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**Pallid Sturgeon Movement Patterns and Habitat Use
Missouri River and Lewis and Clark Reservoir
South Dakota and Nebraska.**

Field Season 2000-2001

Prepared by

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STUDY AREA

The riverine reach of Lewis and Clark Reservoir extends approximately 72 km from below Fort Randall Dam to near Springfield, South Dakota where its features become more like a reservoir. To aid in sampling, the riverine reach was divided into four sample areas of approximately equal length (Figure 1). The upper site extends from Fort Randall Dam (river mile (RM) 880) to downstream of Greenwood, South Dakota (RM 865). The upper-middle site extends from RM 865 to near Verdel, Nebraska (RM 856) and the lower-middle site extends from RM 856 to Running Water, South Dakota (RM 845). The lower site comprises the remainder of the river (RM 845 to near Springfield, SD). The fifth sample site is Lewis and Clark Reservoir from downstream of Springfield, SD to Gavins Point Dam. If all fish are found to remain in the riverine reach, this section will be excluded as a sample site.

METHODS

In 2000, six adult and 50 juvenile pallid sturgeon, *Scaphirhynchus albus*, were surgically implanted with a sonic transmitter and a PIT tag at Gavins Point National Fish Hatchery. Each transmitter emits a unique code specific to an individual fish, and has a life expectancy of 36 months. These fish were held several weeks, following implantation to determine tag retention and survival rates. Following this holding period, surviving fish were transported and released, near Verdel, NE, in the riverine portion of Lewis and Clark Reservoir.

Two tracking methods are employed during each sample period; extensive and intensive. Extensive tracking involves the location of as many fish as possible per zone, and intensive tracking is the following of a few fish for the entire tracking period. During each sample period, at least two zones were tracked extensively, and at least one fish intensively. Tracking began immediately post stocking and continued bi-monthly, i.e. every other week, until weather conditions prohibited tracking during the winter months. Tracking will resume as early as feasible in the spring. All sample zones and sample periods are selected at random to reduce bias. An ultrasonic receiver and directional hydrophone were used to determine fish locations. A location was recorded when the coded impulses from the sonic transmitter became equally audible with a 360° rotation of the hydrophone. Once a fish location was determined, latitude and longitude coordinates were recorded with a PLGR+96 Global Positioning System (GPS) receiver and habitat types were assigned. The habitat types were designated as: main channel, side channel, backwater, island, reservoir, tributary mouths, and tailrace. Combinations of these descriptors may be necessary to get specific habitat types like side channel island, or main channel island. Tracking in tributaries will be conducted if deemed necessary, and will be recorded as a separate habitat type. Along with the habitat types, surface water temperature, flow at 0.2 and 0.8 times water depth and at bottom, turbidity, and percent maximum depth were collected at fish relocation sites. Percent maximum depth is the ratio of the fish depth relative to the maximum cross sectional depth where the fish is located.

Diel movement patterns were determined by dividing a 24 h period into four sub-periods; dawn (1 h before to 1 h after sunrise), day (2 h after sunrise to 2 h before sunset), dusk (1 h before sunset to 1 h after sunset) and night (2 h after sunset to 2 h before sunrise). The tracking periods were determined randomly, and as many fish as possible were followed during that time. Water level fluctuations and poor visibility made night tracking difficult due to decreased flows and safety. To minimize risk, night time tracking was conducted in conjunction with dusk and dawn periods.

This allowed biologists to begin tracking during daylight hours and finish tracking during daylight hours. The GPS coordinates and habitat types for each relocated fish were recorded approximately every hour. Tracking is planned to continue through 2002, or until transmitter failure.

RESULTS

Twenty-two of the fifty juveniles and the six adults survived the tagging operation and holding period. Following the 2000 sampling, 16 of the 22 juveniles and 4 of the 6 adults have been relocated at least once. This year, three additional juveniles were located for the first time, increasing the total number of relocated juveniles to 19. However, only 2 of the 4 adults were found this year. The following data summarize what has been found to date (Table 1).

