THE DISTRIBUTION AND SAMPLING GEAR VULNERABILITY OF THE CRYSTAL DARTER (CRYSTALLARIA ASPRELLA) IN MINNESOTA

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Abstract: Recent stream survey results and historical records compiled in the Minnesota Natural Heritage Program database were reviewed to determine the distribution and sampling gear vulnerability of the crystal darter (Crystallaria asprella) in the Mississippi River Basin of southeastern Minnesota. Including Wisconsin boundary rivers shared with Minnesota, the species has been reported from five major watersheds within the basin at 22 localities which encompass five Minnesota and six Wisconsin counties. Survey gears which have successfully sampled crystal darters include seines, boom and stream electroshockers, and deep water trawl nets.

Introduction

The crystal darter (Crystallaria [Ammocrypta] asprella) reaches the extreme northern edge of its range in southeastern Minnesota (Lee et al 1980) where it has been reported from the St. Croix (Fago 1986), Zumbro, and Mississippi Rivers. In Wisconsin, the species has also been reported from the Mississippi River drainage in the Red Cedar, Chippewa and Trempealeau Rivers (Becker 1983). Regionally, the crystal darter is proposed for Threatened status in Minnesota and listed Endangered in Wisconsin (Schmidt 1995). In 1994, surveys were conducted for the crystal darter in Pools 4, 5A, 6, 7, and 9 of the Mississippi River. These results were pooled with all **known** occurrences of the crystal darter in Minnesota to illustrate distribution, and also, provide a review of sampling gears and methods which have been used to collect the species.

Methods and Materials

Both diurnal and nocturnal surveys were conducted at 31 stations in four Minnesota and three Wisconsin counties from mid September to mid November. Sampling gears consisted of a boom shocker and four types of seines (Table 1).

Table 1. Survey gears, methods, and approximate maximum depth sampled in Mississippi River Pools 4 - 9 during 1994. Codes: B - boom shocker, S - seine, D - day sample, N - night sample.

Pool	Gear	Day/Night	Max. Depth
4	S	D	8+
5	N/A	N/A	N/A
5A	B,S	D,N	8+
6	B	D	8+
7	S	D	5
8	S	D,N	5
9	S	D,N	5

Seine hauls were usually done downstream of wing dams or at the head of islands. Seines consisted of both normal and bag type, quarter inch mesh, and ranged in lengths from 25 to 100 feet and depths from 4 to 6 feet. Wood poles were tied to the tow ropes at each end to provide some control in deep and swift currents. Seines were dragged in a downstream direction with one boot hooked on the pole and firmly planted on the lead line to keep the bottom edge in contact with the river bed. In deep habitats, one hauler remained near shore at approximately chest depth, while the other swam out deploying the seine and thrusting the pole downward as far as possible. All seine haul catches were sorted to species, tallied, and voucher specimens preserved for the fish collection at the James Ford Bell Museum of Natural History in St. Paul.

Boom shocking runs were conducted in habitats associated with wing dams, closing dams, and ripped-rapped banks in **usually** a downstream direction. Polarized sunglasses were used during the day to reduce surface glare and flood lamps at night to illuminate the sample area in front of the boat. Due to the abundance of large fish sampled and variable effectiveness on darters with this gear, dip netters generally targeted only species which resembled the crystal darter in shape, size, and saddle patches.

Stations where the crystal darter was encountered were photographed on 35 mm slides and video taped. Occurrences were mapped on 7.5 minute quadrangles and transcribed for data entry into the Minnesota Natural Heritage Program filing system. Additional records were requested from several sources and similarly compiled through February 1995.

Results and Discussion

The 1994 Mississippi River surveys sampled 1582 fish representing 49 species in 14 families. The emerald shiner was the most frequently sampled and abundant species which was present in 81.2 percent of the samples and comprised 24.7 percent of the total catch. The rarest species included thirteen fishes which were each sampled once and represented by a single specimen (Table 2).

Table 2. Mississippi River 1994 fish survey results.

FAMILY Common Name (Scientific Name)	# Times Sampled	Total Catch	Percent Comp.	Percent Occur.
ACIPENSERIDAE - STURGEONS				
shovelnose sturgeon (Scaphirhynchus platorynchus)	1	1	0.1	3.1
POLYODONTIDAE - PADDLEFISH				
paddlefish (Polyodon spathula)	1	1	0.1	3.1
LEPISOSTEIDAE - GARS				
longnose gar (Lepisosteus osseus)	2	4	0.3	6.2
HIODONTIDAE - MOONEYES				
mooneye (Hiodon tergisus)	6	15	0.9	18.8
CLUPEIDAE - HERRINGS				
gizzard shad (Dorosoma cepedianum)	10	137	8.7	31.2
MINNOWS - CYPRINIDAE				
spotfin shiner (Cyprinella spiloptera)	14	96	6.1	43.8
common carp (Cyprinus carpio)	1	3	0.2	3.1
silver chub Macrhybopsis storeriana)	5	10	0.6	15.6
golden shiner (Notemigonus crysoleucas)	1	1	0.1	3.1
emerald shiner (Notropis atherinoides)	26	391	24.7	81.2
river shiner (Notropis blennius)	21	163	10.3	65.6
spottail shiner (Notropis hudsonius)	3	9	0.6	9.4
sand shiner (Notropis stramineus)	1	3	0.2	3.1
weed shiner (Notropis texanus)	1	1	0.1	3.1
mimic shiner (Notropis volucellus)	10	132	8.3	31.2
channel shiner (Notropis wickliffi)	1	4	0.3	3.1
fathead minnow (Pimephales promelas)	2	3	0.2	6.2
bullhead minnow (Pimephales vigilax)	4	9	0.6	12.5
minnow yoy (Genus species - N/A)	1	9	0.6	3.1

Table 2. Continued.

FAMILY Common Name (Scientific Name)	# Times Sampled	Total Catch	Percent Comp.	Percent Occur.
SUCKERS - CATOSTOMIDAE				
quillback (Carpiodes cyprinus)	14	52	3.3	43.8
blue sucker (Cycleptus elongatus)	1	1	0.1	3.1
smallmouth buffalo (Ictiobus bubalus)	2	5	0.3	6.2
bigmouth buffalo (Ictiobus cyprinellus)	1	1	0.1	3.1
silver redhorse (Moxostoma anisurum)	8	25	1.6	25.0
river redhorse (Moxostoma carinatum)	4	18	1.1	12.5
shorthead redhorse (Moxostoma macrolepidotum)	5	17	1.1	15.6
redhorse yoy (Moxostoma species)	11	33	2.1	34.4
BULLHEAD CATFISHES - ICTALURIDAE				
yellow bullhead (Ameiurus natalis)	1	1	0.1	3.1
channel catfish (Ictalurus punctatus)	1	1	0.1	3.1
stonecat (Noturus flavus)	1	1	0.1	3.1
tadpole madtom (Noturus gyrinus)	1	1	0.1	3.1
PERCOPSIDAE - TROUT-PERCHES				
trout-perch (Percopsis omiscomaycus)	5	7	0.4	15.6
ATHERINIDAE - SILVERSIDES				
brook silverside (Labidesthes sicculus)	1	1	0.1	3.1
PERCICHTHYIDAE - TEMPERATE BASSES				
white bass (Morone chrysops)	23	211	13.3	71.9
SUNFISHES - CENTRARCHIDAE				
rock bass (Ambloplites rupestris)	3	5	0.3	9.4
bluegill (Lepomis macrochirus)	7	9	0.6	21.9
smallmouth bass (Micropterus dolomieu)	5	22	1.4	15.6
largemouth bass (Micropterus salmoides)	2	2	0.1	6.2
white crappie (Pomoxis annularis)	1	1	0.1	3.1
black crappie (Pomoxis nigromaculatus)	4	5	0.3	12.5
PERCHES - PERCIDAE				
western sand darter (Ammocrypta clara)	6	12	0.8	18.8
crystal darter (Crystallaria asprella)	2	2	0.1	6.2
mud darter (Etheostoma asprigene)	2	8	0.5	6.2
johnny darter (Etheostoma nigrum)	12	22	1.4	37.5
yellow Perch (Perca flavescens)	4	4	0.3	12.5
logperch (Percina caprodes)	13	44	2.8	40.6
slenderhead darter (Percina phoxocephala)	1	1	0.1	3.1
river darter (Percina shumardi)	3	4	0.3	9.4
sauger (Stizostedion canadense)	3	10	0.6	9.4
walleye (Stizostedion vitreum)	8	50	3.2	25.0
SCIAENIDAE - DRUMS				
freshwater drum (Aplodinotus grunniens)	6	14	0.9	18.8
Totals:	272	1582	100.0	

