |
| 5 | 14 | 96 | Main channel | 26 | 203.2 | Catostomidae | 2 | 11.50 | 9.50 |
| 6 | 3 | 96 | Main channel | 26 | 223.0 | Unidentified | 2 | 1.50 | 1.50 |
| 5 | 14 | 96 | Main channel | 26 | 225.8 | Common carp | 1 | 68.00 | |
| 5 | 14 | 96 | Main channel | 26 | 225.8 | Catostomidae | 1 | 10.00 | |
| 5 | 14 | 96 | Main channel | 26 | 225.8 | Percidae | 1 | 4.00 | |
| 5 | 14 | 96 | Main channel | IR | 4.5 | Common carp | 2 | 1945.50 | 282.50 |
| 5 | 14 | 96 | Main channel | IR | 4.5 | Gambusia | 2 | 0.50 | 0.50 |
| 5 | 14 | 96 | Main channel | IR | 4.5 | Catostomidae | 2 | 28.00 | 6.00 |
| 5 | 15 | 96 | Main channel | 26 | 203.2 | Common carp | 2 | 582.00 | 61.00 |
| 5 | 15 | 96 | Main channel | 26 | 203.2 | Catostomidae | 2 | 3.00 | 3.00 |
| 5 | 15 | 96 | Main channel | 26 | 203.2 | Percidae | 2 | 1.00 | 1.00 |
| 5 | 15 | 96 | Main channel | 26 | 207.1 | Common carp | 2 | 555.50 | 2.50 |
| 5 | 15 | 96 | Main channel | 26 | 207.1 | Catostomidae | 2 | 20.00 | 9.00 |
| 5 | 15 | 96 | Main channel | 26 | 207.1 | Percidae | 2 | 3.50 | 1.50 |
| 5 | 15 | 96 | Main channel | 26 | 211.2 | Catostomidae | 2 | 62.00 | 1.00 |
| 5 | 15 | 96 | Main channel | 26 | 211.2 | Percidae | 2 | 4.50 | 0.50 |
| 5 | 15 | 96 | Main channel | 26 | 211.2 | Unidentified | 2 | 1.00 | 1.00 |
| 5 | 15 | 96 | Main channel | 26 | 215.7 | Common carp | 2 | 174.00 | 57.00 |
| 5 | 15 | 96 | Main channel | 26 | 215.7 | Catostomidae | 2 | 14.50 | 6.50 |
| 5 | 15 | 96 | Main channel | 26 | 215.7 | Hiodontidae | 2 | 1.50 | 1.50 |
| 5 | 15 | 96 | Main channel | 26 | 215.7 | Percidae | 2 | 5.00 | 4.00 |
| 5 | 16 | 96 | Main channel | 26 | 208.5 | Common carp | 2 | 459.00 | 11.00 |
| 5 | 16 | 96 | Main channel | 26 | 208.5 | Catostomidae | 2 | 27.00 | 2.00 |
| 5 | 16 | 96 | Main channel | 26 | 208.5 | Percidae | 2 | 1.00 | 0.00 |
| 5 | 16 | 96 | Main channel | 26 | 213.5 | Common carp | 2 | 336.50 | 44.50 |
| 5 | 16 | 96 | Main channel | 26 | 213.5 | Catostomidae | 2 | 16.00 | 4.00 |
| 5 | 16 | 96 | Main channel | 26 | 213.5 | Percidae | 2 | 1.50 | 1.50 |

Appendix Table C continued.

| Month | Day | Year | Stratum | River Mile | | Taxon | N | Mean | + 1 SE |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 17 | 96 | Main channel | 26 | 223.0 | Common carp | 1 | 60.00 | |
| 5 | 17 | 96 | Main channel | 26 | 223.0 | Catostomidae | 1 | 11.00 | |
| 5 | 17 | 96 | Main channel | 26 | 227.5 | Common carp | 2 | 177.00 | 13.00 |
| 5 | 17 | 96 | Main channel | 26 | 227.5 | Catostomidae | 2 | 29.00 | 5.00 |
| 5 | 17 | 96 | Main channel | 26 | 227.5 | Percidae | 2 | 2.00 | 2.00 |
| 5 | 17 | 96 | Main channel | 26 | 227.5 | Unidentified | 2 | 1.00 | 1.00 |
| 5 | 17 | 96 | Main channel | 26 | 233.5 | Common carp | 2 | 239.00 | 64.00 |
| 5 | 17 | 96 | Main channel | 26 | 233.5 | Catostomidae | 2 | 44.50 | 9.50 |
| 5 | 17 | 96 | Main channel | 26 | 233.5 | Centrarchidae | 2 | 2.00 | 1.00 |
| 5 | 17 | 96 | Main channel | 26 | 233.5 | Percidae | 2 | 3.50 | 3.50 |
| 5 | 17 | 96 | Main channel | 26 | 233.5 | Unidentified | 2 | 5.00 | 2.00 |
| 5 | 28 | 96 | Main channel | 26 | 203.2 | Common carp | 1 | 52.00 | |
| 5 | 28 | 96 | Main channel | 26 | 203.2 | Clupeidae | 1 | 18.00 | |
| 5 | 28 | 96 | Main channel | 26 | 203.2 | Catostomidae | 1 | 16.00 | |
| 5 | 28 | 96 | Main channel | 26 | 203.2 | Centrarchidae | 1 | 2.00 | |
| 5 | 28 | 96 | Main channel | 26 | 203.2 | Lepisosteidae | 1 | 3.00 | |
| 5 | 28 | 96 | Main channel | 26 | 203.2 | Percidae | 1 | 2.00 | |
| 5 | 28 | 96 | Main channel | 26 | 203.2 | Unidentified | 1 | 4.00 | |
| 5 | 29 | 96 | Main channel | 26 | 208.5 | Common carp | 1 | 10.00 | |
| 5 | 29 | 96 | Main channel | 26 | 208.5 | Freshwater drum | 1 | 1.00 | |
| 5 | 29 | 96 | Main channel | 26 | 208.5 | Clupeidae | 1 | 190.00 | |
| 5 | 29 | 96 | Main channel | 26 | 208.5 | Centrarchidae | 1 | 7.00 | |
| 5 | 29 | 96 | Main channel | 26 | 208.5 | Catostomidae | 1 | 63.00 | |
| 5 | 29 | 96 | Main channel | 26 | 208.5 | Moronidae | 1 | 3.00 | |
| 5 | 29 | 96 | Main channel | 26 | 208.5 | Percidae | 1 | 1.00 | |
| 5 | 29 | 96 | Main channel | 26 | 211.2 | Common carp | 2 | 72.50 | 28.50 |
| 5 | 29 | 96 | Main channel | 26 | 211.2 | Clupeidae | 2 | 14.50 | 7.50 |
| 5 | 29 | 96 | Main channel | 26 | 211.2 | Catostomidae | 2 | 9.50 | 9.50 |
| 5 | 29 | 96 | Main channel | 26 | 211.2 | Lepisosteidae | 2 | 2.00 | 2.00 |
| 5 | 29 | 96 | Main channel | 26 | 211.2 | Moronidae | 2 | 1.00 | 1.00 |
| 5 | 30 | 96 | Main channel | IR | 4.5 | Common carp | 2 | 259.00 | 84.00 |
| 5 | 30 | 96 | Main channel | IR | 4.5 | Freshwater drum | 2 | 29.50 | 22.50 |
| 5 | 30 | 96 | Main channel | IR | 4.5 | Clupeidae | 2 | 33.00 | 7.00 |
| 5 | 30 | 96 | Main channel | IR | 4.5 | Catostomidae | 2 | 0.50 | 0.50 |
| 5 | 30 | 96 | Main channel | IR | 4.5 | Centrarchidae | 2 | 9.50 | 6.50 |
| 5 | 30 | 96 | Main channel | IR | 4.5 | Moronidae | 2 | 2.00 | 2.00 |
| 5 | 30 | 96 | Main channel | IR | 4.5 | Unidentified | 2 | 4.50 | 4.50 |
| 5 | 30 | 96 | Main channel | IR | 9.3 | Common carp | 2 | 109.50 | 12.50 |
| 5 | 30 | 96 | Main channel | IR | 9.3 | Freshwater drum | 2 | 15.00 | 6.00 |

Appendix Table C continued.

| Month | Day | Year | Stratum | River Mile | | Taxon | N | Mean | + 1 SE |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 30 | 96 | Main channel | IR | 9.3 | Clupeidae | 2 | 42.50 | 11.50 |
| 5 | 30 | 96 | Main channel | IR | 9.3 | Catostomidae | 2 | 2.50 | 0.50 |
| 5 | 30 | 96 | Main channel | IR | 9.3 | Centrarchidae | 2 | 10.00 | 2.00 |
| 5 | 30 | 96 | Main channel | IR | 9.3 | Unidentified | 2 | 3.50 | 3.50 |
| 5 | 30 | 96 | Main channel | IR | 13.5 | Common carp | 2 | 211.50 | 31.50 |
| 5 | 30 | 96 | Main channel | IR | 13.5 | Freshwater drum | 2 | 18.00 | 12.00 |
| 5 | 30 | 96 | Main channel | IR | 13.5 | Clupeidae | 2 | 115.00 | 5.00 |
| 5 | 30 | 96 | Main channel | IR | 13.5 | Catostomidae | 2 | 11.00 | 11.00 |
| 5 | 30 | 96 | Main channel | IR | 13.5 | Centrarchidae | 2 | 23.50 | 14.50 |
| 5 | 30 | 96 | Main channel | IR | 13.5 | Lepisosteidae | 2 | 1.00 | 1.00 |
| 5 | 30 | 96 | Main channel | IR | 13.5 | Moronidae | 2 | 6.50 | 3.50 |
| 5 | 30 | 96 | Main channel | IR | 13.5 | Unidentified | 2 | 0.50 | 0.50 |
| 5 | 30 | 96 | Main channel | IR | 18.7 | Common carp | 2 | 84.50 | 11.50 |
| 5 | 30 | 96 | Main channel | IR | 18.7 | Freshwater drum | 2 | 9.00 | 2.00 |
| 5 | 30 | 96 | Main channel | IR | 18.7 | Clupeidae | 2 | 104.50 | 3.50 |
| 5 | 30 | 96 | Main channel | IR | 18.7 | Catostomidae | 2 | 9.50 | 0.50 |
| 5 | 30 | 96 | Main channel | IR | 18.7 | Centrarchidae | 2 | 14.50 | 0.50 |
| 5 | 30 | 96 | Main channel | IR | 18.7 | Lepisosteidae | 2 | 1.00 | 0.00 |
| 5 | 30 | 96 | Main channel | IR | 18.7 | Moronidae | 2 | 4.00 | 3.00 |
| 6 | 3 | 96 | Main channel | 26 | 203.2 | Bowfin | 2 | 0.50 | 0.50 |
| 6 | 3 | 96 | Main channel | 26 | 203.2 | Clupeidae | 2 | 189.00 | 123.00 |
| 6 | 3 | 96 | Main channel | 26 | 203.2 | Centrarchidae | 2 | 20.00 | 13.00 |
| 6 | 3 | 96 | Main channel | 26 | 203.2 | Hiodontidae | 2 | 1.50 | 1.50 |
| 6 | 3 | 96 | Main channel | 26 | 203.2 | Moronidae | 2 | 3.50 | 0.50 |
| 6 | 3 | 96 | Main channel | 26 | 203.2 | Percidae | 2 | 0.50 | 0.50 |
| 6 | 3 | 96 | Main channel | 26 | 203.2 | Unidentified | 2 | 1.50 | 1.50 |
| 6 | 3 | 96 | Main channel | 26 | 207.1 | Common carp | 2 | 89.50 | 63.50 |
| 6 | 3 | 96 | Main channel | 26 | 207.1 | Freshwater drum | 2 | 7.00 | 2.00 |
| 6 | 3 | 96 | Main channel | 26 | 207.1 | Clupeidae | 2 | 74.00 | 40.00 |
| 6 | 3 | 96 | Main channel | 26 | 207.1 | Catostomidae | 2 | 6.00 | 2.00 |
| 6 | 3 | 96 | Main channel | 26 | 207.1 | Hiodontidae | 2 | 1.00 | 0.00 |
| 6 | 3 | 96 | Main channel | 26 | 207.1 | Centrarchidae | 2 | 8.00 | 3.00 |
| 6 | 3 | 96 | Main channel | 26 | 207.1 | Moronidae | 2 | 2.00 | 0.00 |
| 6 | 3 | 96 | Main channel | 26 | 207.1 | Unidentified | 2 | 1.00 | 0.00 |
| 6 | 3 | 96 | Main channel | 26 | 208.5 | Common carp | 2 | 65.00 | 30.00 |
| 6 | 3 | 96 | Main channel | 26 | 208.5 | Freshwater drum | 2 | 3.50 | 2.50 |
| 6 | 3 | 96 | Main channel | 26 | 208.5 | Clupeidae | 2 | 64.50 | 22.50 |
| 6 | 3 | 96 | Main channel | 26 | 208.5 | Catostomidae | 2 | 2.50 | 1.50 |
| 6 | 3 | 96 | Main channel | 26 | 208.5 | Hiodontidae | 2 | 0.50 | 0.50 |

Appendix Table C continued.