Habitat

In 2000, all fish were relocated in main channel habitats. This year, there were 2 fish locations recorded at the confluence of the Missouri and Niobrara Rivers as well as a few locations documented in side-channel habitats. No fish have been located in the reservoir proper or the river marsh area immediately around Springfield, SD. In fact, the downstream most relocation was approximately 5 km below Running Water, SD. It was our hopes that side-scan sonar data would be collected at fish locations this year. This data was to be collected by US Geological Survey staff from Columbia Missouri. As of this writing, arrangements have not been made for this year, but will try to be scheduled during the 2002 sampling period. This data will be useful to help quantify bottom substrate profiles and help determine if these fish are selecting for certain habitats that cannot be identified from the surface.

Movement

Like last year, most fish stayed within a few hundred meters of their original location during intensive tracking (Table 2). However, seasonally the fish moved about substantially. Figures 2-9 depict pallid locations from March through the end of September. During March and April (Figures 2 and 3) fish were mainly found in the middle section (sample zones 2 and 3) of the study area. By May (Figure 4), fish were only located in the upper section (sample zone 1 and the upper portion of zone 2) of the study area where they remained through June (Figure 5). Beginning in July (Figure 6) the fish appeared to disperse from the upper reaches and were found in all zones by early September (Figure 8). By late September (Figure 9) fish were only found in the middle section (sample zones 2 and 3) of the study area. This pattern of moving upstream in the spring and dispersing throughout the system in the fall suggests some type of migratory behavior. Because these fish are from the 1997 year class, it may be assumed that they are immature and not moving for spawning purposes. More likely, the movements were associated with flows from dam operations. This behavior will be statistically analyzed when the study is completed in 2002 at which time a sufficient sample size should have been obtained for analysis.

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Table 1. Summary of data collected at pallid sturgeon locations below Fort Randall Dam, South Dakota during 2000 and 2001. Adult and juvenile data are combined.

| | 2000 | 2001 |
|----------------------------|-------------------------------|--------------------------------|
| Turbidity (NTU's) | 3.3-36.8 (mean 6.2, SE=1.9) | 1-26.4 (mean 6.4, SE=0.33) |
| Mean depth of location (m) | 3.6 m (N=29, SE=0.231) | 3.8 m (N=115, SE=0.18) |
| Percent maximum depth | 30.6-100 (mean 58.2, SE=3.5) | 2.5 - 100 (mean 77.5, SE=1.88) |
| Column velocity (cm/sec) | data not collected | 6.8-108 (mean 57.3 (SE=2.24) |
| Bottom flows (cm/sec) | 5.3-42.1 (mean 17.6, SE=2.02) | 5-106 (mean 47.0, SE=2.14) |

Table 2. Summary of pallid sturgeon movement data collected below Fort Randall Dam, South Dakota during 2000 and 2001. Adult and juvenile data are combined.

| | 2000 | 2001 |
|---|------------------------|----------------------|
| Average distance moved (m/hr) All periods combined | 239.7 (SE=49.2) | 55.5 (SE=8.1) |
| Average distance moved (m/hr) Dawn | 103.8 (N=2, SE=27) | 84.3 (N=15, SE=23.1) |
| Average distance moved (m/hr) Day | 264.9 (N=24, SE=63.3) | 34.2 (N=51, SE=6.3) |
| Average distance moved (m/hr) Dusk | 312.3 (N=12, SE=182.7) | 50.2 (N=15, SE=15.5) |
| Average distance moved (m/hr) Night | 119.1 (N=10, SE=27) | 50.3 (N=22, SE=18.6) |

