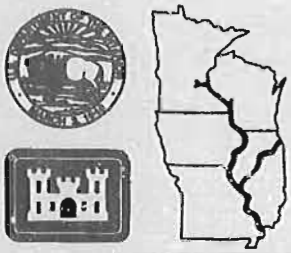
Long Term Resource Monitoring Program

Special Report

94-S008



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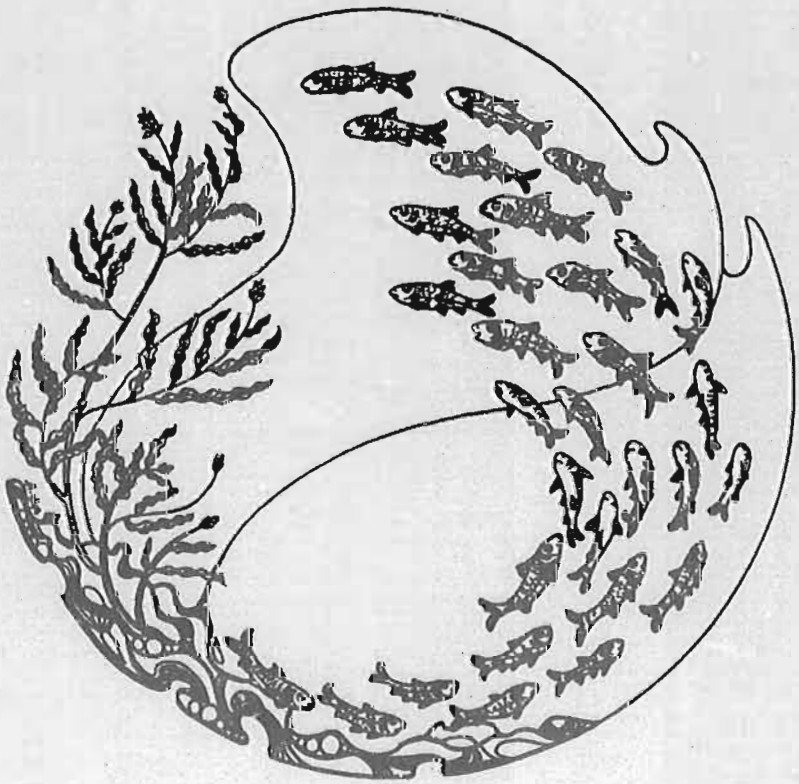

August 1994

Comparison of Fish Catch Between a Mini Fyke Net and a 10.7-Meter Bag Seine in the Upper Mississippi River

by

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The National Biological Survey . . . gathering, analyzing, and sharing the biological information necessary to support the wise stewardship of the Nation's natural resources.

Preface

The Long Term Resource Monitoring Program (LTRMP) was authorized under the Water Resources Development Act of 1986 (Public Law 99-662) as an element of the U.S. Army Corps of Engineers' Environmental Management Program. The LTRMP is being implemented by the Environmental Management Technical Center (EMTC), an office of the National Biological Survey, in cooperation with the five Upper Mississippi River System states, Illinois, Iowa, Minnesota, Missouri, and Wisconsin, with guidance and Program responsibility provided by the U.S. Army Corps of Engineers.

The mission of the LTRMP is to provide decision makers with information to maintain the Upper Mississippi River System as a viable large river ecosystem given its multiple-use character. The long-term goals of the Program are to understand the system, determine resource trends and impacts, develop management alternatives, manage information, and develop useful products.

This report was prepared under Task 2.2.8.5, *Evaluate and Refine the Experimental Design*, Strategy 2.2.8, *Monitor and Evaluate Fish Communities, Guilds, and Populations* as specified in Goal 2 of the Operating Plan of the Upper Mississippi River System Long Term Resource Monitoring Program (USFWS 1992).

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Introduction

The Upper Mississippi River System (UMRS) contains many diverse and unique aquatic habitats. This variability in habitat types makes fishery assessment difficult and occasionally impractical. Seining is accepted as the primary means to sample young-of-the-year (YOY) game fishes and small nongame fishes. However, in many instances, seining is not practical. Areas with excessive aquatic vegetation, soft substrates, deep water, and submerged obstacle conditions are habitats where effective seining is difficult.