Crystal darters were collected at two stations, comprised 0.1 percent of the total catch, and present in 6.2 percent of the samples. Both locations (Pool 5A: unnamed island - River Mile [RM] 733.9 and Pool 4: Hershey Island - RM 758.7) were in the main channel downstream of a wing dam at depths of 8 or 9 feet in moderate to strong current over coarse sand to pebble substrate. Sampling gear in both collections consisted of a bag seine 50 feet long and 4 feet deep.

This study also sampled species which are designated or proposed for Threatened, or Special Concern status in Minnesota and Wisconsin. These include the shovelnose sturgeon, paddlefish, weed shiner, channel shiner, blue sucker, river redhorse, western sand darter, and mud darter.

In 1994, independent surveys produced five additional crystal darter collections in lower Pool 4 of the Mississippi River (RM 754.3 - 758.7). These results were combined with the one collection from this study in that same stream reach to provide an overview of associated species representing 36 fishes in 10 families. The spotfin shiner, river shiner, emerald shiner, white bass, and logperch were the most frequently occurring species and present in 66.7 to 100.0 percent of the crystal darter collections (Table 3).

Table 3. Lower Pool 4 1994 crystal darter species association.

FAMILY Common Name (Scientific Name)	# Times Sampled	Percent Occurrence
HIODONTIDAE - MOONEYES		
goldeye (Hiodon alosoides)	1	16.7
CLUPEIDAE - HERRINGS		
gizzard shad (Dorosoma cepedianum)	3	50.0

Table 3. Continued.

FAMILY Common Name (Scientific Name)	# Times Sampled	Percent Occurrence
MINNOWS - CYPRINIDAE		
spotfin shiner (Cyprinella spiloptera)	4	66.7
common carp (Cyprinus carpio)	1	16.7
silver chub Macrhybopsis storeriana)	2	33.3
emerald shiner (Notropis atherinoides)	5	83.3
river shiner (Notropis blennius)	6	100.3
sand shiner (Notropis stramineus)	2	33.3
mimic shiner (Notropis volucellus)	3	50.0
bullhead minnow (Pimephales vigilax)	1	16.7
SUCKERS - CATOSTOMIDAE		
river carpsucker (Carpiodes carpio)	1	16.7
quillback (Carpiodes cyprinus)	1	16.7
carpsucker (Carpiodes species)	1	16.7
white sucker (Catostomus commersoni)	1	16.7
smallmouth buffalo (Ictiobus bubalus)	2	33.3
bigmouth buffalo (Ictiobus cyprinellus)	2	33.3
silver redhorse (Moxostoma anisurum)	1	16.7
river redhorse (Moxostoma carinatum)	1	16.7
golden redhorse (Moxostoma erythrurum)	2	33.3
shorthead redhorse (Moxostoma macrolepidotum)	3	50.0
redhorse yoy (Moxostoma species)	1	16.7
BULLHEAD CATFISHES - ICTALURIDAE		
tadpole madtom (Noturus gyrinus)	1	16.7
PIKES - ESOCIDAE		
northern pike (Esox lucius)	2	33.3
PERCOPSIDAE - TROUT-PERCHES		
trout-perch (Percopsis omiscomaycus)	2	33.3
PERCICHTHYIDAE - TEMPERATE BASSES		
white bass (Morone chrysops)	4	66.7
SUNFISHES - CENTRARCHIDAE		
rock bass (Ambloplites rupestris)	1	16.7
bluegill (Lepomis macrochirus)	2	33.3
smallmouth bass (Micropterus dolomieu)	2	33.3
black crappie (Pomoxis nigromaculatus)	1	16.7
PERCHES - PERCIDAE		
western sand darter (Ammocrypta clara)	2	33.3
crystal darter (Crystallaria asprella)	6	100.0
mud darter (Etheostoma asprigene)	1	16.7
johnny darter (Etheostoma nigrum)	2	33.3
yellow Perch (Perca flavescens)	2	33.3
logperch (Percina caprodes)	4	66.7
river darter (Percina shumardi)	2	33.3
sauger (Stizostedion canadense)	1	16.7
walleye (Stizostedion vitreum)	3	50.0

All known element occurrence records (EOR) of the crystal darter have been transferred (approximately) to stream maps (Figures 1 - 7) which illustrate the species longitudinal distribution in the Mississippi, St. Croix, and Zumbro Rivers. Data queries for additional information on localities, sampling gears, specimen deposition, and survey sources can be requested from the Minnesota Natural Heritage Program in St. Paul, MN.

The Mississippi (RM 733.8/733.9 - 758.7) from lower Pool 4 - Pool 5A (Figure 5) had the most occurrences at 10, maximum number of specimens sampled in a single collection (13 at RM 754.3 and 11 at RM 733.8), and greatest replication of collections made at the same site (3 at RM 733.8) which encompassed a sampling period from 1980 - 1994. The Zumbro River (Figure 2) was second in the number of occurrences at five, but also had three crystal darter collections at the same station (RM 34.0) from 1984 - 1993. Two collections have been reported from the lower St. Croix River (Figure 1) and is the most northerly distribution for the species.

The crystal darter has not been reported from Mississippi River Pools 1 - 3, 7, upper 9, or lower reaches of larger tributaries (i.e., Minnesota, Cannon, Whitewater, and Root Rivers). There are also no occurrences reported from Lake Pepin, middle and lower Pool 5, lower Pool 5A, middle Pool 6, and middle and lower Pool 8. However, some of these locations (e.g., Lake Pepin and most of Pool 8) may not have sufficient wing dams, current, or substrates which provide suitable habitats for the crystal darter.