| Month | Day | Year | Stratum | River | Mile | Taxon | N | Mean | + 1 SE |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 3 | 96 | Main channel | 26 | 207.1 | Lepisosteidae | 2 | 1.50 | 0.50 |
| 6 | 3 | 96 | Main channel | 26 | 208.5 | Centrarchidae | 2 | 3.00 | 3.00 |
| 6 | 3 | 96 | Main channel | 26 | 208.5 | Moronidae | 2 | 0.50 | 0.50 |
| 6 | 3 | 96 | Main channel | 26 | 208.5 | Unidentified | 2 | 1.50 | 1.50 |
| 6 | 3 | 96 | Main channel | 26 | 211.2 | Common carp | 2 | 41.00 | 20.00 |
| 6 | 3 | 96 | Main channel | 26 | 211.2 | Freshwater drum | 2 | 1.50 | 1.50 |
| 6 | 3 | 96 | Main channel | 26 | 211.2 | Clupeidae | 2 | 46.50 | 3.50 |
| 6 | 3 | 96 | Main channel | 26 | 211.2 | Catostomidae | 2 | 5.50 | 3.50 |
| 6 | 3 | 96 | Main channel | 26 | 211.2 | Hiodontidae | 2 | 1.00 | 1.00 |
| 6 | 3 | 96 | Main channel | 26 | 211.2 | Centrarchidae | 2 | 2.00 | 2.00 |
| 6 | 3 | 96 | Main channel | 26 | 213.5 | Common carp | 2 | 55.00 | 37.00 |
| 6 | 3 | 96 | Main channel | 26 | 213.5 | Freshwater drum | 2 | 4.50 | 0.50 |
| 6 | 3 | 96 | Main channel | 26 | 213.5 | Clupeidae | 2 | 242.50 | 8.50 |
| 6 | 3 | 96 | Main channel | 26 | 213.5 | Catostomidae | 2 | 7.50 | 3.50 |
| 6 | 3 | 96 | Main channel | 26 | 213.5 | Centrarchidae | 2 | 5.00 | 5.00 |
| 6 | 3 | 96 | Main channel | 26 | 213.5 | Lepisosteidae | 2 | 0.50 | 0.50 |
| 6 | 3 | 96 | Main channel | 26 | 213.5 | Moronidae | 2 | 1.50 | 1.50 |
| 6 | 3 | 96 | Main channel | 26 | 213.5 | Unidentified | 2 | 1.50 | 1.50 |
| 6 | 4 | 96 | Main channel | 26 | 215.7 | Common carp | 2 | 61.50 | 15.50 |
| 6 | 4 | 96 | Main channel | 26 | 215.7 | Freshwater drum | 2 | 1.50 | 1.50 |
| 6 | 4 | 96 | Main channel | 26 | 215.7 | Clupeidae | 2 | 215.00 | 129.00 |
| 6 | 4 | 96 | Main channel | 26 | 215.7 | Catostomidae | 2 | 1.00 | 1.00 |
| 6 | 4 | 96 | Main channel | 26 | 215.7 | Percidae | 2 | 1.00 | 1.00 |
| 6 | 4 | 96 | Main channel | IR | 4.5 | Common carp | 2 | 56.00 | 15.00 |
| 6 | 4 | 96 | Main channel | IR | 4.5 | Freshwater drum | 2 | 43.00 | 26.00 |
| 6 | 4 | 96 | Main channel | IR | 4.5 | Clupeidae | 2 | 1139.50 | 321.50 |
| 6 | 4 | 96 | Main channel | IR | 4.5 | Centrarchidae | 2 | 12.00 | 4.00 |
| 6 | 4 | 96 | Main channel | IR | 4.5 | Moronidae | 2 | 4.00 | 0.00 |
| 6 | 4 | 96 | Main channel | IR | 4.5 | Unidentified | 2 | 2.50 | 2.50 |
| 6 | 4 | 96 | Main channel | IR | 9.3 | Common carp | 2 | 30.00 | 3.00 |
| 6 | 4 | 96 | Main channel | IR | 9.3 | Freshwater drum | 2 | 15.50 | 1.50 |
| 6 | 4 | 96 | Main channel | IR | 9.3 | Clupeidae | 2 | 99.50 | 6.50 |
| 6 | 4 | 96 | Main channel | IR | 9.3 | Catostomidae | 2 | 3.50 | 2.50 |
| 6 | 4 | 96 | Main channel | IR | 9.3 | Centrarchidae | 2 | 6.00 | 4.00 |
| 6 | 4 | 96 | Main channel | IR | 9.3 | Moronidae | 2 | 1.50 | 1.50 |
| 6 | 4 | 96 | Main channel | IR | 9.3 | Unidentified | 2 | 1.00 | 0.00 |
| 6 | 4 | 96 | Main channel | IR | 13.5 | Common carp | 2 | 12.50 | 4.50 |
| 6 | 4 | 96 | Main channel | IR | 13.5 | Freshwater drum | 2 | 3.50 | 0.50 |
| 6 | 4 | 96 | Main channel | IR | 13.5 | Clupeidae | 2 | 232.00 | 12.00 |

Appendix Table C continued.

| Month | Day | Year | Stratum | River Mile | | Taxon | N | Mean | + 1 SE |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 4 | 96 | Main channel | IR | 13.5 | Catostomidae | 2 | 7.50 | 0.50 |
| 6 | 4 | 96 | Main channel | IR | 13.5 | Centrarchidae | 2 | 2.50 | 1.50 |
| 6 | 4 | 96 | Main channel | IR | 13.5 | Moronidae | 2 | 2.00 | 0.00 |
| 6 | 4 | 96 | Main channel | IR | 18.7 | Common carp | 2 | 31.50 | 5.50 |
| 6 | 4 | 96 | Main channel | IR | 18.7 | Freshwater drum | 2 | 17.50 | 4.50 |
| 6 | 4 | 96 | Main channel | IR | 18.7 | Clupeidae | 2 | 284.00 | 171.00 |
| 6 | 4 | 96 | Main channel | IR | 18.7 | Catostomidae | 2 | 5.00 | 5.00 |
| 6 | 4 | 96 | Main channel | IR | 18.7 | Centrarchidae | 2 | 3.00 | 1.00 |
| 6 | 5 | 96 | Main channel | 26 | 225.8 | Common carp | 2 | 10.00 | 0.00 |
| 6 | 5 | 96 | Main channel | 26 | 225.8 | Freshwater drum | 2 | 0.50 | 0.50 |
| 6 | 5 | 96 | Main channel | 26 | 225.8 | Clupeidae | 2 | 3.00 | 1.00 |
| 6 | 5 | 96 | Main channel | 26 | 225.8 | Lepisosteidae | 2 | 0.50 | 0.50 |
| 6 | 5 | 96 | Main channel | 26 | 227.5 | Common carp | 2 | 6.00 | 4.00 |
| 6 | 5 | 96 | Main channel | 26 | 227.5 | Catostomidae | 2 | 2.00 | 2.00 |
| 6 | 5 | 96 | Main channel | 26 | 227.5 | Hiodontidae | 2 | 1.50 | 1.50 |
| 6 | 5 | 96 | Main channel | 26 | 227.5 | Lepisosteidae | 2 | 0.50 | 0.50 |
| 6 | 5 | 96 | Main channel | 26 | 227.5 | Unidentified | 2 | 0.50 | 0.50 |
| 6 | 5 | 96 | Main channel | 26 | 230.5 | Common carp | 2 | 8.00 | 1.00 |
| 6 | 5 | 96 | Main channel | 26 | 230.5 | Clupeidae | 2 | 0.50 | 0.50 |
| 6 | 5 | 96 | Main channel | 26 | 230.5 | Catostomidae | 2 | 1.50 | 1.50 |
| 6 | 5 | 96 | Main channel | 26 | 230.5 | Hiodontidae | 2 | 0.50 | 0.50 |
| 6 | 5 | 96 | Main channel | 26 | 233.5 | Common carp | 2 | 13.00 | 1.00 |
| 6 | 5 | 96 | Main channel | 26 | 233.5 | Clupeidae | 2 | 0.50 | 0.50 |
| 6 | 5 | 96 | Main channel | 26 | 233.5 | Catostomidae | 2 | 1.00 | 1.00 |
| 6 | 5 | 96 | Main channel | 26 | 233.5 | Lepisosteidae | 2 | 0.50 | 0.50 |
| 6 | 17 | 96 | Main channel | 26 | 203.2 | Common carp | 2 | 6.00 | 2.00 |
| 6 | 17 | 96 | Main channel | 26 | 203.2 | Freshwater drum | 2 | 0.50 | 0.50 |
| 6 | 17 | 96 | Main channel | 26 | 203.2 | Clupeidae | 2 | 13.00 | 5.00 |
| 6 | 17 | 96 | Main channel | 26 | 203.2 | Hiodontidae | 2 | 0.50 | 0.50 |
| 6 | 17 | 96 | Main channel | 26 | 203.2 | Centrarchidae | 2 | 0.50 | 0.50 |
| 6 | 17 | 96 | Main channel | 26 | 203.2 | Unidentified | 2 | 0.50 | 0.50 |
| 6 | 17 | 96 | Main channel | 26 | 207.1 | Common carp | 2 | 15.50 | 5.50 |
| 6 | 17 | 96 | Main channel | 26 | 207.1 | Clupeidae | 2 | 18.50 | 14.50 |
| 6 | 17 | 96 | Main channel | 26 | 207.1 | Catostomidae | 2 | 5.50 | 2.50 |
| 6 | 17 | 96 | Main channel | 26 | 207.1 | Hiodontidae | 2 | 0.50 | 0.50 |
| 6 | 17 | 96 | Main channel | 26 | 207.1 | Unidentified | 2 | 0.50 | 0.50 |
| 6 | 20 | 96 | Main channel | 26 | 215.7 | Common carp | 1 | 229.00 | |
| 6 | 20 | 96 | Main channel | 26 | 215.7 | Freshwater drum | 1 | 160.00 | |
| 6 | 20 | 96 | Main channel | 26 | 215.7 | Clupeidae | 1 | 693.00 | |

Appendix Table C continued.

| Month | Day | Year | Stratum | River Mile | | Taxon | N | Mean | + 1 SE |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 20 | 96 | Main channel | 26 | 215.7 | Catostomidae | 1 | 76.00 | |
| 6 | 20 | 96 | Main channel | 26 | 215.7 | Moronidae | 1 | 7.00 | |
| 6 | 20 | 96 | Main channel | 26 | 215.7 | Unidentified | 1 | 14.00 | |
| 6 | 20 | 96 | Main channel | IR | 4.5 | Common carp | 2 | 728.00 | 375.00 |
| 6 | 20 | 96 | Main channel | IR | 4.5 | Freshwater drum | 2 | 35.00 | 18.00 |
| 6 | 20 | 96 | Main channel | IR | 4.5 | Clupeidae | 2 | 241.50 | 138.50 |
| 6 | 20 | 96 | Main channel | IR | 4.5 | Unidentified | 2 | 0.50 | 0.50 |
| 6 | 20 | 96 | Main channel | IR | 9.3 | Common carp | 2 | 568.00 | 197.00 |
| 6 | 20 | 96 | Main channel | IR | 9.3 | Freshwater drum | 2 | 67.50 | 45.50 |
| 6 | 20 | 96 | Main channel | IR | 9.3 | Clupeidae | 2 | 617.50 | 194.50 |
| 6 | 20 | 96 | Main channel | IR | 9.3 | Catostomidae | 2 | 2.50 | 0.50 |
| 6 | 20 | 96 | Main channel | IR | 9.3 | Centrarchidae | 2 | 0.50 | 0.50 |
| 6 | 20 | 96 | Main channel | IR | 9.3 | Moronidae | 2 | 8.50 | 6.50 |
| 6 | 20 | 96 | Main channel | IR | 9.3 | Unidentified | 2 | 87.50 | 2.50 |
| 6 | 20 | 96 | Main channel | IR | 13.5 | Common carp | 2 | 456.50 | 2.50 |
| 6 | 20 | 96 | Main channel | IR | 13.5 | Freshwater drum | 2 | 4.50 | 14.50 |
| 6 | 20 | 96 | Main channel | IR | 13.5 | Clupeidae | 2 | 883.50 | 157.50 |
| 6 | 20 | 96 | Main channel | IR | 13.5 | Catostomidae | 2 | 1.00 | 0.00 |
| 6 | 20 | 96 | Main channel | IR | 13.5 | Moronidae | 2 | 6.50 | 5.50 |
| 6 | 20 | 96 | Main channel | IR | 13.5 | Unidentified | 2 | 6.00 | 5.00 |
| 6 | 20 | 96 | Main channel | IR | 18.7 | Common carp | 2 | 541.00 | 210.00 |
| 6 | 20 | 96 | Main channel | IR | 18.7 | Freshwater drum | 2 | 45.50 | 16.50 |
| 6 | 20 | 96 | Main channel | IR | 18.7 | Clupeidae | 2 | 487.00 | 124.00 |
| 6 | 20 | 96 | Main channel | IR | 18.7 | Catostomidae | 2 | 2.00 | 2.00 |
| 6 | 20 | 96 | Main channel | IR | 18.7 | Moronidae | 2 | 0.50 | 0.50 |
| 6 | 20 | 96 | Main channel | IR | 18.7 | Unidentified | 2 | 1.00 | 0.00 |
| 6 | 21 | 96 | Main channel | 26 | 223.0 | Common carp | 2 | 2.50 | 0.50 |
| 6 | 21 | 96 | Main channel | 26 | 223.0 | Freshwater drum | 2 | 152.00 | 85.00 |
| 6 | 21 | 96 | Main channel | 26 | 223.0 | Clupeidae | 2 | 3.50 | 0.50 |
| 6 | 21 | 96 | Main channel | 26 | 223.0 | Catostomidae | 2 | 1.50 | 0.50 |
| 6 | 21 | 96 | Main channel | 26 | 223.0 | Hiodontidae | 2 | 0.50 | 0.50 |
| 6 | 21 | 96 | Main channel | 26 | 223.0 | Unidentified | 2 | 0.50 | 0.50 |
| 6 | 21 | 96 | Main channel | 26 | 225.8 | Common carp | 2 | 2.00 | 0.00 |
| 6 | 21 | 96 | Main channel | 26 | 225.8 | Freshwater drum | 2 | 225.50 | 65.50 |
| 6 | 21 | 96 | Main channel | 26 | 225.8 | Clupeidae | 2 | 2.50 | 0.50 |
| 6 | 21 | 96 | Main channel | 26 | 225.8 | Catostomidae | 2 | 1.00 | 0.00 |
| 6 | 21 | 96 | Main channel | 26 | 225.8 | Lepisosteidae | 2 | 0.50 | 0.50 |
| 6 | 21 | 96 | Main channel | 26 | 225.8 | Unidentified | 2 | 0.50 | 0.50 |
| 6 | 21 | 96 | Main channel | 26 | 230.5 | Common carp | 2 | 12.00 | 1.00 |

Appendix Table C continued.

| Month | Day | Year | Stratum | River Mile | | Taxon | N | Mean | + 1 SE |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 21 | 96 | Main channel | 26 | 230.5 | Freshwater drum | 2 | 906.00 | 628.00 |
| 6 | 21 | 96 | Main channel | 26 | 230.5 | Clupeidae | 2 | 3.00 | 1.00 |
| 6 | 21 | 96 | Main channel | 26 | 230.5 | Catostomidae | 2 | 5.50 | 2.50 |
| 6 | 21 | 96 | Main channel | 26 | 230.5 | Hiodontidae | 2 | 1.00 | 1.00 |
| 6 | 21 | 96 | Main channel | 26 | 230.5 | Centrarchidae | 2 | 2.00 | 2.00 |
| 6 | 21 | 96 | Main channel | 26 | 230.5 | Lepisosteidae | 2 | 0.50 | 0.50 |
| 6 | 21 | 96 | Main channel | 26 | 230.5 | Unidentified | 2 | 4.50 | 4.50 |
| 6 | 21 | 96 | Main channel | 26 | 233.5 | Common carp | 2 | 4.00 | 0.00 |
| 6 | 21 | 96 | Main channel | 26 | 233.5 | Freshwater drum | 2 | 478.00 | 164.00 |
| 6 | 21 | 96 | Main channel | 26 | 233.5 | Clupeidae | 2 | 6.00 | 3.00 |
| 6 | 21 | 96 | Main channel | 26 | 233.5 | Catostomidae | 2 | 4.00 | 2.00 |
| 6 | 21 | 96 | Main channel | 26 | 233.5 | Hiodontidae | 2 | 0.50 | 0.50 |
| 6 | 21 | 96 | Main channel | 26 | 233.5 | Moronidae | 2 | 2.50 | 2.50 |
| 6 | 21 | 96 | Main channel | 26 | 233.5 | Unidentified | 2 | 3.00 | 3.00 |
| 7 | 1 | 96 | Main channel | 26 | 207.1 | Common carp | 2 | 2.00 | 1.00 |
| 7 | 1 | 96 | Main channel | 26 | 207.1 | Freshwater drum | 2 | 240.50 | 72.50 |
| 7 | 1 | 96 | Main channel | 26 | 207.1 | Clupeidae | 2 | 27.00 | 10.00 |
| 7 | 1 | 96 | Main channel | 26 | 207.1 | Catostomidae | 2 | 4.00 | 2.00 |
| 7 | 1 | 96 | Main channel | 26 | 211.2 | Freshwater drum | 1 | 310.00 | |
| 7 | 1 | 96 | Main channel | 26 | 211.2 | Clupeidae | 1 | 1.00 | |
| 7 | 1 | 96 | Main channel | 26 | 211.2 | Catostomidae | 1 | 4.00 | |
| 7 | 1 | 96 | Main channel | 26 | 211.2 | Unidentified | 1 | 1.00 | |
| 7 | 1 | 96 | Main channel | 26 | 213.5 | Common carp | 2 | 4.00 | 0.00 |
| 7 | 1 | 96 | Main channel | 26 | 213.5 | Freshwater drum | 2 | 383.00 | 12.00 |
| 7 | 1 | 96 | Main channel | 26 | 213.5 | Clupeidae | 2 | 53.50 | 0.50 |
| 7 | 1 | 96 | Main channel | 26 | 213.5 | Catostomidae | 2 | 3.50 | 1.50 |
| 7 | 1 | 96 | Main channel | 26 | 213.5 | Unidentified | 2 | 1.00 | 1.00 |
| 7 | 2 | 96 | Main channel | 26 | 203.2 | Common carp | 2 | 0.50 | 0.50 |
| 7 | 2 | 96 | Main channel | 26 | 203.2 | Freshwater drum | 2 | 309.50 | 40.50 |
| 7 | 2 | 96 | Main channel | 26 | 203.2 | Clupeidae | 2 | 10.00 | 3.00 |
| 7 | 2 | 96 | Main channel | 26 | 203.2 | Catostomidae | 2 | 1.50 | 0.50 |
| 7 | 2 | 96 | Main channel | 26 | 203.2 | Unidentified | 2 | 1.50 | 1.50 |
| 7 | 2 | 96 | Main channel | 26 | 208.5 | Common carp | 1 | 1.00 | |
| 7 | 2 | 96 | Main channel | 26 | 208.5 | Freshwater drum | 1 | 558.00 | |
| 7 | 2 | 96 | Main channel | 26 | 208.5 | Clupeidae | 1 | 16.00 | |
| 7 | 2 | 96 | Main channel | 26 | 208.5 | Catostomidae | 1 | 9.00 | |
| 7 | 2 | 96 | Main channel | 26 | 208.5 | Centrarchidae | 1 | 1.00 | |
| 7 | 2 | 96 | Main channel | 26 | 208.5 | Moronidae | 1 | 1.00 | |
| 7 | 2 | 96 | Main channel | 26 | 208.5 | Unidentified | 1 | 1.00 | |