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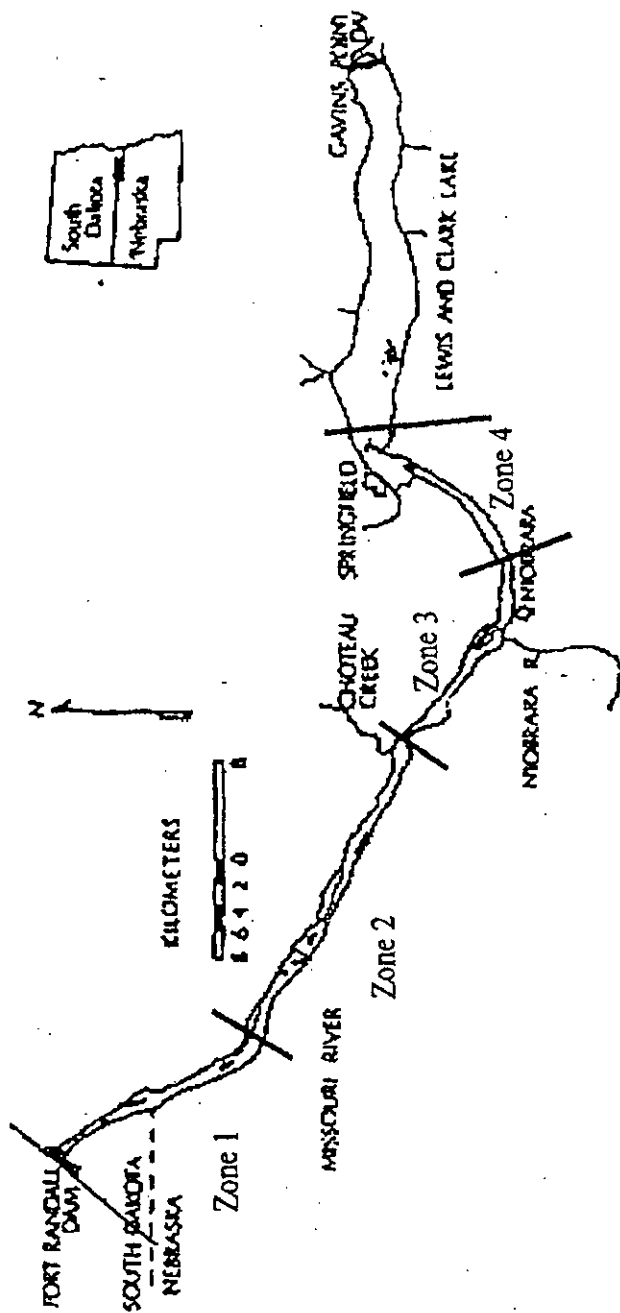
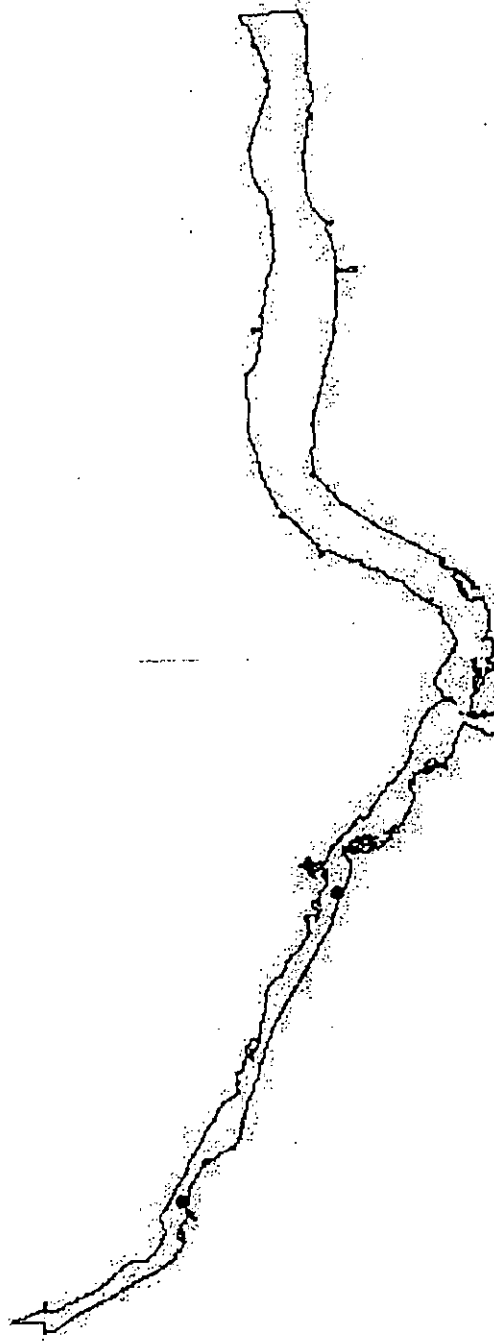