FIGURE 1. ST. CROIX RIVER CRYSTAL DARTER OCCURRENCES (2)
SAMPLING PERIOD: 1978 - 1982

FIGURE 2. ZUMBRO RIVER CRYSTAL DARTER OCCURRENCES (5)
SAMPLING PERIOD: 1961 - 1993

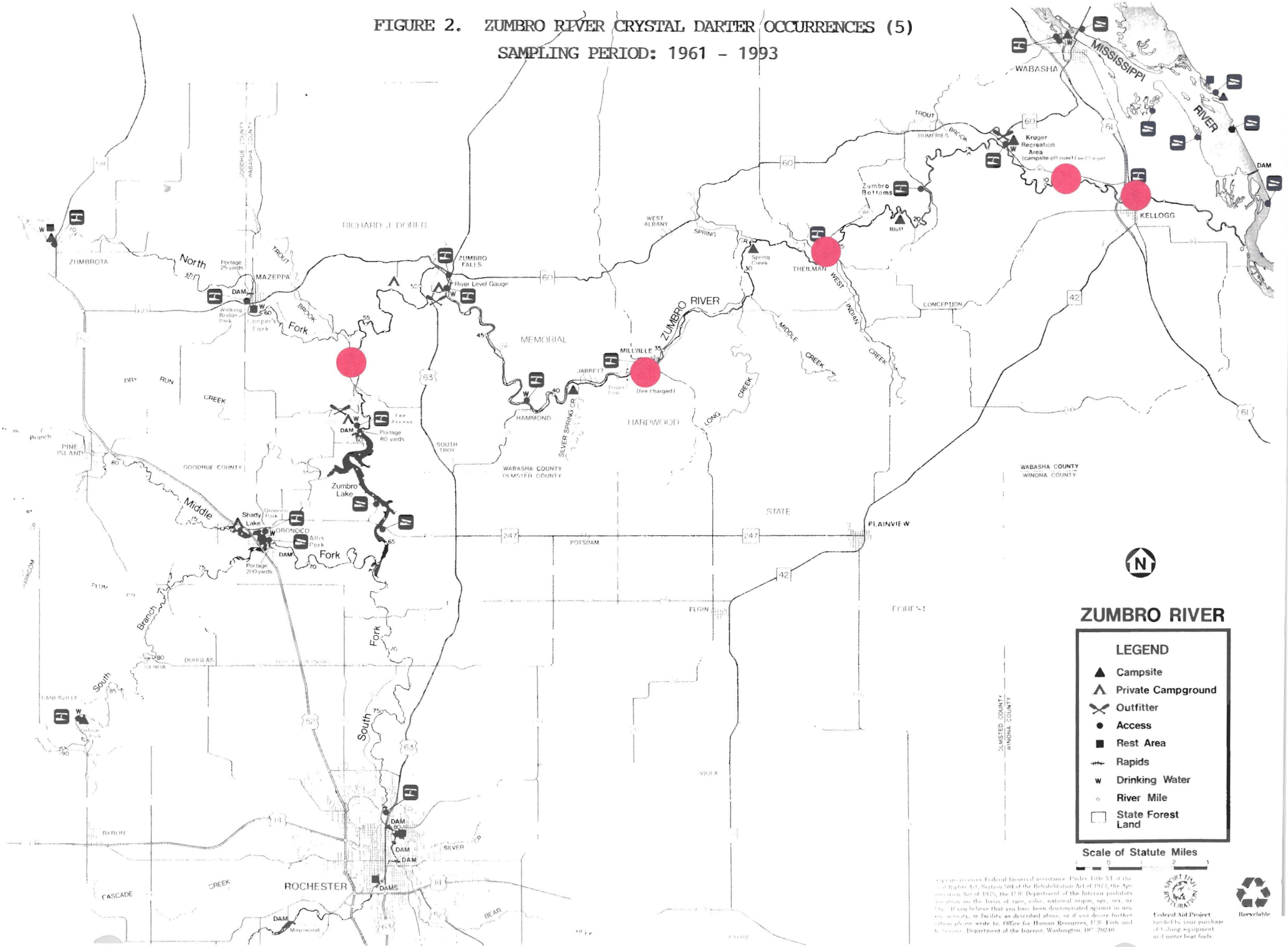
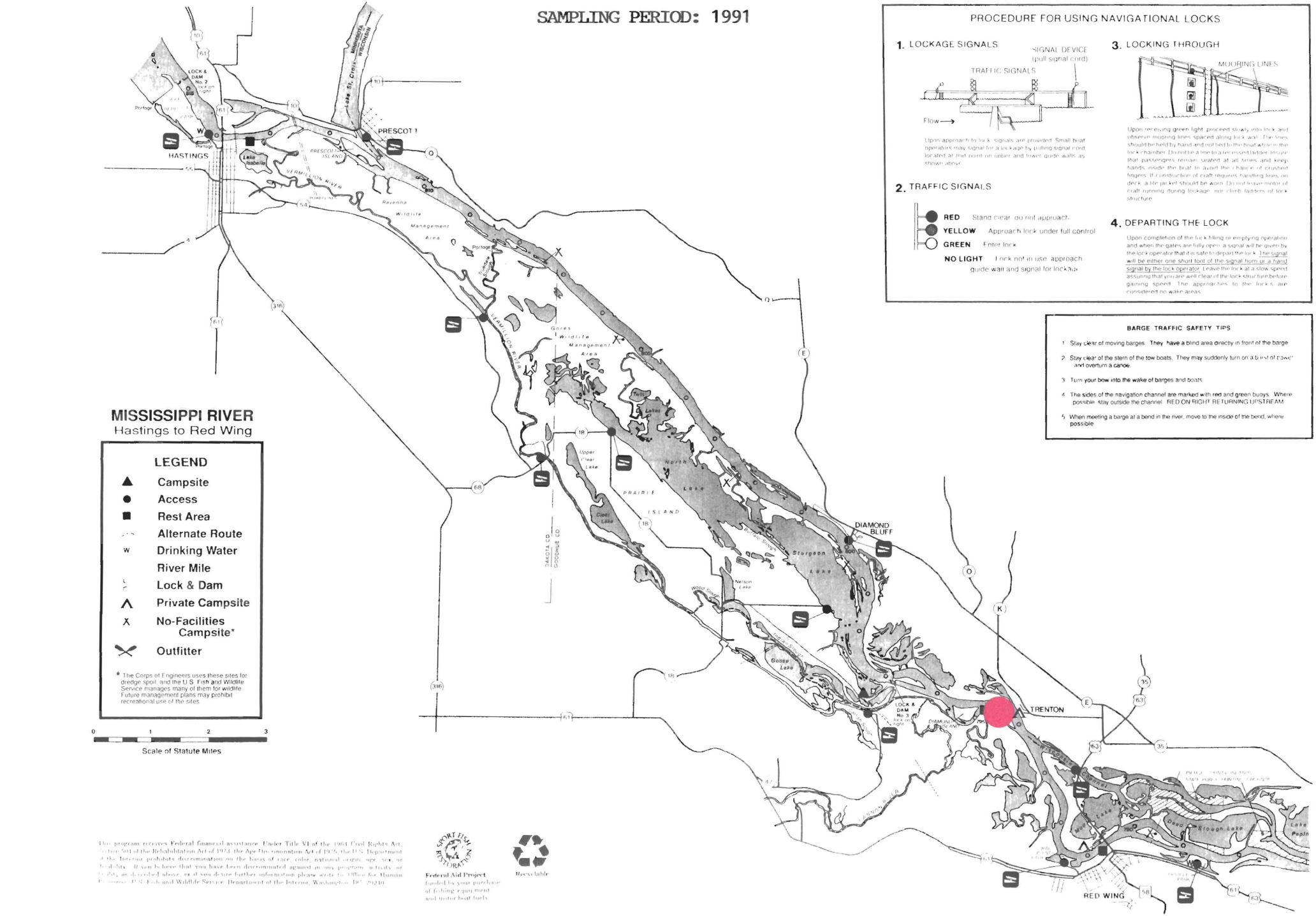


FIGURE 3. MISSISSIPPI RIVER (A) CRYSTAL DARTER OCCURRENCES (1)

SAMPLING PERIOD: 1991



PROCEDURE FOR USING NAVIGATIONAL LOCKS

1. LOCKAGE SIGNALS

Upon approach to lock, signals are provided. Small boat operators may signal for a lockage by pulling signal cord located at mid point on upper and lower guide walls as shown above.