Appendix Table C continued.

| Month | Day | Year | Stratum | River | Mile | Taxon | N | Mean | + 1 SE |
|---|---|---|---|---|---|---|---|---|---|
| 7 | 3 | 96 | Main channel | 26 | 223.0 | Freshwater drum | 2 | 99.50 | 34.50 |
| 7 | 3 | 96 | Main channel | 26 | 225.8 | Freshwater drum | 1 | 196.00 | |
| 7 | 3 | 96 | Main channel | 26 | 233.5 | Common carp | 2 | 0.50 | 0.50 |
| 7 | 3 | 96 | Main channel | 26 | 233.5 | Freshwater drum | 2 | 219.50 | 33.50 |
| 7 | 3 | 96 | Main channel | 26 | 240.2 | Common carp | 1 | 1.00 | |
| 7 | 3 | 96 | Main channel | 26 | 240.2 | Freshwater drum | 1 | 398.00 | |
| 7 | 3 | 96 | Main channel | 26 | 240.2 | Clupeidae | 1 | 1.00 | |
| 7 | 3 | 96 | Main channel | 26 | 240.2 | Unidentified | 1 | 1.00 | |
| 7 | 5 | 96 | Main channel | 26 | 215.7 | Common carp | 2 | 1.00 | 1.00 |
| 7 | 5 | 96 | Main channel | 26 | 215.7 | Freshwater drum | 2 | 451.00 | 307.00 |
| 7 | 5 | 96 | Main channel | 26 | 215.7 | Clupeidae | 2 | 5.00 | 2.00 |
| 7 | 5 | 96 | Main channel | 26 | 215.7 | Catostomidae | 1 | 4.00 | |
| 7 | 5 | 96 | Main channel | IR | 4.5 | Common carp | 2 | 2.00 | 2.00 |
| 7 | 5 | 96 | Main channel | IR | 4.5 | Freshwater drum | 2 | 26.50 | 14.50 |
| 7 | 5 | 96 | Main channel | IR | 4.5 | Clupeidae | 2 | 13.00 | 7.00 |
| 7 | 5 | 96 | Main channel | IR | 4.5 | Catostomidae | 2 | 3.00 | 3.00 |
| 7 | 5 | 96 | Main channel | IR | 4.5 | Unidentified | 2 | 0.50 | 0.50 |
| 7 | 5 | 96 | Main channel | IR | 9.3 | Freshwater drum | 2 | 356.50 | 70.50 |
| 7 | 5 | 96 | Main channel | IR | 9.3 | Clupeidae | 2 | 23.50 | 9.50 |
| 7 | 5 | 96 | Main channel | IR | 9.3 | Catostomidae | 2 | 24.00 | 7.00 |
| 7 | 5 | 96 | Main channel | IR | 9.3 | Moronidae | 2 | 0.50 | 0.50 |
| 7 | 5 | 96 | Main channel | IR | 9.3 | Unidentified | 2 | 1.00 | 1.00 |
| 7 | 5 | 96 | Main channel | IR | 13.5 | Common carp | 2 | 1.50 | 1.50 |
| 7 | 5 | 96 | Main channel | IR | 13.5 | Channel catfish | 2 | 0.50 | 0.50 |
| 7 | 5 | 96 | Main channel | IR | 13.5 | Freshwater drum | 2 | 229.00 | 159.00 |
| 7 | 5 | 96 | Main channel | IR | 13.5 | Clupeidae | 2 | 38.50 | 18.50 |
| 7 | 5 | 96 | Main channel | IR | 13.5 | Catostomidae | 2 | 3.00 | 1.00 |
| 7 | 5 | 96 | Main channel | IR | 13.5 | Moronidae | 2 | 4.50 | 2.50 |
| 7 | 5 | 96 | Main channel | IR | 13.5 | Unidentified | 2 | 2.50 | 2.50 |
| 7 | 5 | 96 | Main channel | IR | 18.7 | Common carp | 2 | 2.00 | 0.00 |
| 7 | 5 | 96 | Main channel | IR | 18.7 | Freshwater drum | 2 | 697.00 | 342.00 |
| 7 | 5 | 96 | Main channel | IR | 18.7 | Clupeidae | 2 | 27.50 | 14.50 |
| 7 | 5 | 96 | Main channel | IR | 18.7 | Catostomidae | 2 | 8.00 | 3.00 |
| 7 | 5 | 96 | Main channel | IR | 18.7 | Centrarchidae | 2 | 1.50 | 1.50 |
| 7 | 5 | 96 | Main channel | IR | 18.7 | Unidentified | 2 | 5.50 | 5.50 |
| 4 | 23 | 97 | Main channel | 26 | 208.5 | None | 2 | 0.00 | 0.00 |
| 4 | 23 | 97 | Main channel | 26 | 215.7 | Gambusia sp. | 2 | 0.50 | 0.50 |
| 4 | 23 | 97 | Main channel | 26 | 233.0 | Freshwater drum | 2 | 1.50 | 1.50 |
| 4 | 23 | 97 | Side channel | 26 | 208.5 | None | 2 | 0.00 | 0.00 |

Appendix Table C continued.

| Month | Day | Year | Stratum | River Mile | | Taxon | N | Mean | + 1 SE |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 23 | 97 | Side channel | 26 | 215.7 | None | 2 | 0.00 | 0.00 |
| 4 | 23 | 97 | Side channel | 26 | 222.6 | None | 2 | 0.00 | 0.00 |
| 4 | 29 | 97 | Main channel | 26 | 208.5 | Percidae | 2 | 0.50 | 0.50 |
| 4 | 29 | 97 | Main channel | 26 | 215.7 | Common carp | 2 | 0.50 | 0.50 |
| 4 | 29 | 97 | Main channel | 26 | 215.7 | Freshwater drum | 2 | 2.00 | 2.00 |
| 4 | 29 | 97 | Main channel | 26 | 215.7 | Catostomidae | 2 | 2.50 | 2.50 |
| 4 | 29 | 97 | Main channel | 26 | 215.7 | Hiodontidae | 2 | 2.00 | 2.00 |
| 4 | 29 | 97 | Main channel | 26 | 222.6 | Percidae | 2 | 0.50 | 0.50 |
| 4 | 29 | 97 | Main channel | 26 | 233.5 | None | 2 | 0.00 | 0.00 |
| 4 | 29 | 97 | Side channel | 26 | 208.5 | None | 2 | 0.00 | 0.00 |
| 4 | 29 | 97 | Side channel | 26 | 215.7 | None | 2 | 0.00 | 0.00 |
| 4 | 29 | 97 | Side channel | 26 | 222.6 | Percidae | 2 | 1.00 | 1.00 |
| 4 | 29 | 97 | Side channel | 26 | 233.5 | None | 2 | 0.00 | 0.00 |
| 5 | 1 | 97 | Side channel | IR | 13.5 | Catostomidae | 2 | 0.50 | 0.50 |
| 5 | 2 | 97 | Backwater | 26 | 222.0 | None | 2 | 0.00 | 0.00 |
| 5 | 13 | 97 | Main channel | 26 | 208.5 | Common carp | 2 | 1.00 | 1.00 |
| 5 | 13 | 97 | Main channel | 26 | 208.5 | Catostomidae | 2 | 16.00 | 5.00 |
| 5 | 13 | 97 | Main channel | 26 | 208.5 | Percidae | 2 | 5.50 | 2.50 |
| 5 | 13 | 97 | Main channel | 26 | 208.5 | Unidentified | 2 | 1.00 | 1.00 |
| 5 | 13 | 97 | Main channel | 26 | 223.0 | Common carp | 2 | 0.50 | 0.50 |
| 5 | 13 | 97 | Main channel | 26 | 223.0 | Catostomidae | 2 | 14.00 | 0.00 |
| 5 | 13 | 97 | Main channel | 26 | 223.0 | Percidae | 2 | 6.00 | 1.00 |
| 5 | 13 | 97 | Main channel | 26 | 233.5 | Gambusia sp. | 1 | 1.00 | |
| 5 | 13 | 97 | Main channel | 26 | 233.5 | Catostomidae | 1 | 10.00 | |
| 5 | 13 | 97 | Main channel | 26 | 233.5 | Hiodontidae | 1 | 1.00 | |
| 5 | 13 | 97 | Main channel | 26 | 233.5 | Percidae | 1 | 3.00 | |
| 5 | 13 | 97 | Side channel | 26 | 208.5 | Common carp | 2 | 0.50 | 0.50 |
| 5 | 13 | 97 | Side channel | 26 | 208.5 | Catostomidae | 2 | 25.00 | 6.00 |
| 5 | 13 | 97 | Side channel | 26 | 208.5 | Percidae | 2 | 14.00 | 14.00 |
| 5 | 13 | 97 | Side channel | 26 | 222.6 | Common carp | 2 | 0.50 | 0.50 |
| 5 | 13 | 97 | Side channel | 26 | 222.6 | Catostomidae | 2 | 10.50 | 3.50 |
| 5 | 13 | 97 | Side channel | 26 | 222.6 | Percidae | 2 | 1.00 | 0.00 |
| 5 | 13 | 97 | Side channel | 26 | 233.2 | Common carp | 2 | 1.50 | 0.50 |
| 5 | 13 | 97 | Side channel | 26 | 233.2 | Catostomidae | 2 | 13.50 | 4.50 |
| 5 | 13 | 97 | Side channel | 26 | 233.2 | Centrarchidae | 2 | 0.50 | 0.50 |
| 5 | 13 | 97 | Side channel | 26 | 233.2 | Lepisosteidae | 2 | 1.00 | 1.00 |
| 5 | 13 | 97 | Side channel | 26 | 233.2 | Percidae | 2 | 3.50 | 0.50 |
| 5 | 13 | 97 | Side channel | 26 | 233.2 | Unidentified | 2 | 2.00 | 1.00 |
| 5 | 16 | 97 | Backwater | 26 | 222.0 | Clupeidae | 2 | 97.00 | 36.00 |

Appendix Table C continued.

| Month | Day | Year | Stratum | River Mile | | Taxon | N | Mean | + 1 SE |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 16 | 97 | Backwater | 26 | 222.0 | Cyprinidae | 2 | 0.50 | 0.50 |
| 5 | 16 | 97 | Backwater | 26 | 222.0 | Centrarchidae | 2 | 10.00 | 3.00 |
| 5 | 16 | 97 | Backwater | 26 | 222.0 | Moronidae | 2 | 2.50 | 2.50 |
| 5 | 16 | 97 | Backwater | 26 | 222.0 | Percidae | 2 | 4.00 | 1.00 |
| 5 | 16 | 97 | Backwater | IR | 9.3 | Gambusia sp. | 2 | 0.50 | 0.50 |
| 5 | 16 | 97 | Backwater | IR | 9.3 | Clupeidae | 2 | 875.00 | 112.00 |
| 5 | 16 | 97 | Backwater | IR | 9.3 | Catostomidae | 2 | 0.50 | 0.50 |
| 5 | 16 | 97 | Backwater | IR | 9.3 | Unidentified | 2 | 2.00 | 2.00 |
| 5 | 19 | 97 | Main channel | IR | 13.5 | Common carp | 2 | 0.50 | 0.50 |
| 5 | 19 | 97 | Main channel | IR | 13.5 | Clupeidae | 2 | 201.00 | 199.00 |
| 5 | 19 | 97 | Main channel | IR | 13.5 | Moronidae | 2 | 30.50 | 26.50 |
| 5 | 19 | 97 | Main channel | IR | 13.5 | Unidentified | 2 | 3.00 | 1.00 |
| 5 | 19 | 97 | Side channel | IR | 13.5 | Freshwater drum | 2 | 24.00 | 18.00 |
| 5 | 19 | 97 | Side channel | IR | 13.5 | Clupeidae | 2 | 140.50 | 97.50 |
| 5 | 19 | 97 | Side channel | IR | 13.5 | Unidentified | 2 | 1.00 | 1.00 |
| 5 | 27 | 97 | Main channel | IR | 13.5 | Common carp | 1 | 1.00 | |
| 5 | 27 | 97 | Main channel | IR | 13.5 | Freshwater drum | 1 | 101.00 | |
| 5 | 27 | 97 | Main channel | IR | 13.5 | Clupeidae | 1 | 30.00 | |
| 5 | 27 | 97 | Main channel | IR | 13.5 | Moronidae | 1 | 12.00 | |
| 5 | 28 | 97 | Backwater | 26 | 222.0 | Common carp | 2 | 5.50 | 1.50 |
| 5 | 28 | 97 | Backwater | 26 | 222.0 | Freshwater drum | 2 | 0.50 | 0.50 |
| 5 | 28 | 97 | Backwater | 26 | 222.0 | Clupeidae | 2 | 473.50 | 74.50 |
| 5 | 28 | 97 | Backwater | 26 | 222.0 | Cyprinidae | 2 | 1.50 | 0.50 |
| 5 | 28 | 97 | Backwater | 26 | 222.0 | Centrarchidae | 2 | 80.00 | 76.00 |
| 5 | 28 | 97 | Backwater | 26 | 222.0 | Moronidae | 2 | 0.50 | 0.50 |
| 5 | 28 | 97 | Backwater | 26 | 222.0 | Unidentified | 2 | 3.50 | 3.50 |
| 5 | 28 | 97 | Backwater | IR | 9.3 | BKSS | 2 | 0.50 | 0.50 |
| 5 | 28 | 97 | Backwater | IR | 9.3 | Gambusia | 2 | 0.50 | 0.50 |
| 5 | 28 | 97 | Backwater | IR | 9.3 | Clupeidae | 2 | 253.00 | 101.00 |
| 5 | 28 | 97 | Backwater | IR | 9.3 | Catostomidae | 2 | 0.50 | 0.50 |
| 5 | 28 | 97 | Backwater | IR | 9.3 | Centrarchidae | 2 | 6.50 | 5.50 |
| 5 | 28 | 97 | Backwater | IR | 9.3 | Unidentified | 2 | 0.50 | 0.50 |
| 5 | 29 | 97 | Side channel | IR | 13.5 | Common carp | 2 | 0.50 | 0.50 |
| 5 | 29 | 97 | Side channel | IR | 13.5 | Freshwater drum | 2 | 420.00 | 122.00 |
| 5 | 29 | 97 | Side channel | IR | 13.5 | Clupeidae | 2 | 9.00 | 4.00 |
| 5 | 29 | 97 | Side channel | IR | 13.5 | Catostomidae | 2 | 0.50 | 0.50 |
| 5 | 29 | 97 | Side channel | IR | 13.5 | Cyprinidae | 2 | 2.50 | 2.50 |
| 5 | 29 | 97 | Side channel | IR | 13.5 | Moronidae | 2 | 9.50 | 9.50 |
| 5 | 29 | 97 | Side channel | IR | 13.5 | Unidentified | 2 | 4.50 | 4.50 |