To collect fish from aquatic habitats not conducive to seining, an alternate sampling method is needed. Mini fyke nets (MFNs), pop nets, and throw nets are possible alternatives to seining. Pop nets and throw nets are effective means of capture but are labor intensive. MFNs are a more viable alternative to seining; they are not labor intensive and they can be set in aquatic vegetation, heavily silted areas, and areas with irregular substrates.

Long Term Resource Monitoring Program (LTRMP) fish sampling procedures on the UMRS require the use of seines to collect fish community data in open water situations and the use of MFNs in vegetated habitats. Comparisons made between open and vegetated habitats are difficult, due to the inherent bias of both gear types. In this study, both gears were fished in open, nonvegetated habitat in order to develop a relationship of species collected.

The purpose of this study was to compare catch characteristics of two commonly used fish sampling gears. This comparison provides information on which to base decisions about deployment of sampling gear and interpretion of data from localized historical sampling.

Methods

A study was conducted from July 31 through August 2, 1991, to compare the catch effectiveness of 10.7-m bag seines with MFNs. Eight collection sites were identified along the shoreline at Crooked Slough (river mile 551.3) in Pool 13 of the UMRS (Fig. 1). The sample sites were free of vegetation and have a substrate composed of gravel, sand, and silt. At each individual sample location, one seine haul was conducted, followed by one MFN catch 24 hr later. Individual sites were separated by 150 m (Fig. 2). Species diversity was measured by the Shannon-Weaver Diversity Index, $H' = E\, p_i$. $\ln p_i$ where p_i is the proportion of species in the sample. A chi-square analysis was used to test the hypothesis that both the seine and the MFN would collect various family groups of fish in similar proportions.

Seines consisted of a 10.7-m bag seine with 3.1-mm "Ace" mesh. The seine was anchored to the bank, with the outer end deployed perpendicular to the bank. A three-person crew swept the seine inshore in a 90° arc (quarter haul) approximately 2.6 m in radius (Fig. 2).

We used 9-m-long Wisconsin-type MFNs, which are commonly used to sample YOY and small fishes from vegetated areas. The net has a 0.6- x 1.2-m frame and is constructed of 3.1-mm "Ace" mesh, with one throat that narrows to a 50-mm opening. A 5.5-m lead was staked to the bank/water interface and the net was set perpendicular to the shoreline (Fig. 2). MFNs were set for a 24-hr period.