2. TRAFFIC SIGNALS

- **RED** Stand clear, do not approach.
- **YELLOW** Approach lock under full control.
- **GREEN** Enter lock.
- **NO LIGHT** Lock not in use; approach guide wall and signal for lockage.

3. LOCKING THROUGH

Upon receiving green light, proceed slowly into lock and observe mooring lines spaced along lock wall. The lines should be held by hand and not tied to the boat while in the lock chamber. Do not tie a line to any recreational vehicle. Ensure that passengers remain seated at all times and keep hands inside the boat to avoid the chance of crushed fingers. If construction of craft requires handling lines on deck, a life jacket should be worn. Do not leave motor of craft running during lockage; nor climb ladders of lock structure.

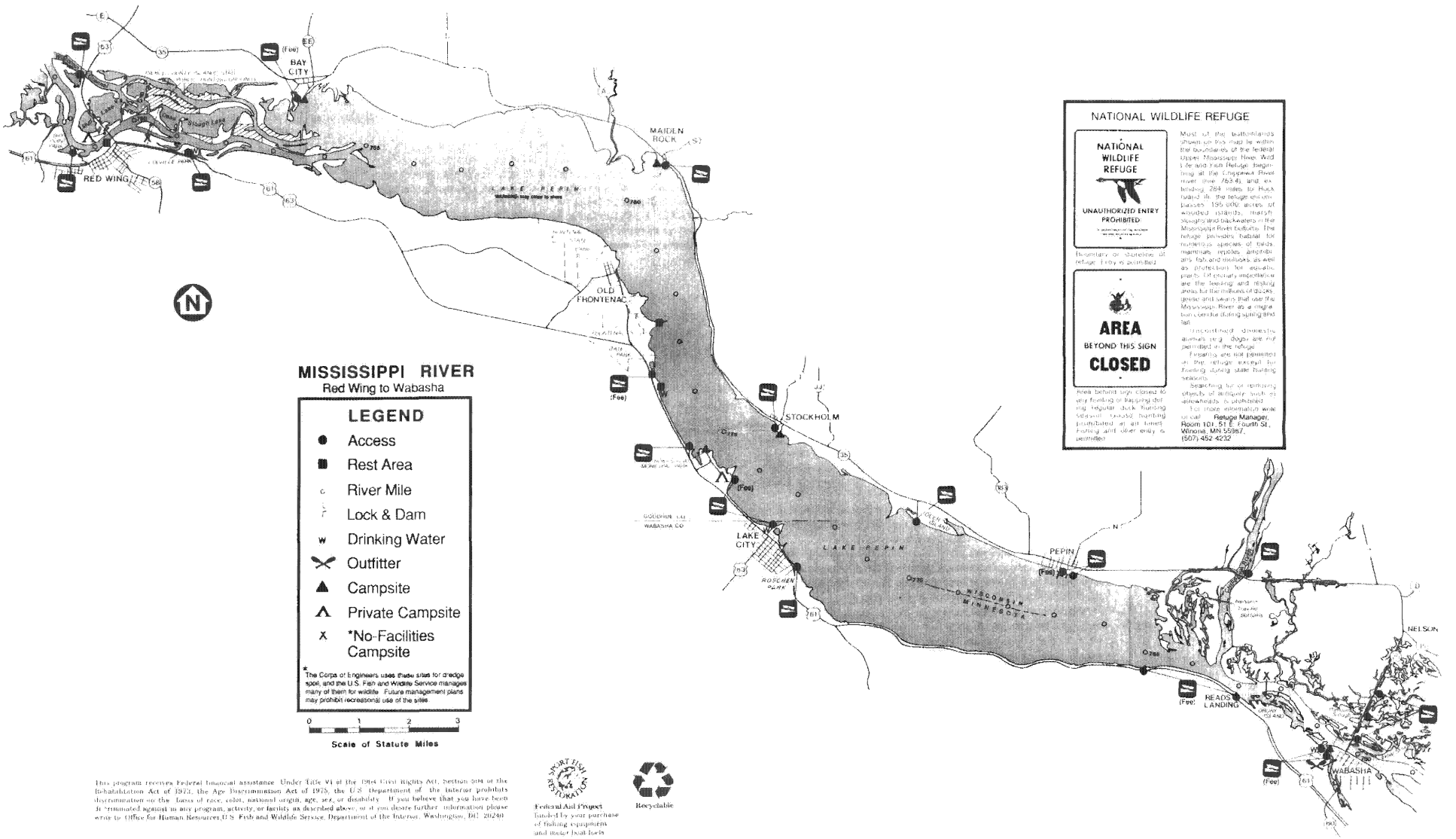
4. DEPARTING THE LOCK

Upon completion of the lock filling or emptying operation and when the gates are fully open, a signal will be given by the lock operator that it is safe to depart the lock. The signal will be either one short toot of the signal horn or a hand signal by the lock operator. Leave the lock at a slow speed assuring that you are well clear of the lock structure before gaining speed. The approaches to the locks are considered no wake areas.

BARGE TRAFFIC SAFETY TIPS

1. Stay clear of moving barges. They have a blind area directly in front of the barge.
2. Stay clear of the stern of the tow boats. They may suddenly turn on a burst of power and overturn a canoe.
3. Turn your bow into the wake of barges and boats.
4. The sides of the navigation channel are marked with red and green buoys. Where possible, stay outside the channel. RED ON RIGHT RETURNING UPSTREAM.
5. When meeting a barge at a bend in the river, move to the inside of the bend, where possible.

FIGURE 4. MISSISSIPPI RIVER (B) CRYSTAL DARTER OCCURRENCES (0)