Appendix Table C continued.

| Month | Day | Year | Stratum | River Mile | | Taxon | N | Mean | + 1 SE |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 30 | 97 | Main channel | 26 | 215.7 | Clupeidae | 2 | 0.50 | 0.50 |
| 5 | 30 | 97 | Main channel | 26 | 215.7 | Hiodontidae | 2 | 0.50 | 0.50 |
| 5 | 30 | 97 | Main channel | 26 | 223.0 | Catostomidae | 2 | 10.00 | 5.00 |
| 5 | 30 | 97 | Main channel | 26 | 223.0 | Hiodontidae | 2 | 7.50 | 2.50 |
| 5 | 30 | 97 | Main channel | 26 | 223.0 | Centrarchidae | 2 | 1.00 | 1.00 |
| 5 | 30 | 97 | Main channel | 26 | 223.0 | Moronidae | 2 | 0.50 | 0.50 |
| 5 | 30 | 97 | Main channel | 26 | 233.5 | Catostomidae | 1 | 7.00 | |
| 5 | 30 | 97 | Main channel | 26 | 233.5 | Cyprinidae | 1 | 2.00 | |
| 5 | 30 | 97 | Main channel | 26 | 233.5 | Hiodontidae | 1 | 19.00 | |
| 5 | 30 | 97 | Main channel | 26 | 233.5 | Percidae | 1 | 2.00 | |
| 5 | 30 | 97 | Side channel | 26 | 215.7 | Common carp | 1 | 2.00 | |
| 5 | 30 | 97 | Side channel | 26 | 215.7 | Clupeidae | 1 | 8.00 | |
| 5 | 30 | 97 | Side channel | 26 | 215.7 | Catostomidae | 1 | 15.00 | |
| 5 | 30 | 97 | Side channel | 26 | 215.7 | Hiodontidae | 1 | 6.00 | |
| 5 | 30 | 97 | Side channel | 26 | 215.7 | Centrarchidae | 1 | 4.00 | |
| 5 | 30 | 97 | Side channel | 26 | 215.7 | Moronidae | 1 | 1.00 | |
| 5 | 30 | 97 | Side channel | 26 | 215.7 | Percidae | 1 | 3.00 | |
| 5 | 30 | 97 | Side channel | 26 | 222.6 | Common carp | 2 | 2.00 | 0.00 |
| 5 | 30 | 97 | Side channel | 26 | 222.6 | Freshwater drum | 2 | 1.00 | 1.00 |
| 5 | 30 | 97 | Side channel | 26 | 222.6 | Clupeidae | 2 | 2.00 | 1.00 |
| 5 | 30 | 97 | Side channel | 26 | 222.6 | Catostomidae | 2 | 16.50 | 12.50 |
| 5 | 30 | 97 | Side channel | 26 | 222.6 | Hiodontidae | 2 | 11.00 | 3.00 |
| 5 | 30 | 97 | Side channel | 26 | 222.6 | Centrarchidae | 2 | 6.50 | 4.50 |
| 5 | 30 | 97 | Side channel | 26 | 222.6 | Moronidae | 2 | 0.50 | 0.50 |
| 5 | 30 | 97 | Side channel | 26 | 222.6 | Unidentified | 2 | 1.50 | 1.50 |
| 5 | 30 | 97 | Side channel | 26 | 233.5 | Catostomidae | 2 | 2.00 | 2.00 |
| 5 | 30 | 97 | Side channel | 26 | 233.5 | Cyprinidae | 2 | 1.00 | 1.00 |
| 5 | 30 | 97 | Side channel | 26 | 233.5 | Hiodontidae | 2 | 4.50 | 1.50 |
| 6 | 10 | 97 | Main channel | IR | 13.5 | Common carp | 2 | 148.00 | 21.00 |
| 6 | 10 | 97 | Main channel | IR | 13.5 | Freshwater drum | 2 | 1326.00 | 274.00 |
| 6 | 10 | 97 | Main channel | IR | 13.5 | Gambusia | 2 | 0.50 | 0.50 |
| 6 | 10 | 97 | Main channel | IR | 13.5 | Clupeidae | 2 | 18.50 | 18.50 |
| 6 | 10 | 97 | Main channel | IR | 13.5 | Catostomidae | 2 | 6.00 | 6.00 |
| 6 | 10 | 97 | Main channel | IR | 13.5 | Cyprinidae | 2 | 1.00 | 1.00 |
| 6 | 10 | 97 | Main channel | IR | 13.5 | Unidentified | 2 | 2.50 | 2.50 |
| 6 | 10 | 97 | Side channel | IR | 13.5 | Common carp | 2 | 26.50 | 7.50 |
| 6 | 10 | 97 | Side channel | IR | 13.5 | Freshwater drum | 2 | 906.50 | 239.50 |
| 6 | 10 | 97 | Side channel | IR | 13.5 | Clupeidae | 2 | 4.00 | 0.00 |
| 6 | 10 | 97 | Side channel | IR | 13.5 | Catostomidae | 2 | 2.00 | 2.00 |

Appendix Table C continued.

| Month | Day | Year | Stratum | River Mile | | Taxon | N | Mean | + 1 SE |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 10 | 97 | Side channel | IR | 13.5 | Cyprinidae | 2 | 1.00 | 0.00 |
| 6 | 10 | 97 | Side channel | IR | 13.5 | Unidentified | 2 | 17.00 | 1.00 |
| 6 | 11 | 97 | Backwater | 26 | 222.0 | Clupeidae | 2 | 2144.00 | 169.00 |
| 6 | 11 | 97 | Backwater | 26 | 222.0 | Cyprinidae | 2 | 3.00 | 3.00 |
| 6 | 11 | 97 | Backwater | 26 | 222.0 | Centrarchidae | 2 | 28.00 | 28.00 |
| 6 | 11 | 97 | Backwater | IR | 9.3 | Silversides | 2 | 1.00 | 1.00 |
| 6 | 11 | 97 | Backwater | IR | 9.3 | Common carp | 2 | 0.50 | 0.50 |
| 6 | 11 | 97 | Backwater | IR | 9.3 | Clupeidae | 2 | 86.00 | 33.00 |
| 6 | 11 | 97 | Backwater | IR | 9.3 | Centrarchidae | 2 | 17.00 | 9.00 |
| 6 | 12 | 97 | Main channel | 26 | 208.5 | Common carp | 2 | 4.00 | 0.00 |
| 6 | 12 | 97 | Main channel | 26 | 208.5 | Freshwater drum | 2 | 515.50 | 92.50 |
| 6 | 12 | 97 | Main channel | 26 | 208.5 | Clupeidae | 2 | 92.50 | 75.50 |
| 6 | 12 | 97 | Main channel | 26 | 208.5 | Catostomidae | 2 | 16.00 | 4.00 |
| 6 | 12 | 97 | Main channel | 26 | 208.5 | Hiodontidae | 2 | 0.50 | 0.50 |
| 6 | 12 | 97 | Main channel | 26 | 215.7 | Common carp | 2 | 0.50 | 0.50 |
| 6 | 12 | 97 | Main channel | 26 | 215.7 | Freshwater drum | 2 | 169.00 | 101.00 |
| 6 | 12 | 97 | Main channel | 26 | 215.7 | Clupeidae | 2 | 6.50 | 4.50 |
| 6 | 12 | 97 | Main channel | 26 | 215.7 | Catostomidae | 2 | 5.00 | 5.00 |
| 6 | 12 | 97 | Main channel | 26 | 215.7 | Hiodontidae | 2 | 1.50 | 0.50 |
| 6 | 12 | 97 | Main channel | 26 | 223.0 | Common carp | 2 | 0.50 | 0.50 |
| 6 | 12 | 97 | Main channel | 26 | 223.0 | Catostomidae | 2 | 2.50 | 0.50 |
| 6 | 12 | 97 | Main channel | 26 | 223.0 | Unidentified | 2 | 0.50 | 0.50 |
| 6 | 12 | 97 | Main channel | 26 | 233.5 | Common carp | 1 | 1.00 | |
| 6 | 12 | 97 | Main channel | 26 | 233.5 | Catostomidae | 1 | 3.00 | |
| 6 | 12 | 97 | Side channel | 26 | 208.5 | Common carp | 2 | 16.00 | 2.00 |
| 6 | 12 | 97 | Side channel | 26 | 208.5 | Freshwater drum | 2 | 1164.50 | 23.50 |
| 6 | 12 | 97 | Side channel | 26 | 208.5 | Clupeidae | 2 | 14.50 | 9.50 |
| 6 | 12 | 97 | Side channel | 26 | 208.5 | Catostomidae | 2 | 6.00 | 0.00 |
| 6 | 12 | 97 | Side channel | 26 | 208.5 | Hiodontidae | 2 | 2.50 | 0.50 |
| 6 | 12 | 97 | Side channel | 26 | 208.5 | Moronidae | 2 | 4.00 | 4.00 |
| 6 | 12 | 97 | Side channel | 26 | 208.5 | Percidae | 2 | 0.50 | 0.50 |
| 6 | 12 | 97 | Side channel | 26 | 222.6 | Freshwater drum | 2 | 2.00 | 2.00 |
| 6 | 12 | 97 | Side channel | 26 | 222.6 | Catostomidae | 2 | 5.00 | 3.00 |
| 6 | 12 | 97 | Side channel | 26 | 222.6 | Hiodontidae | 2 | 0.50 | 0.50 |
| 6 | 12 | 97 | Side channel | 26 | 222.6 | Unidentified | 2 | 3.50 | 3.50 |
| 6 | 12 | 97 | Side channel | 26 | 233.5 | Common carp | 2 | 0.50 | 0.50 |
| 6 | 12 | 97 | Side channel | 26 | 233.5 | Freshwater drum | 2 | 0.50 | 0.50 |
| 6 | 12 | 97 | Side channel | 26 | 233.5 | Moronidae | 2 | 1.00 | 1.00 |
| 6 | 24 | 97 | Backwater | 26 | 222.0 | Bighead carp | 2 | 0.50 | 0.50 |

Appendix Table C continued.

| Month | Day | Year | Stratum | River | Mile | Taxon | N | Mean | + 1 SE |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 24 | 97 | Backwater | 26 | 222.0 | Silversides | 2 | 1.00 | 0.00 |
| 6 | 24 | 97 | Backwater | 26 | 222.0 | Gambusia | 2 | 119.00 | 31.00 |
| 6 | 24 | 97 | Backwater | 26 | 222.0 | Clupeidae | 2 | 81.00 | 12.00 |
| 6 | 24 | 97 | Backwater | 26 | 222.0 | Cyprinidae | 2 | 8.00 | 1.00 |
| 6 | 24 | 97 | Backwater | 26 | 222.0 | Centrarchidae | 2 | 1933.00 | 11.00 |
| 6 | 24 | 97 | Backwater | IR | 9.3 | Silversides | 1 | 23.00 | |
| 6 | 24 | 97 | Backwater | IR | 9.3 | Clupeidae | 1 | 9.00 | |
| 6 | 24 | 97 | Backwater | IR | 9.3 | Centrarchidae | 1 | 105.00 | |
| 6 | 24 | 97 | Backwater | IR | 9.3 | Unidentified | 1 | 1.00 | |
| 6 | 25 | 97 | Main channel | IR | 13.5 | Common carp | 2 | 32.50 | 3.50 |
| 6 | 25 | 97 | Main channel | IR | 13.5 | Freshwater drum | 2 | 2073.00 | 307.00 |
| 6 | 25 | 97 | Main channel | IR | 13.5 | Clupeidae | 2 | 46.50 | 8.50 |
| 6 | 25 | 97 | Main channel | IR | 13.5 | Catostomidae | 2 | 514.00 | 105.00 |
| 6 | 25 | 97 | Main channel | IR | 13.5 | Centrarchidae | 2 | 0.50 | 0.50 |
| 6 | 25 | 97 | Main channel | IR | 13.5 | Moronidae | 2 | 4.00 | 3.00 |
| 6 | 25 | 97 | Main channel | IR | 13.5 | Unidentified | 2 | 9.00 | 8.00 |
| 6 | 25 | 97 | Side channel | IR | 13.5 | Common carp | 2 | 42.50 | 4.50 |
| 6 | 25 | 97 | Side channel | IR | 13.5 | Freshwater drum | 2 | 5007.00 | 396.00 |
| 6 | 25 | 97 | Side channel | IR | 13.5 | Clupeidae | 2 | 24.00 | 1.00 |
| 6 | 25 | 97 | Side channel | IR | 13.5 | Catostomidae | 2 | 195.50 | 7.50 |
| 6 | 25 | 97 | Side channel | IR | 13.5 | Cyprinidae | 2 | 9.00 | 8.00 |
| 6 | 25 | 97 | Side channel | IR | 13.5 | Centrarchidae | 2 | 1.00 | 1.00 |
| 6 | 25 | 97 | Side channel | IR | 13.5 | Moronidae | 2 | 3.50 | 1.50 |
| 6 | 25 | 97 | Side channel | IR | 13.5 | Unidentified | 2 | 15.50 | 9.50 |
| 6 | 26 | 97 | Main channel | 26 | 208.5 | Freshwater drum | 2 | 37.50 | 27.50 |
| 6 | 26 | 97 | Main channel | 26 | 208.5 | Clupeidae | 2 | 30.00 | 24.00 |
| 6 | 26 | 97 | Main channel | 26 | 208.5 | Catostomidae | 2 | 89.00 | 40.00 |
| 6 | 26 | 97 | Main channel | 26 | 215.7 | Common carp | 2 | 1.50 | 0.50 |
| 6 | 26 | 97 | Main channel | 26 | 215.7 | Freshwater drum | 2 | 107.50 | 68.50 |
| 6 | 26 | 97 | Main channel | 26 | 215.7 | Clupeidae | 2 | 46.00 | 9.00 |
| 6 | 26 | 97 | Main channel | 26 | 215.7 | Catostomidae | 2 | 49.50 | 5.50 |
| 6 | 26 | 97 | Main channel | 26 | 215.7 | Hiodontidae | 2 | 1.50 | 1.50 |
| 6 | 26 | 97 | Main channel | 26 | 223.0 | Common carp | 2 | 1.00 | 0.00 |
| 6 | 26 | 97 | Main channel | 26 | 223.0 | Freshwater drum | 2 | 111.00 | 109.00 |
| 6 | 26 | 97 | Main channel | 26 | 223.0 | Clupeidae | 2 | 10.50 | 10.50 |
| 6 | 26 | 97 | Main channel | 26 | 223.0 | Catostomidae | 2 | 30.50 | 24.50 |
| 6 | 26 | 97 | Main channel | 26 | 223.0 | Cyprinidae | 2 | 7.00 | 7.00 |
| 6 | 26 | 97 | Main channel | 26 | 233.5 | Common carp | 2 | 2.00 | 1.00 |
| 6 | 26 | 97 | Main channel | 26 | 233.5 | Freshwater drum | 2 | 320.50 | 108.50 |