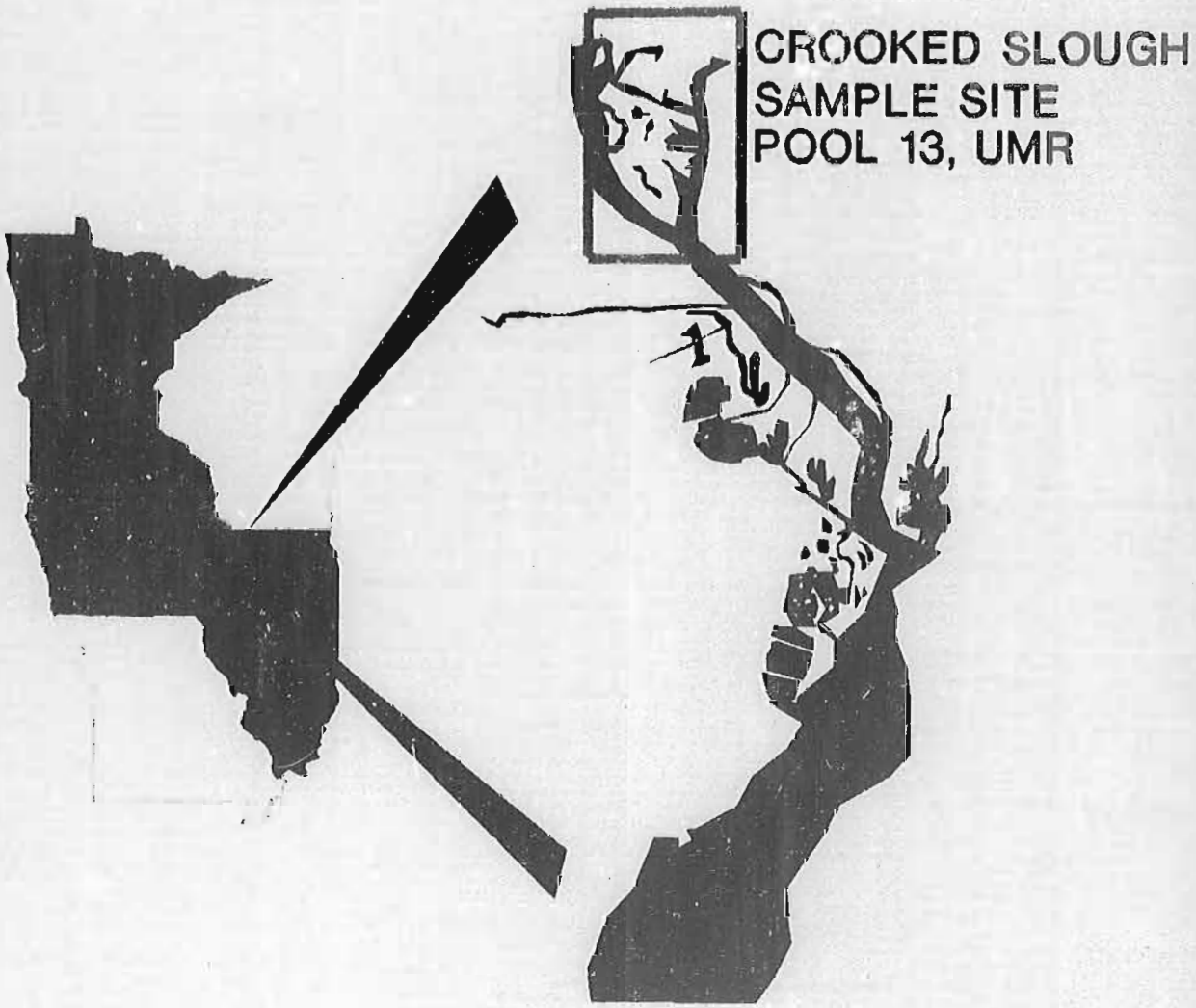

Figure 1. Map of Crooked Slough sampling area, Upper Mississippi River Pool 13, 1991