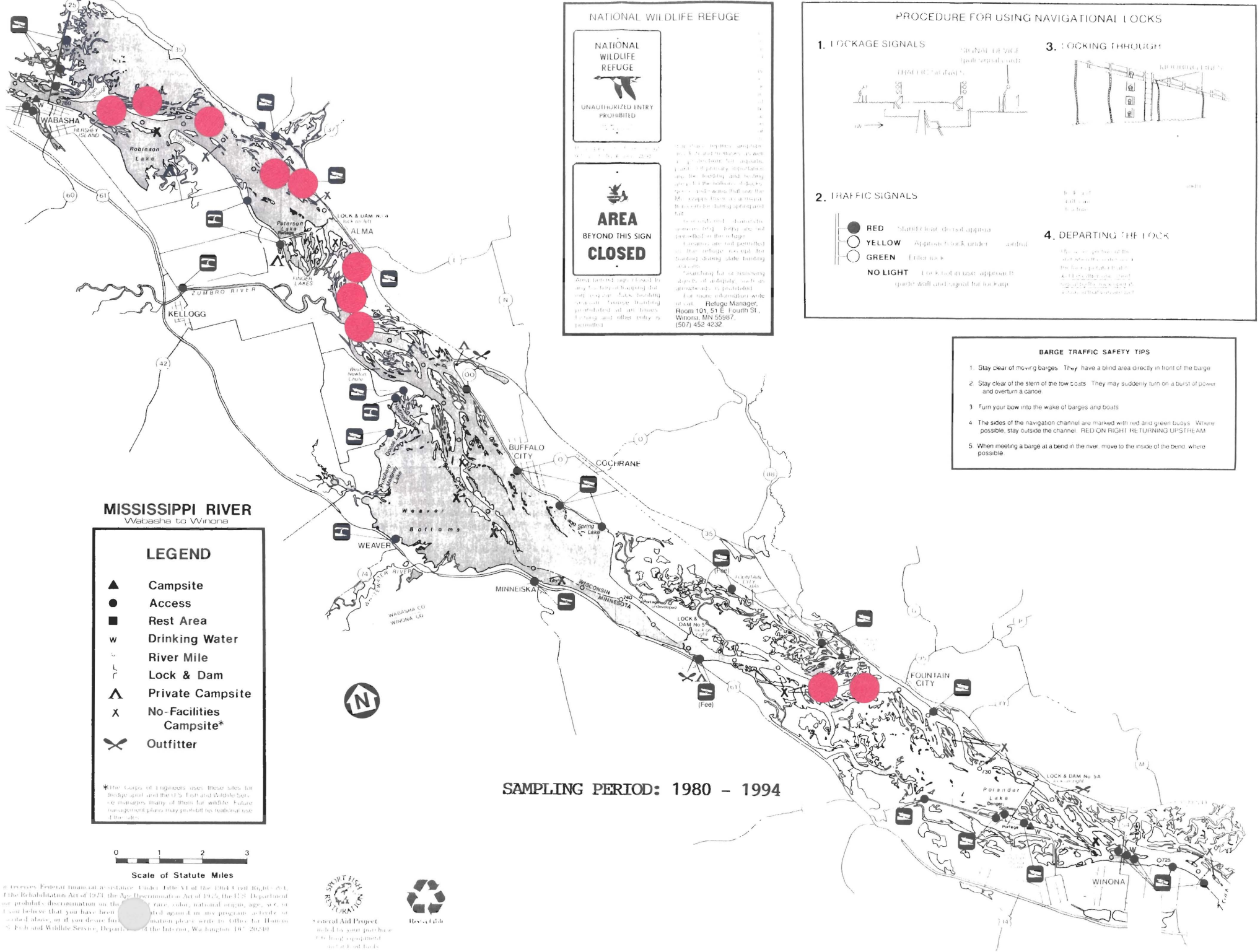


FIGURE 6. MISSISSIPPI RIVER (D) CRYSTAL DARTER OCCURRENCES (4)

SAMPLING PERIOD: 1945 - 1994

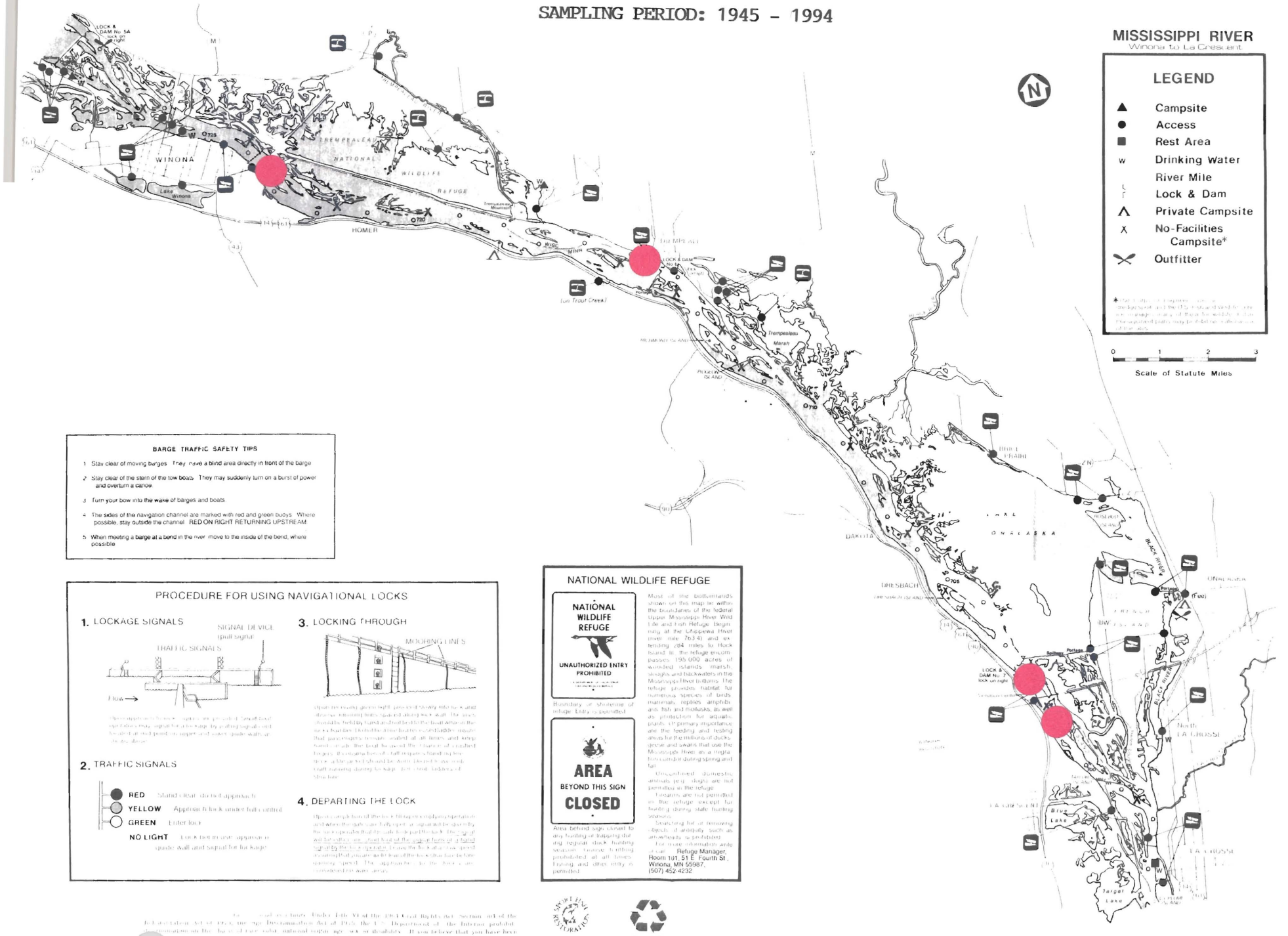
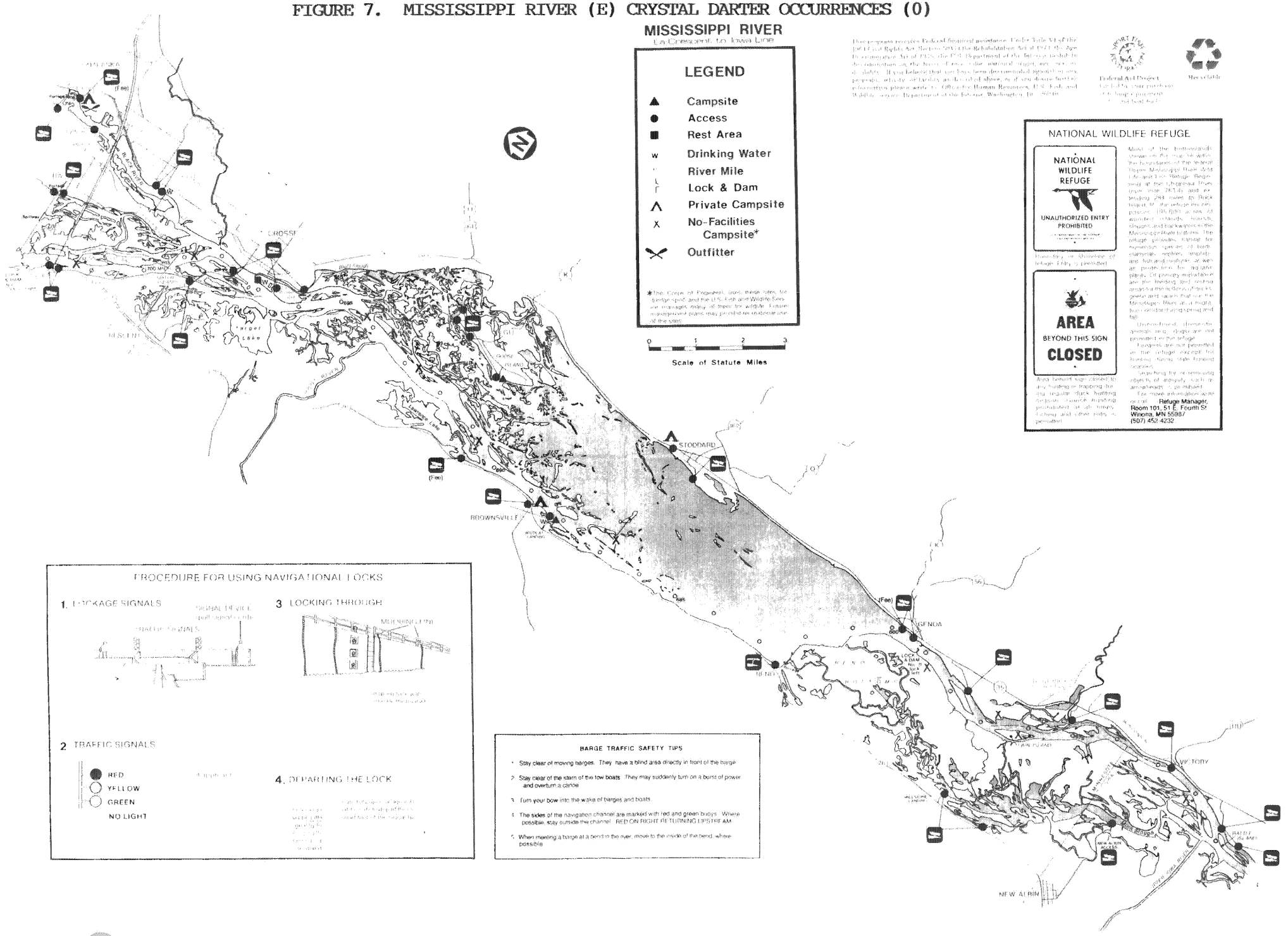