Appendix Table C continued.

| Month | Day | Year | Stratum | River Mile | | Taxon | N | Mean | + 1 SE |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 26 | 97 | Main channel | 26 | 233.5 | Clupeidae | 2 | 5.00 | 5.00 |
| 6 | 26 | 97 | Main channel | 26 | 233.5 | Catostomidae | 2 | 26.00 | 11.00 |
| 6 | 26 | 97 | Main channel | 26 | 233.5 | Cyprinidae | 2 | 6.50 | 1.50 |
| 6 | 26 | 97 | Main channel | 26 | 233.5 | Moronidae | 2 | 1.50 | 0.50 |
| 6 | 26 | 97 | Main channel | 26 | 233.5 | Percidae | 2 | 2.50 | 2.50 |
| 6 | 26 | 97 | Side channel | 26 | 208.5 | Common carp | 2 | 5.50 | 0.50 |
| 6 | 26 | 97 | Side channel | 26 | 208.5 | Freshwater drum | 2 | 509.00 | 166.00 |
| 6 | 26 | 97 | Side channel | 26 | 208.5 | Clupeidae | 2 | 91.00 | 51.00 |
| 6 | 26 | 97 | Side channel | 26 | 208.5 | Catostomidae | 2 | 21.50 | 4.50 |
| 6 | 26 | 97 | Side channel | 26 | 208.5 | Centrarchidae | 2 | 0.50 | 0.50 |
| 6 | 26 | 97 | Side channel | 26 | 208.5 | Moronidae | 2 | 3.50 | 3.50 |
| 6 | 26 | 97 | Side channel | 26 | 215.7 | Common carp | 2 | 5.50 | 3.50 |
| 6 | 26 | 97 | Side channel | 26 | 215.7 | Freshwater drum | 2 | 33.00 | 24.00 |
| 6 | 26 | 97 | Side channel | 26 | 215.7 | Clupeidae | 2 | 922.50 | 909.50 |
| 6 | 26 | 97 | Side channel | 26 | 215.7 | Catostomidae | 2 | 39.50 | 3.50 |
| 6 | 26 | 97 | Side channel | 26 | 215.7 | Cyprinidae | 2 | 22.00 | 22.00 |
| 6 | 26 | 97 | Side channel | 26 | 215.7 | Centrarchidae | 2 | 5.50 | 5.50 |
| 6 | 26 | 97 | Side channel | 26 | 215.7 | Unidentified | 2 | 2.50 | 2.50 |
| 6 | 26 | 97 | Side channel | 26 | 222.6 | Common carp | 2 | 3.00 | 1.00 |
| 6 | 26 | 97 | Side channel | 26 | 222.6 | Freshwater drum | 2 | 107.50 | 60.50 |
| 6 | 26 | 97 | Side channel | 26 | 222.6 | Clupeidae | 2 | 12.50 | 0.50 |
| 6 | 26 | 97 | Side channel | 26 | 222.6 | Catostomidae | 2 | 74.50 | 37.50 |
| 6 | 26 | 97 | Side channel | 26 | 222.6 | Cyprinidae | 2 | 0.50 | 0.50 |
| 6 | 26 | 97 | Side channel | 26 | 222.6 | Moronidae | 2 | 1.00 | 1.00 |
| 6 | 26 | 97 | Side channel | 26 | 222.6 | Unidentified | 2 | 9.00 | 9.00 |
| 6 | 26 | 97 | Side channel | 26 | 233.5 | Common carp | 2 | 2.50 | 1.50 |
| 6 | 26 | 97 | Side channel | 26 | 233.5 | Freshwater drum | 2 | 71.00 | 11.00 |
| 6 | 26 | 97 | Side channel | 26 | 233.5 | Clupeidae | 2 | 9.00 | 7.00 |
| 6 | 26 | 97 | Side channel | 26 | 233.5 | Catostomidae | 2 | 9.00 | 1.00 |
| 6 | 26 | 97 | Side channel | 26 | 233.5 | Cyprinidae | 2 | 1.50 | 1.50 |
| 6 | 26 | 97 | Side channel | 26 | 233.5 | Centrarchidae | 2 | 0.50 | 0.50 |
| 6 | 26 | 97 | Side channel | 26 | 233.5 | Moronidae | 2 | 0.50 | 0.50 |
| 6 | 26 | 97 | Side channel | 26 | 233.5 | Unidentified | 2 | 1.50 | 1.50 |
| 7 | 8 | 97 | Main channel | 26 | 208.5 | Common carp | 2 | 0.50 | 0.50 |
| 7 | 8 | 97 | Main channel | 26 | 208.5 | Clupeidae | 2 | 2.00 | 0.00 |
| 7 | 8 | 97 | Main channel | 26 | 208.5 | Catostomidae | 2 | 2.00 | 2.00 |
| 7 | 8 | 97 | Main channel | 26 | 208.5 | Cyprinidae | 2 | 10.50 | 3.50 |
| 7 | 8 | 97 | Main channel | 26 | 215.7 | Freshwater drum | 2 | 1.00 | 0.00 |
| 7 | 8 | 97 | Main channel | 26 | 215.7 | Clupeidae | 2 | 1.00 | 0.00 |

Appendix Table C continued.

| Month | Day | Year | Stratum | River Mile | | Taxon | N | Mean | + 1 SE |
|---|---|---|---|---|---|---|---|---|---|
| 7 | 8 | 97 | Main channel | 26 | 215.7 | Catostomidae | 2 | 5.50 | 2.50 |
| 7 | 8 | 97 | Main channel | 26 | 215.7 | Cyprinidae | 2 | 25.50 | 6.50 |
| 7 | 8 | 97 | Main channel | 26 | 223.0 | Clupeidae | 1 | 11.00 | |
| 7 | 8 | 97 | Main channel | 26 | 223.0 | Catostomidae | 1 | 5.00 | |
| 7 | 8 | 97 | Main channel | 26 | 223.0 | Cyprinidae | 1 | 32.00 | |
| 7 | 8 | 97 | Main channel | 26 | 223.0 | Lepisosteidae | 1 | 1.00 | |
| 7 | 8 | 97 | Main channel | 26 | 233.5 | Freshwater drum | 2 | 4.50 | 1.50 |
| 7 | 8 | 97 | Main channel | 26 | 233.5 | Gambusia | 2 | 1.00 | 0.00 |
| 7 | 8 | 97 | Main channel | 26 | 233.5 | Clupeidae | 2 | 3.50 | 1.50 |
| 7 | 8 | 97 | Main channel | 26 | 233.5 | Catostomidae | 2 | 2.50 | 0.50 |
| 7 | 8 | 97 | Main channel | 26 | 233.5 | Cyprinidae | 2 | 30.50 | 7.50 |
| 7 | 8 | 97 | Main channel | 26 | 233.5 | Centrarchidae | 2 | 0.50 | 0.50 |
| 7 | 8 | 97 | Side channel | 26 | 208.5 | Freshwater drum | 1 | 4.00 | |
| 7 | 8 | 97 | Side channel | 26 | 208.5 | Clupeidae | 1 | 20.00 | |
| 7 | 8 | 97 | Side channel | 26 | 208.5 | Catostomidae | 1 | 13.00 | |
| 7 | 8 | 97 | Side channel | 26 | 208.5 | Cyprinidae | 1 | 20.00 | |
| 7 | 8 | 97 | Side channel | 26 | 208.5 | Hiodontidae | 1 | 1.00 | |
| 7 | 8 | 97 | Side channel | 26 | 215.7 | Cyprinidae | 2 | 26.00 | 26.00 |
| 7 | 8 | 97 | Side channel | 26 | 222.6 | Freshwater drum | 2 | 4.00 | 3.00 |
| 7 | 8 | 97 | Side channel | 26 | 222.6 | Clupeidae | 2 | 7.00 | 2.00 |
| 7 | 8 | 97 | Side channel | 26 | 222.6 | Catostomidae | 2 | 10.50 | 10.50 |
| 7 | 8 | 97 | Side channel | 26 | 222.6 | Cyprinidae | 2 | 19.00 | 6.00 |
| 7 | 8 | 97 | Side channel | 26 | 233.5 | Clupeidae | 2 | 4.00 | 1.00 |
| 7 | 8 | 97 | Side channel | 26 | 233.5 | Catostomidae | 2 | 1.00 | 1.00 |
| 7 | 8 | 97 | Side channel | 26 | 233.5 | Cyprinidae | 2 | 44.50 | 5.50 |
| 7 | 9 | 97 | Backwater | IR | 9.3 | Silversides | 2 | 48.50 | 42.50 |
| 7 | 9 | 97 | Backwater | IR | 9.3 | Clupeidae | 2 | 5.00 | 0.00 |
| 7 | 9 | 97 | Backwater | IR | 9.3 | Centrarchidae | 2 | 495.50 | 161.50 |
| 7 | 10 | 97 | Main channel | IR | 13.5 | Clupeidae | 1 | 24.00 | |
| 7 | 10 | 97 | Main channel | IR | 13.5 | Catostomidae | 1 | 48.00 | |
| 7 | 10 | 97 | Side channel | IR | 13.5 | Freshwater drum | 2 | 2.00 | 1.00 |
| 7 | 10 | 97 | Side channel | IR | 13.5 | Clupeidae | 2 | 8.00 | 4.00 |
| 7 | 10 | 97 | Side channel | IR | 13.5 | Cyprinidae | 2 | 2.00 | 0.00 |
| 7 | 22 | 97 | Main channel | 26 | 208.5 | Common carp | 2 | 0.50 | 0.50 |
| 7 | 22 | 97 | Main channel | 26 | 208.5 | Clupeidae | 2 | 1.00 | 1.00 |
| 7 | 22 | 97 | Main channel | 26 | 208.5 | Catostomidae | 2 | 4.50 | 0.50 |
| 7 | 22 | 97 | Main channel | 26 | 208.5 | Cyprinidae | 2 | 26.00 | 3.00 |
| 7 | 22 | 97 | Main channel | 26 | 208.5 | Centrarchidae | 2 | 0.50 | 0.50 |
| 7 | 22 | 97 | Main channel | 26 | 215.7 | Freshwater drum | 2 | 1.00 | 1.00 |

Appendix Table C continued.

| Month | Day | Year | Stratum | River Mile | | Taxon | N | Mean | + 1 SE |
|---|---|---|---|---|---|---|---|---|---|
| 7 | 22 | 97 | Main channel | 26 | 215.7 | Gambusia | 2 | 0.50 | 0.50 |
| 7 | 22 | 97 | Main channel | 26 | 215.7 | Catostomidae | 2 | 0.50 | 0.50 |
| 7 | 22 | 97 | Main channel | 26 | 215.7 | Cyprinidae | 2 | 8.50 | 4.50 |
| 7 | 22 | 97 | Main channel | 26 | 223.0 | Freshwater drum | 2 | 1.00 | 0.00 |
| 7 | 22 | 97 | Main channel | 26 | 223.0 | Clupeidae | 2 | 0.50 | 0.50 |
| 7 | 22 | 97 | Main channel | 26 | 223.0 | Catostomidae | 2 | 3.50 | 1.50 |
| 7 | 22 | 97 | Main channel | 26 | 223.0 | Cyprinidae | 2 | 44.00 | 3.00 |
| 7 | 22 | 97 | Main channel | 26 | 233.5 | Freshwater drum | 2 | 1.00 | 1.00 |
| 7 | 22 | 97 | Main channel | 26 | 233.5 | Gambusia | 2 | 0.50 | 0.50 |
| 7 | 22 | 97 | Main channel | 26 | 233.5 | Catostomidae | 2 | 5.00 | 3.00 |
| 7 | 22 | 97 | Main channel | 26 | 233.5 | Cyprinidae | 2 | 48.00 | 1.00 |
| 7 | 22 | 97 | Main channel | 26 | 233.5 | Hiodontidae | 2 | 0.50 | 0.50 |
| 7 | 22 | 97 | Side channel | 26 | 215.7 | Freshwater drum | 2 | 1.50 | 0.50 |
| 7 | 22 | 97 | Side channel | 26 | 215.7 | Clupeidae | 2 | 0.50 | 0.50 |
| 7 | 22 | 97 | Side channel | 26 | 215.7 | Cyprinidae | 2 | 75.00 | 10.00 |
| 7 | 22 | 97 | Side channel | 26 | 215.7 | Unidentified | 2 | 2.00 | 1.00 |
| 7 | 22 | 97 | Side channel | 26 | 222.6 | Freshwater drum | 2 | 3.50 | 3.50 |
| 7 | 22 | 97 | Side channel | 26 | 222.6 | Catostomidae | 2 | 14.00 | 1.00 |
| 7 | 22 | 97 | Side channel | 26 | 222.6 | Cyprinidae | 2 | 72.00 | 9.00 |
| 7 | 22 | 97 | Side channel | 26 | 222.6 | Hiodontidae | 2 | 0.50 | 0.50 |
| 7 | 22 | 97 | Side channel | 26 | 222.6 | Centrarchidae | 2 | 0.50 | 0.50 |
| 7 | 22 | 97 | Side channel | 26 | 222.6 | Unidentified | 2 | 0.50 | 0.50 |
| 7 | 22 | 97 | Side channel | 26 | 233.5 | Freshwater drum | 1 | 5.00 | |
| 7 | 22 | 97 | Side channel | 26 | 233.5 | Catostomidae | 1 | 5.00 | |
| 7 | 22 | 97 | Side channel | 26 | 233.5 | Cyprinidae | 1 | 140.00 | |
| 7 | 22 | 97 | Side channel | 26 | 233.5 | Unidentified | 1 | 1.00 | |
| 7 | 23 | 97 | Main channel | IR | 13.5 | Clupeidae | 2 | 17.00 | 6.00 |
| 7 | 23 | 97 | Main channel | IR | 13.5 | Cyprinidae | 2 | 4.50 | 4.50 |
| 7 | 23 | 97 | Main channel | IR | 13.5 | Centrarchidae | 2 | 1.00 | 1.00 |
| 7 | 23 | 97 | Side channel | IR | 13.5 | Clupeidae | 2 | 12.00 | 1.00 |
| 7 | 23 | 97 | Side channel | IR | 13.5 | Cyprinidae | 2 | 0.50 | 0.50 |
| 7 | 25 | 97 | Backwater | IR | 9.3 | Silversides | 2 | 40.00 | 29.00 |
| 7 | 25 | 97 | Backwater | IR | 9.3 | Gambusia | 2 | 2.50 | 0.50 |
| 7 | 25 | 97 | Backwater | IR | 9.3 | Clupeidae | 2 | 5.50 | 5.50 |
| 7 | 25 | 97 | Backwater | IR | 9.3 | Centrarchidae | 2 | 197.50 | 24.50 |