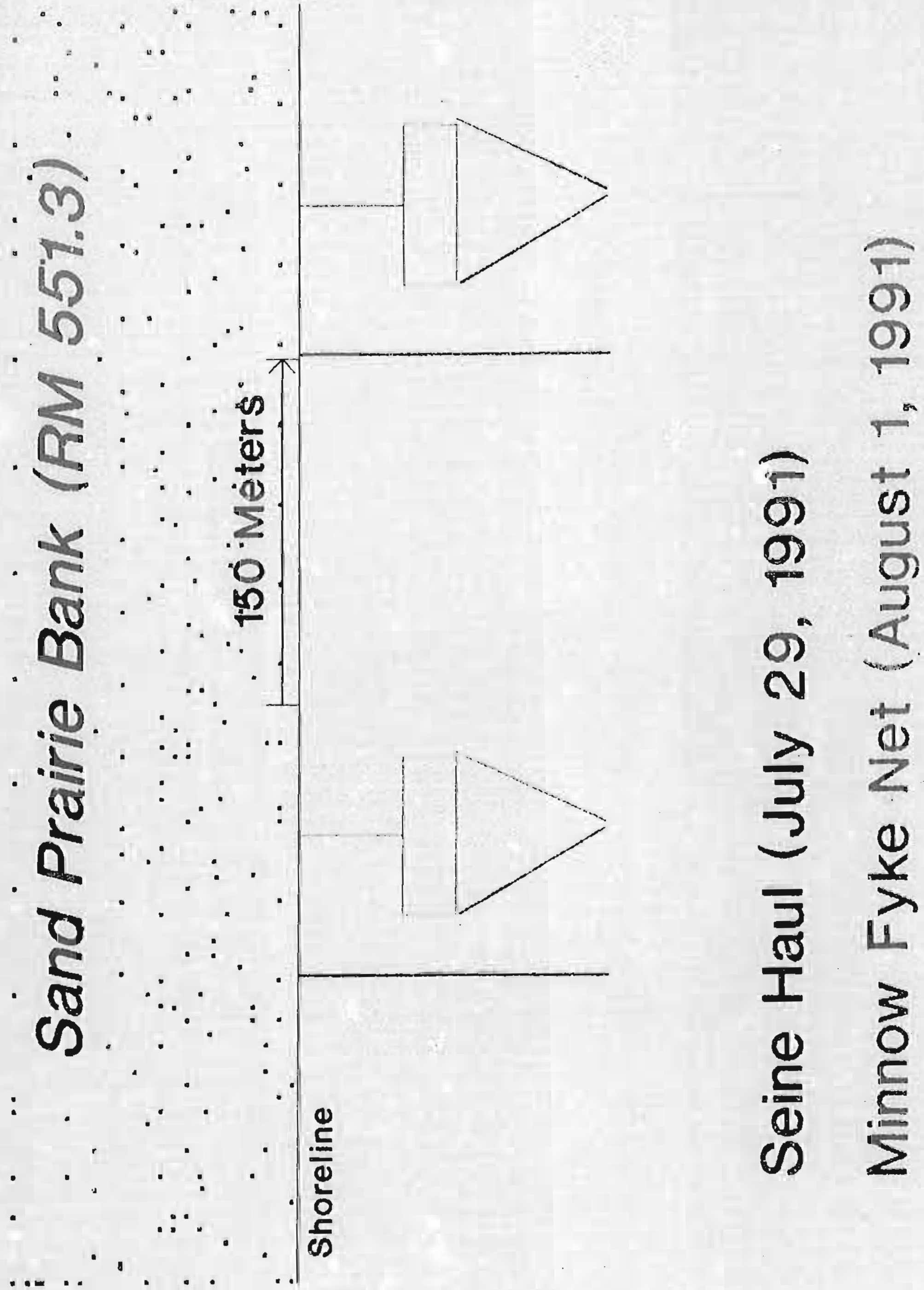

Figure 2. Seine and mini fyke net sampling configuration along the sand prairie bank in Crooked Slough, Upper Mississippi River Pool 13, 1991

Results

A combined total of 11,927 fish comprising 29 species was collected from eight MFNs and eight seine hauls. The MFNs collected 97.2% of the total fish (11,598 fish) and had the highest species richness (25 species). Seines collected 329 fish of 16 species. The Shannon-Weaver diversity index was only slightly higher for the MFN (2.06) compared to the seine (1.86) because this index combines species richness with species evenness. Bluegills were omitted from the index since they were caught in large numbers and were thought to be using the nets as habitat.

Bluegill (*Lepomis macrochirus*) dominated both samples, comprising 97.3% and 60.7% of fish collected from the MFNs and seines, respectively. Mimic shiner (*Notropis volucellus*) and pugnose minnow (*Opsopoeodus emiliae*) ranked second and third in abundance in the MFN collections; however, gizzard shad (*Dorosoma cepedianum*) and white bass (*Morone chrysops*) ranked second and third in the seine samples.