FIGURE 7. MISSISSIPPI RIVER (E) CRYSTAL DARTER OCCURRENCES (0)



Sampling Gear Review: Gear types were not reported for all occurrences, but the crystal darter has been sampled with seines, stream shockers (wading sites), boom shockers (boat sites), deepwater trawls, and in one collection, impingement screens which cover cooling water intake pipes for a power generating plant. Depths, when provided, ranged from approximately three to 30 feet.

Seines have been used longer than any other gear, compiled the most records, and also sampled the greatest number of specimens for a single collection (13 at RM 754.3 and 11 at RM 733.8). Gear specifications and techniques are similar to those described in the Methods and Materials section. However, MDNR Fisheries crews used a boat in one collection to deploy the seine in deep water, and Eddy and Underhill (1973) reported the dislodging of woody debris in swift currents would flush specimens into a seine held directly downstream.

The primary disadvantage of this gear occurs at depths greater than the seine. The floats excessive buoyancy lift the lead line off the bottom and the seine passes over darters and other benthic fishes. The crystal darter's reported burrowing behavior (Robison and Buchanan 1988) also injects an unknown variable which **suggests** all seining efforts to date may have actually undersampled the species. To be effective, especially in large rivers, seines should have a depth of at least 10 feet, and a sufficiently weighted lead line which must (1) always remain in contact with the river bed over its entire length, and (2) also provide some agitation to dislodge crystal darters buried in the substrates.

Generally, darters are poor candidates for electroshocking surveys especially in deep or turbid water because they posses either a rudimentary swim bladder or lack one entirely which eliminates buoyancy. The electrical field often stuns darters on the bottom without exhibiting galvanotaxis (forced swimming with direction) toward the anode electrode and waiting dip netter.

Stream shockers are used in shallower water and usually more effective than boom shockers (at least in clear streams) because immobilized darters can be recovered off the bottom. However, collections of this gear type have been made only in the Zumbro River.

Boom shockers can cover several miles of stream in a single day, and permit sampling in swift currents over wing and closing dams and extensive gravel-sand raceways which are too large or deep to wade with a stream shocker. However, this gear is rarely effective on darters over a depth of about three feet and less under turbid conditions. Despite these limitations, boom shockers rank second to the seine in compiling the overall number of crystal darter records.

Deepwater trawl surveys have produced only two crystal darter collections in upper Pools 5 and 8 at depths of about 30 feet which is likely not the maximum depth this species inhabits. However, these habitats are not routinely sampled and additional surveys need to be conducted before this gear can be adequately evaluated.

Conclusions and Recommendations

The crystal darter does not warrant Threatened status in Minnesota for the following reasons. (1) Unless federally listed, peripheral species such as the crystal darter should never qualify for status higher than Special Concern. (2) All but two of the occurrences are relatively recent (1978 - 1994), and most of these are the results of surveys conducted since 1991. (3) Many occurrences are comprised of multiple records which encompass varying sample periods (i.e., weeks, months, years, and decades) and verifies the same results can be reproduced on a fairly consistent basis. (4) The current distribution is much wider than what was known in 1983 when the species was first reviewed and appropriately designated Special Concern. (5) The crystal darter has exhibited the ability to successfully adapt and utilize habitats associated with wing dams which are extensive and abundant throughout most of species reported range in Mississippi River Pools 4 - 9.

Future efforts to document the crystal darter in Minnesota and identify threats to habitats should include the following: (1) Surveys should be conducted where the species has not been reported in the Mississippi River drainage below St. Anthony Falls. This includes lower reaches of the Minnesota, Cannon, Whitewater, and Root Rivers, and Mississippi River Pools 1 - 3, 7, and 9. (2) When the species is sampled in a new locality, at least one voucher specimen should be deposited in the fish collection at the James Ford Bell Museum of Natural History in St. Paul. (3) Seines used in the Mississippi River must be deep enough and sufficiently weighted to **effectively** sample depths

from a minimum of six to at least nine feet. In the 1994 study, this requirement was never met and the seine was either too shallow (Table 1) or too deep where the lead line was only partially or sporadically in contact with the bottom. (4) A boom shocking survey should be conducted down the last 10 to 20 miles of the Zumbro River and selectively target only preferred habitats (i.e., gravel-sand raceways and embedded woody debris). If these efforts produce favorable results, expand surveys to include other large Mississippi River tributaries. (4) Deepwater trawl surveys should be attempted in scour holes below lock and dams, wing and closing dams, and tributary mouths. (5) Kuehne and Barbour (1983) reported the crystal darter may be more vulnerable to nocturnal sampling which should be incorporated in all survey gear regimes. (5) Surveys should be done during low flows from about late June to mid September. Crystal darters have been collected as late as November, but this 1994 study observed a dramatic decline of all species and total catch in late September when fishes are apparently moving into deeper water. (6) Abundance data is lacking on the species and follow up SCUBA surveys at sites where the crystal darter has been recently sampled may provide this information, and also, reveal the actual effectiveness of the gear type used. However, Dr. Jay Hatch (pers.comm.) from the University of Minnesota experienced almost zero visibility during a 1994 summer dive due to turbidity. Additional dives should be attempted during extended droughts and winter months when optimum water clarity conditions exist. (7) Robison and Buchanan (1988) reported that crystal darter habitats are extremely vulnerable to channelization, dredging, and impoundments.