Appendix D. Catch per unit effort (CPUE; number/h) for each species of small fish collected using a bottom beam trawl in the lower Illinois River and in Pool 26 of the Mississippi River during July and September 1997. DNT=did not trawl.

| River mile | Species | CPUE (number/h) August | CPUE (number/h) September |
|---|---|---|---|
| | Illinois River | | |
| 5.5 | Blue catfish | DNT | 0.0 |
| | Channel catfish | DNT | 7.8 |
| | Common carp | DNT | 7.8 |
| | Freshwater drum | DNT | 100.2 |
| | Gizzard shad | DNT | 43.8 |
| | River carpsucker | DNT | 4.2 |
| | Smallmouth buffalo | DNT | 4.2 |
| 9.3 | Blue catfish | DNT | 0.0 |
| | Channel catfish | DNT | 12.0 |
| | Common carp | DNT | 0.0 |
| | Freshwater drum | DNT | 64.2 |
| | Gizzard shad | DNT | 4.2 |
| | River carpsucker | DNT | 0.0 |
| | Smallmouth buffalo | DNT | 4.2 |
| 13.5 | Blue catfish | DNT | 4.2 |
| | Channel catfish | DNT | 7.8 |
| | Common carp | DNT | 0.0 |
| | Freshwater drum | DNT | 91.8 |
| | River carpsucker | DNT | 0.0 |
| | Smallmouth buffalo | DNT | 4.2 |

Appendix Table D continued.

| River mile | Species | CPUE (number/h) | |
|---|---|---|---|
| | | August | September |
| | Mississippi River | | |
| 203.2 | Channel catfish | 54.0 | 0.0 |
| | Freshwater drum | 18.0 | 0.0 |
| | Gizzard shad | 0.0 | 4.2 |
| | Goldeye | 6.0 | 0.0 |
| | Mooneye | 30.0 | 0.0 |
| | Skipjack herring | 0.0 | 0.0 |
| | Unidentified sunfish | 0.0 | 4.2 |
| | White bass | 0.0 | 0.0 |
| 207.1 | Channel catfish | 0.0 | 9.0 |
| | Freshwater drum | 0.0 | 3.0 |
| | Gizzard shad | 0.0 | 0.0 |
| | Goldeye | 0.0 | 0.0 |
| | Mooneye | 0.0 | 0.0 |
| | Skipjack herring | 0.0 | 0.0 |
| | Unidentified sunfish | 0.0 | 0.0 |
| | White bass | 0.0 | 0.0 |
| 211.2 | Channel catfish | DNT | 0.0 |
| | Freshwater drum | DNT | 0.0 |
| | Gizzard shad | DNT | 0.0 |
| | Goldeye | DNT | 4.2 |
| | Mooneye | DNT | 4.2 |
| | Skipjack herring | DNT | 0.0 |
| | Unidentified sunfish | DNT | 0.0 |

| River | | CPUE (number/h) | |
|---|---|---|---|
| mile | Species | August | September |
| | White bass | DNT | 4.2 |
| 213.6 | Channel catfish | DNT | 30.0 |
| | Freshwater drum | DNT | 3.0 |
| | Gizzard shad | DNT | 0.0 |
| | Goldeye | DNT | 0.0 |
| | Mooneye | DNT | 0.0 |
| | Skipjack herring | DNT | 0.0 |
| | Unidentified sunfish | DNT | 0.0 |
| | White bass | DNT | 0.0 |
| 215.7 | Channel catfish | 42.0 | DNT |
| | Freshwater drum | 66.0 | DNT |
| | Gizzard shad | 0.0 | DNT |
| | Goldeye | 0.0 | DNT |
| | Mooneye | 12.0 | DNT |
| | Skipjack herring | 0.0 | DNT |
| | Unidentified sunfish | 0.0 | DNT |
| | White bass | 0.0 | DNT |
| 223.0 | Channel catfish | 138.0 | 0.0 |
| | Freshwater drum | 0.0 | 0.0 |
| | Gizzard shad | 0.0 | 0.0 |
| | Goldeye | 0.0 | 0.0 |
| | Mooneye | 6.0 | 0.0 |
| | Skipjack herring | 0.0 | 3.0 |
| | Unidentified sunfish | 0.0 | 0.0 |

| River mile | Species | CPUE (number/h) | |
|---|---|---|---|
| | | August | September |
| 223.0 | White bass | 0.0 | 0.0 |
| 227.1 | Channel catfish | 72.0 | 0.0 |
| | Freshwater drum | 12.0 | 0.0 |
| | Gizzard shad | 0.0 | 0.0 |
| | Goldeye | 6.0 | 3.0 |
| | Mooneye | 6.0 | 3.0 |
| | Skipjack herring | 0.0 | 0.0 |
| | Unidentified sunfish | 0.0 | 0.0 |
| | White bass | 0.0 | 0.0 |
| 233.5 | Channel catfish | 108.0 | 0.0 |
| | Freshwater drum | 6.0 | 0.0 |
| | Gizzard shad | 0.0 | 0.0 |
| | Goldeye | 0.0 | 0.0 |
| | Mooneye | 6.0 | 0.0 |
| | Skipjack herring | 0.0 | 0.0 |
| | Unidentified sunfish | 0.0 | 0.0 |
| | White bass | 0.0 | 0.0 |
| 238.2 | Channel catfish | 96.0 | 0.0 |
| | Freshwater drum | 0.0 | 0.0 |
| | Gizzard shad | 0.0 | 0.0 |
| | Goldeye | 0.0 | 0.0 |
| | Mooneye | 12.0 | 0.0 |
| | Skipjack herring | 0.0 | 0.0 |
| | Unidentified sunfish | 0.0 | 0.0 |

| River | | CPUE (number/h) | |
|---|---|---|---|
| mile | Species | August | September |
| 238.2 | White bass | 0.0 | 0.0 |

Appendix E. Catch per unit effort (CPUE; number/h) for each adult fishes collected using the rockhopper bottom trawl in the lower Illinois River and in Pool 26 of the Mississippi River, 1996-1997.

Appendix Table E-1. Total catch per unit effort, CPUE (1 SE) expressed as catch per hour of rockhopper trawling of all species captured in the lower Illinois River during August-December, 1996. DNT=did not trawl. One trawl sample was conducted at River Mile 16.5 in August, yielding a CPUE of 4.0 fish per hour.

| | Mean CPUE ( 1 SE) | | | |
|---|---|---|---|---|
| River mile | August | October | November | December |
| 5.5 | DNT | 370.93(118.07) | 941.25 | 15.00 |
| 9.3 | DNT | 222.00(90.00) | 414.00 | 27.69 |
| 13.5 | 6.0 | 436.50(211.50) | 927.00 | 24.00 |
| 18.7 | 3.0 | 196.25(70.75) | 96.00 | 0.00 |

Appendix Table E-2. Catch per unit effort, CPUE (1 SE) expressed as catch per hour of rockhopper trawling for individual species at each sampling location during August-December, 1996. DNT=did not trawl. One trawl sample was conducted at River Mile 16.5 in August, yielding a CPUE of 4.0 freshwater drum per hour.

| Species | River mile | Mean CPUE (1 SE) Aug | Oct | Nov | Dec |
|---|---|---|---|---|---|
| Bigmouth buffalo | 5.5 | DNT | 0 | 0 | 0 |
| | 9.3 | DNT | 4.5(4.5) | 0 | 0 |
| | 13.5 | 0 | 0 | 3.0 | 0 |
| | 18.7 | 0 | 1.5(1.5) | 0 | 0 |
| Blue catfish | 5.5 | DNT | 2.1(2.1) | 3.8 | 0 |
| | 9.3 | DNT | 0 | 0 | 0 |
| | 13.5 | 0 | 0 | 6.0 | 0 |
| | 18.7 | 0 | 3.0(3.0) | 0 | 0 |
| Channel catfish | 5.5 | DNT | 66.0(36.0) | 45.0 | 6.0 |
| | 9.3 | DNT | 10.5(1.5) | 60.0 | 4.6 |
| | 13.5 | 0 | 19.5(4.5) | 189.0 | 12.0 |
| | 18.7 | 0 | 25.5(1.5) | 24.0 | 0 |
| Common carp | 5.5 | DNT | 6.0(6.0) | 18.8 | 0 |
| | 9.3 | DNT | 12.0(6.0) | 6.0 | 0 |
| | 13.5 | 0 | 6.0(0.0) | 6.0 | 0 |
| | 18.7 | 3.0 | 6.8(2.3) | 6.0 | 0 |

Appendix Table E-2, continued

| | | | | | |
|---|---|---|---|---|---|
| Flathead catfish | 5.5 | DNT | 0 | 0 | 0 |
| | 9.3 | DNT | 0 | 0 | 9.2 |
| | 13.5 | 0 | 0 | 0 | 0 |
| | 18.7 | 0 | 1.5(1.5) | 0 | 0 |
| Freshwater Drum | 5.5 | DNT | 284.4(78.6) | 847.5 | 3.0 |
| | 9.3 | DNT | 133.5(103.5) | 309.0 | 4.6 |
| | 13.5 | 3.0 | 403.5(205.5) | 678.0 | 3.0 |
| | 18.7 | 0 | 143.8(54.3) | 51.0 | 0 |
| Gizzard shad | 5.5 | DNT | 3.0(3.0) | 0 | 3.0 |
| | 9.3 | DNT | 21.0(15.0) | 3.0 | 0 |
| | 13.5 | 3.0 | 3.0(3.0) | 27.0 | 6.0 |
| | 18.7 | 0 | 6.0(6.0) | 3.0 | 0 |
| Highfin carpsucker | 5.5 | DNT | 0 | 0 | 0 |
| | 9.3 | DNT | 0 | 0 | 0 |
| | 13.5 | 0 | 0 | 0 | 0 |
| | 18.7 | 0 | 0 | 6.0 | 0 |
| Sauger | 5.5 | DNT | 0 | 7.5 | 0 |
| | 9.3 | DNT | 0 | 0 | 0 |
| | 13.5 | 0 | 1.5(1.5) | 0 | 3.0 |
| | 18.7 | 0 | 1.5(1.5) | 0 | 0 |

Appendix Table E-2, continued

| | | | | | |
|---|---|---|---|---|---|
| Shorthead redhorse | 5.5 | DNT | 0 | 3.8 | 0 |
| | 9.3 | DNT | 0 | 0 | 0 |
| | 13.5 | 0 | 0 | 0 | 0 |
| | 18.7 | 0 | 0 | 3.0 | 0 |
| Shortnose gar | 5.5 | DNT | 1.5(1.5) | 0 | 0 |
| | 9.3 | DNT | 0 | 0 | 0 |
| | 13.5 | 0 | 0 | 0 | 0 |
| | 18.7 | 0 | 0 | 0 | 0 |
| Smallmouth buffalo | 5.5 | DNT | 3.6(0.6) | 15.0 | 3.0 |
| | 9.3 | DNT | 40.5(25.5) | 36.0 | 4.6 |
| | 13.5 | 0 | 1.5(1.5) | 18.0 | 0 |
| | 18.7 | 0 | 3.0(3.0) | 0 | 0 |
| White bass | 5.5 | DNT | 4.3(4.3) | 0 | 0 |
| | 9.3 | DNT | 0 | 0 | 4.6 |
| | 13.5 | 0 | 1.5(1.5) | 0 | 0 |
| | 18.7 | 0 | 6.8(2.3) | 0 | 0 |

Appendix Table E-3. Total catch per unit effort, CPUE (1 SE) expressed as catch per hour of rockhopper trawling for all species captured in lower Illinois River during June-November, 1997. DNT=did not trawl

| | Mean CPUE (1 SE) | | | |
|---|---|---|---|---|
| River mile | June | July | September | November |
| 5.5 | 90.0 | 255.0(65.0) | 253.5(106.5) | 1432.0 |
| 9.3 | 34.3 | 69.0 | 157.5(28.5) | 576.0 |
| 13.5 | DNT | 210.0 | 138.0(69.0) | DNT |
| 18.7 | DNT | 387.0 | 90.0 | DNT |

Appendix Table E-4. Total catch per unit effort, CPUE (1 SE) expressed as catch per hour of rockhopper trawling for each species captured in the lower Illinois River during June-November, 1997. DNT=did not trawl

| | River | Mean CPUE (± 1 SE) | | | |
|---|---|---|---|---|---|
| Species | mile | June | July | September | November |
| Blue catfish | 5.5 | 0 | 0 | 1.5(1.5) | 0 |
| | 9.3 | 0 | 0 | 6.0(3.0) | 0 |
| | 13.5 | DNT | 0 | 0 | DNT |
| | 18.7 | DNT | 0 | 0 | DNT |
| Channel catfish | 5.5 | 69.0 | 6.5(1.5) | 12.0(0.0) | 0 |
| | 9.3 | 34.3 | 0 | 9.0(3.0) | 36.0 |
| | 13.5 | DNT | 6.0 | 6.0(3.0) | DNT |
| | 18.7 | DNT | 24.0 | 3.0 | DNT |
| Common carp | 5.5 | 0 | 8.0(8.0) | 25.5(16.5) | 0 |
| | 9.3 | 0 | 3.0 | 12.0(0.0) | 0 |
| | 13.5 | DNT | 3.0 | 1.5(1.5) | DNT |
| | 18.7 | DNT | 0 | 0 | DNT |
| Flathead catfish | 5.5 | 0 | 2.0(2.0) | 1.5(1.5) | 0 |
| | 9.3 | 0 | 3.0 | 0 | 0 |
| | 13.5 | DNT | 0 | 3.0(3.0) | DNT |
| | 18.7 | DNT | 0 | 0 | DNT |
| Freshwater drum | 5.5 | 12.0 | 194.0(74.0) | 153.0(45.0) | 12.0 |
| | 9.3 | 0 | 51.0 | 88.5(16.5) | 516.0 |
| | 13.5 | DNT | 153.0 | 123.0(66.0) | DNT |
| | 18.7 | DNT | 351.0 | 81.0 | DNT |

Appendix Table E-4, continued

| | | | | | |
|---|---|---|---|---|---|
| Gizzard shad | 5.5 | 0 | 0 | 25.5(19.5) | 1412.0 |
| | 9.3 | 0 | 0 | 1.5(1.5) | 24.0 |
| | 13.5 | DNT | 3.0 | 1.5(1.5) | DNT |
| | 18.7 | DNT | 0 | 6.0 | DNT |
| Mooneye | 5.5 | 0 | 0 | 0 | 4.0 |
| | 9.3 | 0 | 0 | 0 | 0 |
| | 13.5 | DNT | 0 | 0 | DNT |
| | 18.7 | DNT | 0 | 0 | DNT |
| River carpsucker | 5.5 | 0 | 2.0(2.0) | 1.5(1.5) | 0 |
| | 9.3 | 0 | 0 | 0 | 0 |
| | 13.5 | DNT | 0 | 1.5(1.5) | DNT |
| | 18.7 | DNT | 0 | 0 | DNT |
| Smallmouth buffalo | 5.5 | 9.0 | 42.5(22.5) | 33.0(21.0) | 0 |
| | 9.3 | 0 | 12.0 | 40.5(40.5) | 0 |
| | 13.5 | DNT | 45.0 | 1.5(1.5) | DNT |
| | 18.7 | DNT | 12.0 | 0 | DNT |
| White bass | 5.5 | 0 | 0 | 0 | 4.0 |
| | 9.3 | 0 | 0 | 0 | 0 |
| | 13.5 | DNT | 0 | 0 | DNT |
| | 18.7 | DNT | 0 | 0 | DNT |

Appendix Table E-5. Total catch per unit effort, CPUE (1 SE) expressed as catch per hour of rockhopper trawling for all species captured in Pool 26 of the Mississippi River during August-December, 1996. DNT=did not trawl

| | Mean CPUE (1 SE) | | | |
|---|---|---|---|---|
| River mile[a] | August | October | November | December |
| 203.2 | DNT | 109.4(20.7) | 45.0 | 3.0 |
| 207.1 | 69.00 | 425.5(62.6) | 44.5(36.5) | 3.0 |
| 213.6 | 63.8(27.8) | 162.3(55.2) | 12.0(6.0) | 18.0 |
| 215.7 | 24.0(3.0) | 165.0(78.0) | 15.0(6.0) | 6.0 |
| 223.0 | 9.0 | 30.7(17.3) | 16.5(4.5) | 6.32 |
| 227.2 | 135.0(45.0) | 720.6(115.8) | 68.7(3.3) | 12.0 |
| 230.5 | 39.0 | 1492.0 | 64.0(1.0) | 27.0 |
| 233.5 | DNT | 821.0(601.0) | 30.0 | 54.0 |
| 238.2 | DNT | 432.5(284.5) | 66.0(33.0) | 6.0 |

[a] Data from one trawl sample taken at river mile 211.2 is included in the mean for river mile 213.6 and data from one trawl sample taken at river mile 225.8 is included in the mean for river mile 227.2.