When comparing the two gears, several species present and/or abundant in one gear were greatly reduced or missing in the other (Table 1). Channel catfish (*Ictalurus punctatus*), stonecat (*Noturus flavus*), tadpole madtom (*Noturus gyrinus*), and yellow bullhead (*Ameiurus natalis*) were all taken by the MFNs but were not captured by the seines. Darter species also exhibited differences between the two sampling methods. The river darter (*Percina shumardi*) was the most numerous darter in the study collections, with 19 individuals captured with MFNs and only two by seining. A total of 17 mud darters (*Etheostoma asprigene*) and 8 logperch (*Percina caprodes*) was also captured with the MFNs, with no individuals collected by seining. Orangespotted sunfish (*Lepomis humilis*) and pumpkinseed (*Lepomis gibbosus*) were common in the minnow traps but were also missing in the seine samples. Pugnose minnow were also more numerous in MFNs, with 48 individuals caught, compared to 11 individuals in the seine samples.

Although MFNs collected greater numbers of individual fish and species, a few species were collected exclusively by seining, including river shiner (*Notropis blennius*), spotfin shiner (*Cyprinella spiloptera*), silver chub (*Macrhybopsis storeriana*), and walleye (*Stizostedion vitreum*). Three species of fish were also more abundant in seine samples: emerald shiner (*Notropis atherinoides*) (22 in seine and 1 in MFN), gizzard shad (41 and 7), and white bass (23 and 10).

Chi-square analysis indicated a significant difference in the proportion of family groups caught with the MFN as compared to the seine (X^2 = 117.6 with 5 df; Table 2). Species were grouped to the family level to eliminate trace catches of some types within a family group. Esocids, catostomids, and scianenids were eliminated from the analysis because they represented only trace family occurrences (Table 2).

Discussion

The catch of fish between MFNs and seines was dissimilar. The MFNs caught a greater number of individuals and species. The use of the nets as "protective" structures and/or the nocturnal activities of certain fish species may account for the greater success of MFNs.

The MFN samples were dominated by bluegill. The YOY bluegill appeared to be using the MFNs as habitat or protective cover. When the nets were retrieved, numerous YOY bluegills fell off the outside cab of the nets. Because these nets were set in an area where no visible cover existed (e.g., fallen trees), YOY bluegill were attracted to the MFN structures, possibly to use as cover.

Table 1. The number of fish and the species collected from Crooked Slough, river mile 551.3, Upper Mississippi River Pool 13, 1991

Family/species	Total number of fish	
	Eight mini fyke nets	Eight seines
CLUPEIDAE		
Gizzard shad (*Dorosoma petenense*)	7	41
CYPRINIDAE		
Spotfin shiner (*Cyprinella spiloptera*)	0	3
Common shiner (*Luxil us cornutus*)	2	0
Speckled chub (*Macrhybopsis aestivalis*)	1	0
Silver chub (*Macrhybopsis storeriana*)	0	9
Emerald shiner (*Notropis atherinoides*)	1	22
River shiner (*Notropis blennius*)	0	10
Spottail shiner (*Notropis hudsonius*	1	6
Mimic shiner (*Notropis volucellus*)	143	2
Pugnose minnow (*Opsopoedus emiliae*)	48	11
Bullhead minnow (*Pimephales vigilax*)	3	3
CATOSTOMIDAE		
Shorthead redhorse (*Moxostoma macrolepidotum*)	1	0
ICTALURIDAE		
Yellow bullhead (*Ameiurus natalis*)	2	0
Channel catfish (*Ictalurus punctatus*)	3	0
Stonecat (*Noturus flavus*)	1	0
Tadpole madtom (*Noturus gyrinus*)	1	0
ESOCIDAE		
Northern pike (*Esox lucius*)	1	0
PERCICHTHYIDAE		
White bass (*Morone chrysops*)	10	23
CENTRARCHIDAE		
Pumpkinseed (*Lepomis gibbosus*)	6	0
Orangespotted sunfish (*Lepomis humilis*)	11	0
Bluegill (*Lepomis macrochirus*)	11,283	187

Table 1. Continued

Family/species	Total number of fish	
	Eight mini fyke nets	Eight seines
Largemouth bass (*Micropterus salmoides*)	8	6
White crappie (*Pomoxis annularis*)	4	0
Black crappie (*Pomoxis nigromaculatus*)	16	
PERCIDAE		
Mud darter (*Etheostoma asprigene*)	17	0
River darter (*Percina shumardi*)	19	2
Logperch (*Percina caprodes*)	8	0
Walleye (*Stizostedion vitreum*)	0	1
SCIAENIDAE		
Freshwater drum (*Aplodinotus grunniens*)	1	3
Totals	11,598	329