The Mississippi River is managed for commercial navigation which includes the practice of dredging a minimum channel depth and dumping dredge spoil on river banks and islands. This would **appear** to be the greatest threat facing the crystal darter in Minnesota. However, one lower Pool 4 collection was made in 1994 at an island (RM 756.4) which is a designated and active dredge spoil disposal site. The unconsolidated material gradually eroding back into the river **may be** providing a source of suitable substrates which favor the crystal darter's burrowing behavior. The potential impacts (negative and positive) of this practice should be fully assessed through long term studies conducted at this site and others designated for dredge spoil dumping. Variables to be monitored should include the presence and abundance of fishes both tolerant and sensitive to siltation and turbidity, water depth, current velocity and direction, substrate composition and embeddedness, and sediment deposition on wing dams.

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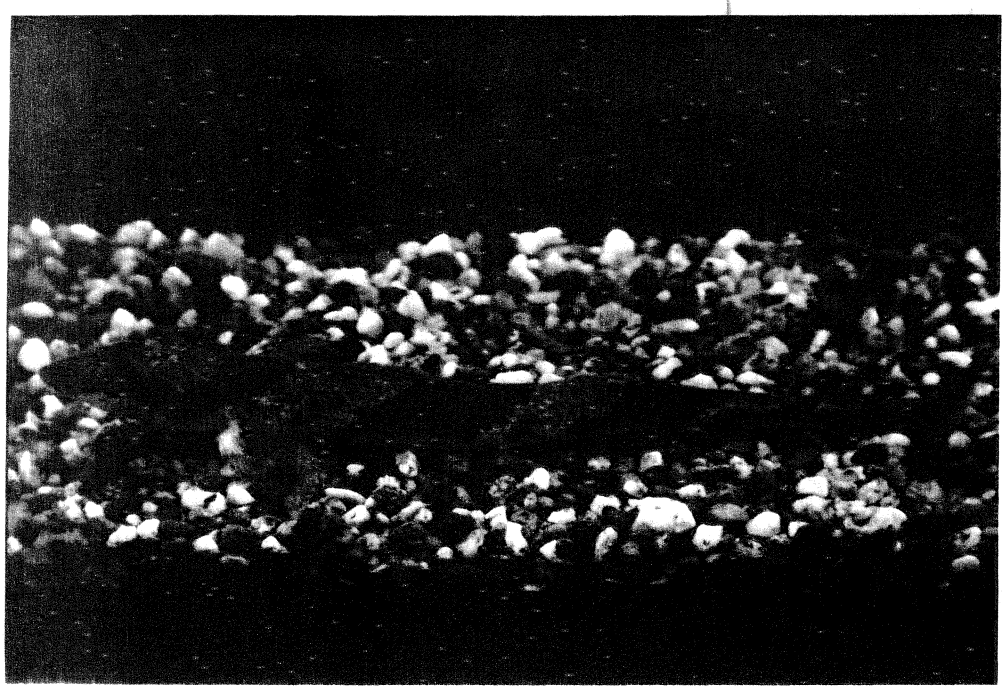
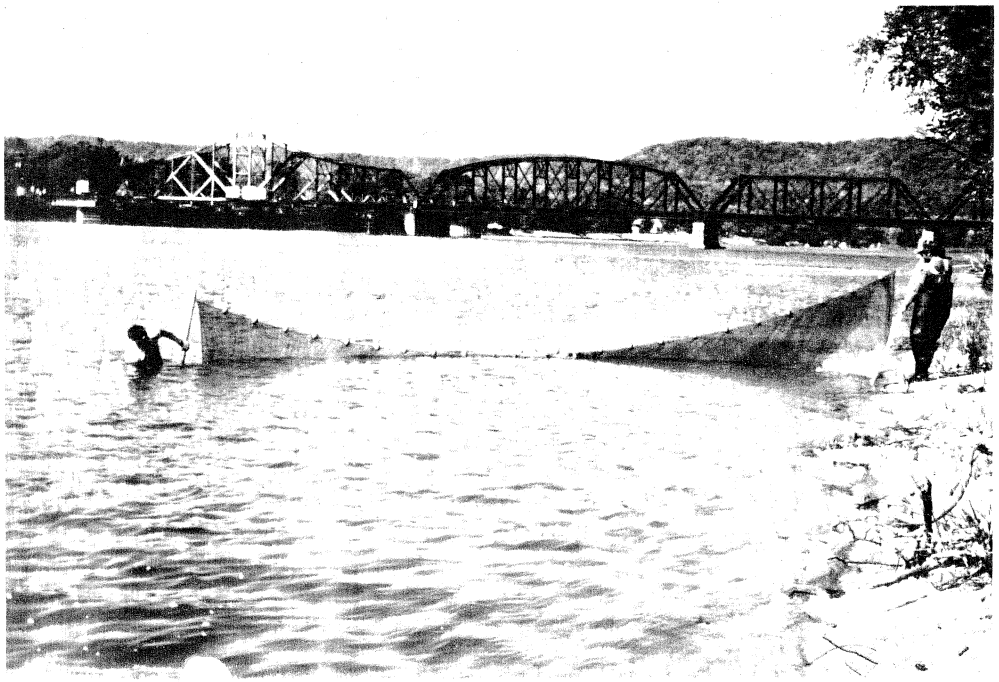
CRYSTAL DARTER-ZUMBRO RIVER WABASHA CO./SEINING



COLLECTION SITE: HERSHEY ISLAND RM 758.7 UP/DOWN



COLLECTION SITE: UNNAMED ISLAND RM 754.3 UP/DOWN

COLLECTION SITE: UNNAMED ISLAND RM 733.9 UP/DOWN

CRYSTAL DARTER (CRYSTALLARIA ASPRELLA)
WISCONSIN BOUNDARY AND ALL MINNESOTA RECORDS
FEDERAL-STATE AGENCY, UNIVERSITY, AND PUBLIC UTILITY
UPPER MIDWEST FISH DATABASE OVERVIEW SUMMARY
COMPILED BY KONRAD SCHMIDT (612) 776-3468
1663 IOWA AVENUE EAST
SAINT PAUL, MINNESOTA 55106

*** OVERALL SUMMARY ***

Last Data Entry Date:	04/17/95
Database Records:	30
No Date Data Records:	0
Pre-1945 Records:	1
1946-1969 Records:	3
1970-Present Records:	26
No Catch Data Records:	1
1-5 Catch Records:	25
6-10 Catch Records:	2
>10 Catch Records:	2
Total Catch:	75
Average Catch:	3
Maximum Catch:	13
Sample Stations:	24
Replicate Samples:	6
First Sample Date:	19450802
Last Sample Date:	19941014
Sampling Days:	28
Drainage Basins (12):	2
Major Watersheds (82):	5
Disjunct Basin Records:	0