Appendix Table E-6. Mean catch per unit effort, CPUE (1 SE) expressed as catch per hour of rockhopper trawling for each species captured collected by rockhopper trawling in the navigation channel of Pool 26 of the Mississippi River during August-December 1996. DNT=did not trawl.

| | | Mean CPUE (1 SE) | | | |
|---|---|---|---|---|---|
| Species | River mile[a] | Aug | Oct | Nov | Dec |
| Bigmouth | 203.2 | DNT | 3.6(1.8) | 0 | 0 |
| buffalo | 207.1 | 0 | 23.2(12.8) | 0 | 0 |
| | 213.6 | 0 | 1.9(1.9) | 0 | 0 |
| | 215.7 | 0 | 0 | 0 | 0 |
| | 223.0 | 0 | 0 | 0 | 0 |
| | 227.2 | 0 | 5.0(2.6) | 0 | 0 |
| | 230.5 | 0 | 0 | 0 | 0 |
| | 233.5 | DNT | 36.0(36.0) | 0 | 0 |
| | 238.2 | DNT | 3.5(0.5) | 0 | 0 |
| Black crappie | 203.2 | DNT | 0 | 0 | 0 |
| | 207.1 | 0 | 0 | 0 | 0 |
| | 213.6 | 0 | 0 | 0 | 0 |
| | 215.7 | 0 | 0 | 0 | 0 |
| | 223.0 | 0 | 0 | 0 | 0 |
| | 227.2 | 0 | 1.0(1.0) | 0 | 0 |
| | 230.5 | 0 | 0 | 0 | 0 |
| | 233.5 | DNT | 0 | 0 | 0 |
| | 238.2 | DNT | 0 | 0 | 0 |

Appendix Table E-6, continued

| | | | | | |
|---|---|---|---|---|---|
| Black buffalo | 203.2 | DNT | 0.8(0.8) | 0 | 0 |
| | 207.1 | 0 | 0 | 0 | 0 |
| | 213.6 | 0 | 0 | 0 | 0 |
| | 215.7 | 6.0(6.0) | 0 | 0 | 0 |
| | 223.0 | 0 | 0 | 0 | 0 |
| | 227.2 | 0 | 0 | 0 | 0 |
| | 230.5 | 0 | 0 | 0 | 0 |
| | 233.5 | DNT | 0 | 0 | 0 |
| | 238.2 | DNT | 0 | 0 | 0 |
| Blue catfish | 203.2 | DNT | 7.5(4.5) | 6.0 | 0 |
| | 207.1 | 0 | 29.9(9.2) | 5.4(5.4) | 0 |
| | 213.6 | 4.6(1.4) | 1.9(1.9) | 0 | 0 |
| | 215.7 | 0 | 1.5(1.5) | 0 | 0 |
| | 223.0 | 0 | 0 | 0 | 0 |
| | 227.2 | 0 | 5.0(3.6) | 0 | 0 |
| | 230.5 | 0 | 0 | 0 | 0 |
| | 233.5 | DNT | 0 | 0 | 0 |
| | 238.2 | DNT | 0 | 0 | 0 |
| Blue sucker | 203.2 | DNT | 0 | 0 | 0 |
| | 207.1 | 0 | 0 | 0 | 0 |
| | 213.6 | 0 | 0 | 0 | 0 |
| | 215.7 | 0 | 0 | 0 | 0 |
| | 223.0 | 0 | 2.3(1.2) | 0 | 0 |

Appendix Table E-6, continued

| | | | | | |
|---|---|---|---|---|---|
| | 227.2 | 0 | 0 | 0 | 0 |
| | 230.5 | 0 | 0 | 0 | 3.0 |
| | 233.5 | DNT | 0 | 0 | 0 |
| | 238.2 | DNT | 0 | 0 | 0 |
| Channel catfish | 203.2 | DNT | 14.8(5.9) | 30.0 | 3.0 |
| | 207.1 | 69.0 | 83.5(27.3) | 11.5(11.5) | 3.0 |
| | 213.6 | 15.4(0.4) | 7.0(3.1) | 3.0(3.0) | 3.0 |
| | 215.7 | 3.0(3.0) | 4.5(4.5) | 3.0(3.0) | 0 |
| | 223.0 | 0 | 0 | 4.5(1.5) | 0 |
| | 227.2 | 11.6(0.4) | 26.8(10.7) | 19.9(1.1) | 0 |
| | 230.5 | 0 | 0 | 17.0(8.0) | 0 |
| | 233.5 | DNT | 3.0(3.0) | 6.0 | 0 |
| | 238.2 | DNT | 1.5(1.5) | 9.0(9.0) | 0 |
| Common carp | 203.2 | DNT | 0.8(0.8) | 0 | 0 |
| | 207.1 | 0 | 4.4(1.5) | 0 | 0 |
| | 213.6 | 0 | 15.0(11.1) | 0 | 0 |
| | 215.7 | 0 | 6.0(3.0) | 1.5(1.5) | 0 |
| | 223.0 | 3.0 | 2.3(1.2) | 0 | 0 |
| | 227.2 | 8.3(0.8) | 82.6(14.8) | 4.0(4.0) | 0 |
| | 230.5 | 0 | 4.0 | 0 | 0 |
| | 233.5 | DNT | 0 | 0 | 0 |
| | 238.2 | DNT | 11.0(7.0) | 0 | 0 |

Appendix Table E-6, continued

| | | | | | |
|---|---|---|---|---|---|
| Flathead | 203.2 | DNT | 1.5(1.5) | 0 | 0 |
| catfish | 207.1 | 0 | 1.5(0.9) | 0 | 0 |
| | 213.6 | 0 | 0.7(0.7) | 0 | 0 |
| | 215.7 | 0 | 1.5(1.5) | 0 | 0 |
| | 223.0 | 0 | 1.0(1.0) | 0 | 0 |
| | 227.2 | 1.9(1.9) | 0 | 1.5(1.5) | 0 |
| | 230.5 | 0 | 0 | 0 | 0 |
| | 233.5 | DNT | 0 | 0 | 0 |
| | 238.2 | DNT | 0 | 0 | 0 |
| Freshwater | 203.2 | DNT | 61.4(22.7) | 3.0 | 0 |
| drum | 207.1 | 0 | 186.3(60.3) | 22.6(19.3) | 0 |
| | 213.6 | 42.2(27.2) | 87.0(40.8) | 3.0(3.0) | 0 |
| | 215.7 | 12.0(3.0) | 117.0(63.0) | 6.0(6.0) | 0 |
| | 223.0 | 3.0 | 0 | 1.5(1.5) | 0 |
| | 227.2 | 80.6(24.4) | 212.2(67.6) | 20.4(8.4) | 0 |
| | 230.5 | 24.0 | 8.0 | 0 | 0 |
| | 233.5 | DNT | 0 | 0 | 0 |
| | 238.2 | DNT | 5.0(1.0) | 0 | 0 |
| Gizzard shad | 203.2 | DNT | 10.4(5.8) | 3.0 | 0 |
| | 207.1 | 0 | 22.7(9.9) | 0.8(0.8) | 0 |
| | 213.6 | 0 | 5.2(3.7) | 0 | 3.0 |
| | 215.7 | 0 | 3.0(3.0) | 4.5(1.5) | 0 |
| | 223.0 | 0 | 3.0(3.0) | 10.5(7.5) | 0 |

Appendix Table E-6, continued

| | | | | | |
|---|---|---|---|---|---|
| | 227.2 | 0 | 311.6(173.7) | 1.5(1.5) | 0 |
| | 230.5 | 0 | 1456.0 | 0 | 0 |
| | 233.5 | DNT | 675.0(519.0) | 3.0 | 3.0 |
| | 238.2 | DNT | 195.0(123.0) | 6.0(0.0) | 0 |
| Goldeye | 203.2 | DNT | 0 | 0 | 0 |
| | 207.1 | 0 | 2.1(1.3) | 0 | 0 |
| | 213.6 | 0 | 0 | 0 | 0 |
| | 215.7 | 0 | 0 | 0 | 0 |
| | 223.0 | 0 | 0 | 0 | 0 |
| | 227.2 | 0 | 0 | 0 | 0 |
| | 230.5 | 0 | 0 | 2.5(2.5) | 3.0 |
| | 233.5 | DNT | 0 | 0 | 0 |
| | 238.2 | DNT | 1.5(1.5) | 0 | 0 |
| Highfin carpsucker | 203.2 | DNT | 0 | 0 | 0 |
| | 207.1 | 0 | 0.8(0.8) | 0 | 0 |
| | 213.6 | 0 | 0 | 0 | 0 |
| | 215.7 | 0 | 0 | 0 | 0 |
| | 223.0 | 0 | 0 | 0 | 0 |
| | 227.2 | 0 | 0 | 0 | 0 |
| | 230.5 | 0 | 0 | 0 | 0 |
| | 233.5 | DNT | 0 | 0 | 6.0 |
| | 238.2 | DNT | 0 | 0 | 0 |

Appendix Table E-6, continued

| | | | | | |
|---|---|---|---|---|---|
| Lake sturgeon | 203.2 | DNT | 0 | 0 | 0 |
| | 207.1 | 0 | 0.8(0.8) | 0 | 0 |
| | 213.6 | 0 | 0 | 0 | 0 |
| | 215.7 | 0 | 0 | 0 | 0 |
| | 223.0 | 0 | 0 | 0 | 0 |
| | 227.2 | 3.4(0.4) | 1.0(1.0) | 1.5(1.5) | 3.0 |
| | 230.5 | 0 | 0 | 0 | 0 |
| | 233.5 | DNT | 0 | 0 | 0 |
| | 238.2 | DNT | 3.0(3.0) | 0 | 0 |
| Mooneye | 203.2 | DNT | 0 | 0 | 0 |
| | 207.1 | 0 | 2.0(2.0) | 0 | 0 |
| | 213.6 | 0 | 0 | 0 | 3.0 |
| | 215.7 | 0 | 0 | 0 | 0 |
| | 223.0 | 0 | 3.0(3.0) | 0 | 3.2 |
| | 227.2 | 0 | 12.8(8.6) | 3.0(3.0) | 3.0 |
| | 230.5 | 0 | 0 | 0 | 0 |
| | 233.5 | DNT | 42.0(6.0) | 0 | 27.0 |
| | 238.2 | DNT | 155.5(123.5) | 0 | 0 |
| Quillback | 203.2 | DNT | 1.4(1.4) | 0 | 0 |
| | 207.1 | 0 | 2.9(1.2) | 0 | 0 |
| | 213.6 | 0 | 1.3(0.8) | 0 | 0 |
| | 215.7 | 0 | 1.5(1.5) | 0 | 0 |
| | 223.0 | 0 | 2.7(2.7) | 0 | 0 |

Appendix Table E-6, continued

| | | | | | |
|---|---|---|---|---|---|
| | 227.2 | 0 | 1.0(1.0) | 0 | 0 |
| | 230.5 | 0 | 4.0 | 0 | 0 |
| | 233.5 | DNT | 0 | 0 | 0 |
| | 238.2 | DNT | 3.0(3.0) | 0 | 0 |
| River | 203.2 | DNT | 0 | 0 | 0 |
| carpsucker | 207.1 | 0 | 0.8(0.8) | 2.3(0.8) | 0 |
| | 213.6 | 0 | 0 | 0 | 0 |
| | 215.7 | 0 | 0 | 0 | 0 |
| | 223.0 | 0 | 0 | 0 | 0 |
| | 227.2 | 1.5(1.5) | 2.0(2.0) | 0 | 0 |
| | 230.5 | 0 | 0 | 0 | 0 |
| | 233.5 | DNT | 0 | 0 | 0 |
| | 238.2 | DNT | 0 | 0 | 0 |
| Sauger | 203.2 | DNT | 0 | 0 | 0 |
| | 207.1 | 0 | 5.9(2.8) | 0.8(0.8) | 0 |
| | 213.6 | 0 | 0 | 1.5(1.5) | 0 |
| | 215.7 | 0 | 0 | 0 | 0 |
| | 223.0 | 0 | 1.3(1.3) | 0 | 0 |
| | 227.2 | 0.8(0.8) | 1.0(1.0) | 3.5(0.5) | 0 |
| | 230.5 | 0 | 0 | 0 | 0 |
| | 233.5 | DNT | 0 | 3.0 | 0 |
| | 238.5 | DNT | 1.5(1.5) | 1.5(1.5) | 0 |

Appendix Table E-6, continued

| | | | | | |
|---|---|---|---|---|---|
| Shorthead redhorse | 203.2 | DNT | 0 | 3.0 | 0 |
| | 207.1 | 0 | 0 | 0 | 0 |
| | 213.6 | 0 | 0 | 0 | 6.0 |
| | 215.7 | 0 | 0 | 0 | 0 |
| | 223.0 | 0 | 0 | 0 | 0 |
| | 227.2 | 0 | 1.0(1.0) | 4.5(4.5) | 0 |
| | 230.5 | 0 | 0 | 5.0(5.0) | 3.0 |
| | 233.5 | DNT | 0 | 0 | 6.0 |
| | 238.2 | DNT | 0 | 1.5(1.5) | 0 |
| Shortnose gar | 203.2 | DNT | 0 | 0 | 0 |
| | 207.1 | 0 | 0 | 0 | 0 |
| | 213.6 | 0 | 0 | 0 | 0 |
| | 215.7 | 0 | 1.5(1.5) | 0 | 0 |
| | 223.0 | 0 | 0 | 0 | 0 |
| | 227.2 | 0 | 0 | 0 | 0 |
| | 230.5 | 0 | 0 | 0 | 0 |
| | 233.5 | DNT | 0 | 0 | 0 |
| | 238.2 | DNT | 0 | 0 | 0 |
| Shovelnose sturgeon | 203.2 | DNT | 0 | 0 | 0 |
| | 207.1 | 0 | 0 | 0 | 0 |
| | 213.6 | 0 | 1.3(1.3) | 1.5(1.5) | 3.0 |
| | 215.7 | 1.5(1.5) | 6.0(3.0) | 0 | 6.0 |
| | 223.0 | 0 | 0 | 0 | 3.2 |