Table 2. **Total catch by family in the seines and mini fyke nets used in the chi-square analysis ($P=0.05$). Bluegill (*Lepomis macrochirus*) were not used in the analysis since they were collected in large numbers and were believed to be attracted to nets for use as cover. Also, trace collections of three families were not used.**

Family	Seine	p_i	Mini fyke nets	p_i
Centrarchidae	45	0.15	16	0.12
Cyprinidae	195	0.63	51	0.38
Percidae	44	0.14	3	0.02
Ictaluridae	8	0.03	-	-
Clupeidae	7	0.02	41	0.31
Percichthyidae	10	0.03	23	0.17
Total catch	309		134	

p_i = proportion of individuals

Because seining was conducted only during the day, the nocturnal movement of certain fishes at the site could not be detected. However, nocturnal movements of fish into the site may have contributed to the high number of species and individual counts. Fish movement into shoreline areas is well documented; it is believed that fish move into shorelines at night to avoid predation (Janecek 1990). This nocturnal movement would make fish more susceptible to capture in the MFNs, which were set for a 24-hr period. In Pool 13, Griffin et. al. (1991 in review) reported that night electrofishing on Pool 13 caught 57% more fish than day electrofishing. Also, night electrofishing collected several more species than were collected during day electrofishing (43 versus 34). Although these catches consisted primarily of adult fishes, small fishes were also considerably more numerous in night collections.

The nocturnal habits of some species such as catfish, which are primarily active night feeders (Pflieger 1975; Becker 1983), also would make individuals more susceptible to capture in an MFN. Day seining may not detect nocturnal fish use at a particular site.

The seine haul and MFN catches in this study do not appear comparable. The MFNs were more effective than seines in the number of fish collected and in documenting the presence of

various species. MFNs can be fished in several areas that cannot be sampled with seines (e.g., vegetated areas) and have been shown to be effective in sampling open habitats, which are presently sampled with seines. To make direct comparisons between open and vegetated habitats, it may be advantageous to use MFNs to sample both. However, if MFNs were used to compare both vegetated and open areas, the catch rates may still be biased. The "need" of YOY sunfish to use the MFNs as protective cover may be greatly diminished in vegetated areas, since they can use the cover already present. Vegetative stands have been known to act as nursery cover, and to provide concealment and protective cover for YOY fishes (Janecek 1990). MFNs set in vegetated habitat may provide little additional cover, and fish may not be attracted to them. Also, Janecek (1990) noted that vegetative cover may act as a screen and reduce movement of fishes within a site; thus, the catch may be diminished. Both these factors should reduce the effectiveness of the MFN in the vegetated habitat.

An effective gear type is one that collects the most fish with the least amount of variation. Analysis of variance could not be determined in this study, since the collections were pooled. From field observations, all samples appeared to be similar in size and content, but future studies should be undertaken to determine the variability of both gears.

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13. ABSTRACT (Maximum 200 words)

The purpose of this study was to compare catch characteristics of two commonly used fish sampling gears. This comparison provides information on which to base decisions about deployment of sampling gear and interpretion of data from localized historical sampling. A comparison of fish catch was made between a 10.7-m bag seine and a mini fyke net (MFN) in Upper Mississippi River Pool 13. The MFNs were found to capture a higher number of individuals and to have a higher species diversity than the seine. Comparisons of family catches between the MFN and the seine revealed that the two gear types do not catch family groups in similar proportions (X^2 = 117.6 with 5 df, P < or = 0.05). Because MFNs can be set in nearly all nonflowing shoreline habitats and the catch rates were higher in MFNs, it is recommended that MFNs be used exclusively in all backwater areas. Further study is needed to determine the variance of the seines and MFNs. Also, the effects of vegetation on the fish catch with MFNs needs further review.

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