CRYSTAL DARTER (CRYSTALLARIA ASPRELLA)
WISCONSIN BOUNDARY AND ALL MINNESOTA RECORDS
FEDERAL-STATE AGENCY, UNIVERSITY, AND PUBLIC UTILITY
UPPER MIDWEST FISH DATABASE OVERVIEW SUMMARY
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*** MINNESOTA SUMMARY ***

Database Records:	17
Total Catch:	41
Average Catch:	2
Maximum Catch:	11
Sample Stations:	13
Replicate Samples:	4
First Sample Date:	19610816
Last Sample Date:	19941014
Sampling Days:	16
Counties (87):	3

*** WISCONSIN SUMMARY ***

Database Records:	13
Total Catch:	34
Average Catch:	3
Maximum Catch:	13
Sample Stations:	11
Replicate Samples:	2
First Sample Date:	19450802
Last Sample Date:	19940929
Sampling Days:	13
Counties (72):	4

CRYSTAL DARTER (CRYSTALLARIA ASPRELLA)
WISCONSIN BOUNDARY AND ALL MINNESOTA RECORDS
FEDERAL-STATE AGENCY, UNIVERSITY, AND PUBLIC UTILITY
UPPER MIDWEST FISH DATABASE OVERVIEW SUMMARY
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MN - WI BORDER POOLED DATA SUMMARY
(BURNETT - VERNON COUNTIES, WI)

St. Croix Records:	2
St. Croix Catch:	2
Average Catch:	1
Mississippi Records:	21
Mississippi Catch:	54
Average Catch:	3

*** IOWA SUMMARY ***

Database Records:	0
Total Catch:	0
Average Catch:	0
Maximum Catch:	0
Sample Stations:	0
Replicate Samples:	0
First Sample Date:	0
Last Sample Date:	0
Sampling Days:	0
Counties (99):	0

CRYSTAL DARTER (CRYSTALLARIA ASPRELLA)
WISCONSIN BOUNDARY AND ALL MINNESOTA RECORDS
FEDERAL-STATE AGENCY, UNIVERSITY, AND PUBLIC UTILITY
UPPER MIDWEST FISH DATABASE BASIN DISTRIBUTION SUMMARY
COMPILED BY KONRAD SCHMIDT (612) 776-3468
1663 IOWA AVENUE EAST
SAINT PAUL, MINNESOTA 55106

Total Catch	Average Catch	Database Records	Sample Stations	Replicate Samples	Sample Days	Major Watersheds
Mississippi Headwaters Basin (15 Major Watersheds)						
0	0	0	0	0	0	0
Upper Mississippi Black-Root Basin (6 Major Watersheds)						
73	3	28	22	6	26	4
Upper Mississippi Maquoketa-Plum Basin (3 Major Watersheds)						
0	0	0	0	0	0	0
Upper Mississippi Iowa-Skunk-Wapsipinicon Basin (4 Major Watersheds)						
0	0	0	0	0	0	0
Minnesota Basin (12 Major Watersheds)						
0	0	0	0	0	0	0
Saint Croix Basin (4 Major Watersheds)						
2	1	2	2	0	2	1
Des Moines Basin (3 Major Watersheds)						
0	0	0	0	0	0	0
Missouri-Big Sioux Basin (3 Major Watersheds)						
0	0	0	0	0	0	0
Missouri-Little Sioux Basin (1 Major Watershed)						
0	0	0	0	0	0	0
Lake Superior Basin (5 Major Watersheds)						
0	0	0	0	0	0	0
Red River of the North Basin (17 Major Watersheds)						
0	0	0	0	0	0	0
Rainy Basin (9 Major Watersheds)						
0	0	0	0	0	0	0
Overall (12 Basins/82 Major Watersheds)						
75	3	30	24	6	28	5

UPPER MIDWEST FISH DATABASE RECORDS
COMPILED FROM FEDERAL-STATE AGENCY, PUBLIC UTIILITY, AND
UNIVERSITY LAKE AND STREAM SURVEYS
KONRAD SCHMIDT, 1663 IOWA AVE. E., ST. PAUL, MN 55106

LOCATION/TWP-RGE-SEC:RIVER MILE	COUNTY-STATE	CATCH	DATE	SOURCE
** PERCIDAE - PERCHES				
* CRYSTAL DARTER (AMMOCRYPTA ASPRELLA)				
St.Croix R/33-19-27:46.3	Polk-WI	1	19781016	WDNR-Fago
St.Croix R/31-19-29:31.9	St. Croix-WI	1	19820826	WDNR-Fago
Mississippi R/113-15-11:794.4	Goodhue-MN	1	19910903	MDNR-LTRM
Mississippi R/111-10-34:758.7	Wabasha-MN	1	19940714	MDNR-Fish
Mississippi R/111-10-34:758.7	Wabasha-MN	1	19941013	Schmidt
Mississippi R/22-13-20:758.0	Buffalo-WI	1	19940929	MDNR-LTRM
Mississippi R/22-13-21:756.4	Buffalo-WI	2	19940812	MDNR-LTRM
Mississippi R/22-13-34:754.3	Buffalo-WI	7	19940817	Hatch
Mississippi R/22-13-34:754.3	Buffalo-WI	13	19940824	Hatch
Mississippi R/22-13-35:753.9	Buffalo-WI	1	19930729	MDNR-LTRM
Mississippi R/108-08-23:734.8	Winona-MN	1	19820600	EA Inc.
Mississippi R/108-08-25:733.8	Winona-MN	2	19821110	EA Inc.
Mississippi R/108-08-25:733.9	Winona-MN	1	19941014	Schmidt
Mississippi R/108-08-25:wdam 2-4	Winona-MN	11	19800000	Army COE
Mississippi R/18-10-08:723	Buffalo-WI	1	19450802	Greenbank
Mississippi R/18-10-08:723	Buffalo-WI	2	19940804	Mundahl
Mississippi R/21-13-13:1706.9S	Buffalo-WI	3	19800925	Dairyland
Mississippi R/21-13-14:1706.0+	Buffalo-WI	1	19800000	WDNR-Fago
Mississippi R/21-13-23:750.0	Buffalo-WI	1	19820721	Simon
Mississippi R/18-09-27:1670.1+	Trempealeau-WI	0	19490000	WDNR-Fago
Zumbro R/109-12-18:34.0	Wabasha-MN	1	19840820	MDNR-Fish
Zumbro R/109-12-18:34.0	Wabasha-MN	3	19850918	MDNR-Fish
Zumbro R/109-12-18:34.0	Wabasha-MN	3	19931019	MDNR-Fish
Zumbro R/109-14-15	Wabasha-MN	2	19850520	MDNR-Fish
Zumbro R/110-10-17	Wabasha-MN	1	19610816	Bell
Zumbro R/110-10-22	Wabasha-MN	6	19610816	Bell
Zumbro R/110-11-31:Theilman	Wabasha-MN	3	19850000	Gates
Mississippi R/105-04-33:702.3	Winona-MN	1	19920817	WDNR-LTRM
Mississippi R/105-04-33:702.3	Winona-MN	1	19921015	WDNR-LTRM
Mississippi R/105-04-34:701.2	Winona-MN	2	19930908	WDNR-LTRM
* Subsubtotal *		75		
** Subtotal **		75		
*** Total ***		75		