Appendix Table E-6, continued

| | | | | | |
|---|---|---|---|---|---|
| | 227.2 | 16.5(9.0) | 2.8(1.6) | 16.0(4.0) | 6.0 |
| | 230.5 | 12.0 | 0 | 38.0(13.0) | 21.0 |
| | 233.5 | DNT | 7.0(1.0) | 18.0 | 6.0 |
| | 238.2 | DNT | 12.0(0.0) | 42.0(24.0) | 6.0 |
| Silver chub | 203.2 | DNT | 0 | 0 | 0 |
| | 207.1 | 0 | 0 | 0 | 0 |
| | 213.6 | 0 | 0 | 0 | 0 |
| | 215.7 | 0 | 0 | 0 | 0 |
| | 223.0 | 0 | 0 | 0 | 0 |
| | 227.2 | 0 | 0 | 0 | 0 |
| | 230.5 | 0 | 0 | 0 | 0 |
| | 233.5 | DNT | 0 | 0 | 0 |
| | 238.2 | DNT | 0 | 3.0(0.0) | 0 |
| Smallmouth buffalo | 203.2 | DNT | 7.3(0.9) | 0 | 0 |
| | 207.1 | 0 | 58.0(19.0) | 1.1(1.1) | 0 |
| | 213.6 | 1.6(1.6) | 41.1(10.8) | 3.0(3.0) | 0 |
| | 215.7 | 1.5(1.5) | 22.5(4.5) | 0 | 0 |
| | 223.0 | 3.0 | 12.7(9.0) | 0 | 0 |
| | 227.2 | 10.5(10.5) | 52.0(5.3) | 2.0(2.0) | 0 |
| | 230.5 | 3.0 | 20.0 | 0 | 0 |
| | 233.5 | DNT | 51.0(39.0) | 0 | 3.0 |
| | 238.2 | DNT | 29.0(13.0) | 3.0(0.0) | 0 |

Appendix Table E-6, continued

| | | | | | |
|---|---|---|---|---|---|
| White bass | 203.2 | DNT | 0 | 0 | 0 |
| | 207.1 | 0 | 0.7(0.7) | 0 | 0 |
| | 213.6 | 0 | 0 | 0 | 0 |
| | 215.7 | 0 | 0 | 0 | 0 |
| | 223.0 | 0 | 2.3(1.2) | 0 | 0 |
| | 227.2 | 0 | 2.8(1.6) | 0 | 0 |
| | 230.5 | 0 | 0 | 0 | 0 |
| | 233.5 | DNT | 7.0(1.0) | 0 | 0 |
| | 238.2 | DNT | 11.0(7.0) | 0 | 0 |

[a] Data from one trawl sample taken at river mile 211.2 are included in the mean for river mile 213.6 and data from one trawl sample taken at river mile 225.8 are included in the mean for river mile 227.2.

Appendix Table E-7. Mean total catch per unit effort, CPUE (1 SE), expressed as catch per hour of rockhopper trawling, of all species captured in Navigation Pool 26 of the Mississippi River during March-November, 1997. DNT=did not trawl

| River | Mean CPUE (1 SE) | | | | | | |
|---|---|---|---|---|---|---|---|
| mile[a] | March | April | June | July | Sept | Oct | Nov |
| 203.2 | 54.0(21.0) | 75.0 | 6.3 | 18.0 | 241.5(76.5) | DNT | 66.0 |
| 207.1 | 6.0 | 9.0 | 15.0 | 100.0 | 288.7(133.3) | 144.0 | DNT |
| 213.6 | 6.0 | DNT | 18.0 | 175.5(127.5) | 307.5(16.5) | 81.0 | DNT |
| 215.7 | DNT | DNT | 3.0 | 18.0 | DNT | DNT | DNT |
| 223.0 | 3.0 | DNT | 30.0 | 6.0 | 22.5(1.5) | DNT | DNT |
| 227.2 | 15.0 | DNT | 60.0 | 9.0 | 27.0 | 30.0 | DNT |
| 233.5 | 9.0 | 3.0 | 33.0 | 3.0 | DNT | 24.0 | DNT |
| 238.5 | 15.0 | DNT | 69.0 | 66.0 | 21.0 | 78.0 | DNT |

[a] Data from river mile 211.2 is included with the mean from river mile 213.6, data from river mile 225.8 is included with the mean from river mile 227.2, and data from river mile 240.2 is included with the mean from river mile 238.5.

Appendix Table E-8. Mean total catch per unit effort, CPUE (1 SE), expressed as catch per hour of rockhopper trawling, for each species captured in the navigation channel of Pool 26 of the Mississippi River during March-November, 1997. DNT=did not trawl

| Species | River mile[a] | Mean CPUE (± 1 SE) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | March | April | June | July | Sept | Oct | Nov |
| Bighead | 203.2 | 0 | 0 | 0 | 0 | 0 | DNT | 0 |
| carp | 207.1 | 0 | 0 | 0 | 4.0 | 0 | 0 | DNT |
| | 213.6 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 0 | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| Bigmouth | 203.2 | 0 | 0 | 0 | 3.0 | 7.5(7.5) | DNT | 3.0 |
| buffalo | 207.1 | 0 | 0 | 0 | 0 | 3.0(1.7) | 6.0 | DNT |
| | 213.6 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 0 | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |

Appendix Table E-8, continued

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| Black | 203.2 | 0 | 0 | 0 | 0 | 0 | DNT | 0 |
| buffalo | 207.1 | 0 | 0 | 0 | 0 | 1.5(1.5) | 0 | DNT |
| | 213.6 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 0 | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| Blue | 203.2 | 0 | 0 | 0 | 3.0 | 1.5(1.5) | DNT | 0 |
| catfish | 207.1 | 0 | 0 | 0 | 0 | 14.6(8.2) | 6.0 | DNT |
| | 213.6 | 0 | DNT | 0 | 4.5(4.5) | 4.5(1.5) | 3.0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 0 | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 0 | 6.0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |

Appendix Table E-8, continued

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Blue | 203.2 | 0 | 0 | 0 | 0 | 0 | DNT | 0 |
| sucker | 207.1 | 0 | 0 | 0 | 0 | 0 | 0 | DNT |
| | 213.6 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 0 | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 0 | 6.0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| Channel | 203.2 | 15.0(15.0) | 30.0 | 3.2 | 0 | 10.5(1.5) | DNT | 3.0 |
| catfish | 207.1 | 0 | 6.0 | 9.0 | 56.0 | 28.7(12.8) | 18.0 | DNT |
| | 213.6 | 0 | DNT | 9.0 | 36.5(20.5) | 54.0(27.0) | 18.0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 3.0 | DNT | 0 | 0 | 0 | DNT | DNT |
| | 227.2 | 3.0 | DNT | 3.0 | 3.0 | 0 | 9.0 | DNT |
| | 233.5 | 0 | 0 | 3.0 | 0 | DNT | 18.0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |

Appendix Table E-8, continued

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Common | 203.2 | 0 | 0 | 0 | 0 | 6.0(3.0) | DNT | 0 |
| carp | 207.1 | 0 | 0 | 0 | 0 | 4.5(2.9) | 0 | DNT |
| | 213.6 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 0 | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 3.0 | 0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | | | | | | | | |
| Flathead | 203.2 | 1.5(1.5) | 0 | 0 | 0 | 3.0(3.0) | DNT | 0 |
| catfish | 207.1 | 0 | 0 | 0 | 0 | 2.1(0.7) | 6.0 | DNT |
| | 213.6 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 0 | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 3.0 | 0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |

Appendix Table E-8

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Freshwater drum | 203.2 | 3.0(0.0) | 0 | 0 | 3.0 | 85.5(19.5) | DNT | 3.0 |
| | 207.1 | 0 | 0 | 6.0 | 32.0 | 192.8(70.4) | 36.0 | DNT |
| | 213.6 | 0 | DNT | 9.0 | 94.5(70.5) | 181.5(22.5) | 27.0 | DNT |
| | 215.7 | DNT | DNT | 3.0 | 18.0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 15.0 | 0 | 1.5(1.5) | DNT | DNT |
| | 227.2 | 0 | DNT | 12.0 | 0 | 0 | 0 | DNT |
| | 233.5 | 0 | 0 | 3.0 | 0 | DNT | 6.0 | DNT |
| | 238.5 | 0 | DNT | 6.0 | 6.0 | 0 | 12.0 | DNT |
| Gizzard Shad | 203.2 | 30.0(3.0) | 33.0 | 0 | 0 | 45.0(33.0) | DNT | 42.0 |
| | 207.1 | 0 | 3.0 | 0 | 0 | 12.6(10.8) | 0 | DNT |
| | 213.6 | 3.0 | DNT | 0 | 1.5(1.5) | 0 | 3.0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 3.0 | 0 | 1.5(1.5) | DNT | DNT |
| | 227.2 | 0 | DNT | 3.0 | 0 | 9.0 | 0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |

Appendix Table E-8, continued

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Goldeye | 203.2 | 1.5(1.5) | 0 | 0 | 3.0 | 0 | DNT | 6.0 |
| | 207.1 | 0 | 0 | 0 | 0 | 2.3(1.4) | 0 | DNT |
| | 213.6 | 0 | DNT | 0 | 1.5(1.5) | 0 | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 0 | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| Highfin carpsucker | 203.2 | 0 | 0 | 0 | 0 | 1.5(1.5) | DNT | 0 |
| | 207.1 | 0 | 0 | 0 | 0 | 1.4(0.8) | 0 | DNT |
| | 213.6 | 0 | DNT | 0 | 0 | 4.5(1.5) | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 0 | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |

Appendix Table E-8, continued

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Lake | 203.2 | 0 | 0 | 0 | 0 | 0 | DNT | 0 |
| sturgeon | 207.1 | 0 | 0 | 0 | 0 | 0 | 0 | DNT |
| | 213.6 | 0 | DNT | 0 | 0 | 1.5(1.5) | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 0 | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| Mooneye | 203.2 | 0 | 0 | 0 | 3.0 | 13.5(13.5) | DNT | 3.0 |
| | 207.1 | 0 | 0 | 0 | 0 | 5.3(3.1) | 0 | DNT |
| | 213.6 | 0 | DNT | 0 | 1.5(1.5) | 6.0(6.0) | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 4.5(1.5) | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 6.0 | 0 | DNT |
| | 233.5 | 0 | 0 | 3.0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |

Appendix Table E-8, continued

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Quillback | 203.2 | 0 | 0 | 0 | 0 | 4.5(4.5) | DNT | 0 |
| | 207.1 | 0 | 0 | 0 | 0 | 17.0(11.4) | 42.0 | DNT |
| | 213.6 | 0 | DNT | 0 | 0 | 13.5(7.5) | 6.0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 1.5(1.5) | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 3.0 | 0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| River carpsucker | 203.2 | 0 | 0 | 0 | 3.0 | 24.0(6.0) | DNT | 0 |
| | 207.1 | 0 | 0 | 0 | 0 | 29.0(15.6) | 0 | DNT |
| | 213.6 | 0 | DNT | 0 | 0 | 9.0(9.0) | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 0 | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |

Appendix Table E-8, continued

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sauger | 203.2 | 0 | 0 | 0 | 0 | 1.5(1.5) | DNT | 0 |
| | 207.1 | 0 | 0 | 0 | 0 | 1.4(0.8) | 6.0 | DNT |
| | 213.6 | 0 | DNT | 0 | 1.5(1.5) | 4.5(1.5) | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 3.0(3.0) | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 233.5 | 3.0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| Shorthead | 203.2 | 0 | 0 | 0 | 0 | 0 | DNT | 0 |
| redhorse | 207.1 | 0 | 0 | 0 | 0 | 0 | 6.0 | DNT |
| | 213.6 | 0 | DNT | 0 | 1.5(1.5) | 0 | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 3.0 | 0 | 0 | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |

Appendix Table E-8, continued

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Shortnose | 203.2 | 0 | 0 | 0 | 0 | 0 | DNT | 0 |
| gar | 207.1 | 0 | 0 | 0 | 0 | 0 | 0 | DNT |
| | 213.6 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 0 | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 3.0 | 0 | DNT |
| | | | | | | | | |
| Shovelnose | 203.2 | 1.5(1.5) | 0 | 0 | 0 | 0 | DNT | 0 |
| sturgeon | 207.1 | 0 | 0 | 0 | 4.0 | 0 | 6.0 | DNT |
| | 213.6 | 3.0 | DNT | 0 | 3.5(0.5) | 1.5(1.5) | 3.0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 6.0 | 0 | 0 | DNT | DNT |
| | 227.2 | 12.0 | DNT | 36.0 | 6.0 | 0 | 6.0 | DNT |
| | 233.5 | 6.0 | 3.0 | 24.0 | 3.0 | DNT | 0 | DNT |
| | 238.5 | 15.0 | DNT | 60.0 | 45.0 | 18.0 | 57.0 | DNT |

Appendix Table E-8, continued

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Skipjack | 203.2 | 0 | 0 | 0 | 0 | 0 | DNT | 0 |
| herring | 207.1 | 0 | 0 | 0 | 0 | 0 | 0 | DNT |
| | 213.6 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 4.5(1.5) | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 3.0 | 0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| Speckled | 203.2 | 0 | 0 | 0 | 0 | 0 | DNT | 0 |
| chub | 207.1 | 0 | 0 | 0 | 0 | 0 | 0 | DNT |
| | 213.6 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 0 | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 233.5 | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 12.0 | 0 | 0 | DNT |

Appendix Table E-8, continued

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Smallmouth | 203.2 | 1.5(1.5) | 0 | 3.2 | 0 | 37.5(4.5) | DNT | 6.0 |
| buffalo | 207.1 | 6.0 | 0 | 0 | 4.0 | 72.2(25.8) | 12.0 | DNT |
| | 213.6 | 0 | DNT | 0 | 29.0(25.0) | 24.0(6.0) | 21.0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 3.0 | 6.0 | 6.0(3.0) | DNT | DNT |
| | 227.2 | 0 | DNT | 6.0 | 0 | 0 | 3.0 | DNT |
| | 233.5 | 0 | DNT | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | 0 | 3.0 | 3.0 | 0 | 6.0 | DNT |
| White bass | 203.2 | 0 | 0 | 0 | 0 | 0 | DNT | 0 |
| | 207.1 | 0 | 0 | 0 | 0 | 0.8(0.8) | 0 | DNT |
| | 213.6 | 0 | DNT | 0 | 0 | 3.0(3.0) | 0 | DNT |
| | 215.7 | DNT | DNT | 0 | 0 | DNT | DNT | DNT |
| | 223.0 | 0 | DNT | 0 | 0 | 0 | DNT | DNT |
| | 227.2 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |
| | 233.5. | 0 | 0 | 0 | 0 | DNT | 0 | DNT |
| | 238.5 | 0 | DNT | 0 | 0 | 0 | 0 | DNT |

[a] Data from river mile 211.2 is included with the mean from river mile 213.6, data from river mile 225.8 is included with the mean from river mile 227.2, and data from river mile 240.2 is included with the mean from river mile 238.5.