Figure 1. Map of four sample zones on Missouri River from Fort Randall Dam to Gavins Point Dam, South Dakota.

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Figure 2. Pallid sturgeon locations based on extensively tracking from Fort Randall Dam, South Dakota to the head of Lewis and Clark Reservoir during March 2001.



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Figure 3. Pallid sturgeon locations based on extensively tracking from Fort Randall Dam, South Dakota to the head of Lewis and Clark Reservoir during April 2001.



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Figure 4. Pallid sturgeon locations based on extensively tracking from Fort Randall Dam, South Dakota to the head of Lewis and Clark Reservoir during May 2001.



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Figure 5. Pallid sturgeon locations based on extensively tracking from Fort Randall Dam, South Dakota to the head of Lewis and Clark Reservoir during June 2001.

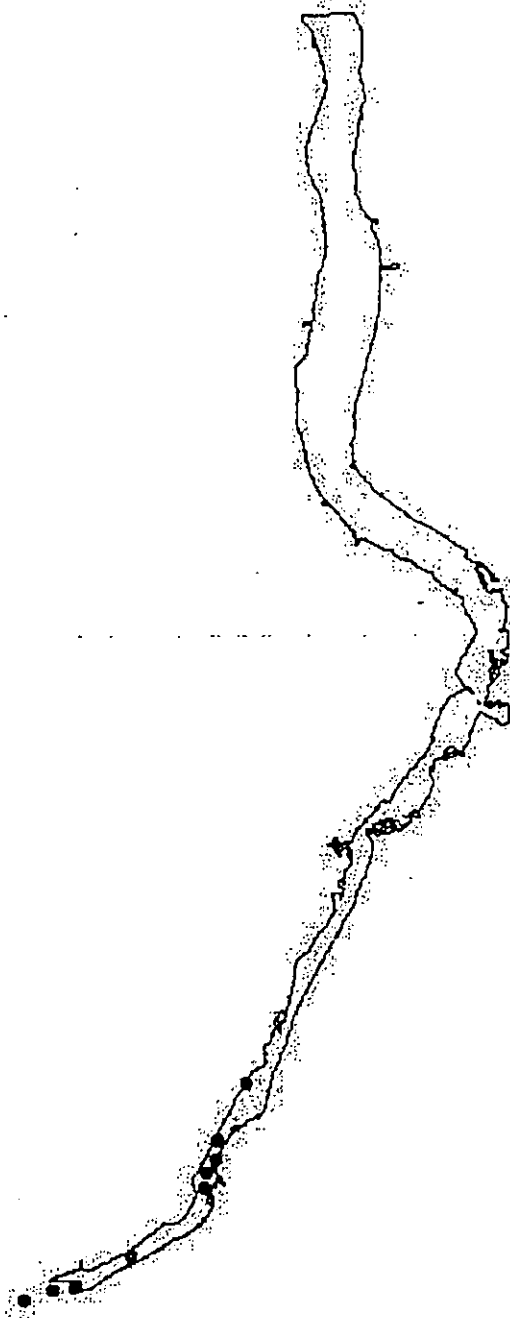


Figure 6. Pallid sturgeon locations based on extensively tracking from Fort Randall Dam, South Dakota to the head of Lewis and Clark Reservoir during July 2001.



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Figure 7. Pallid sturgeon locations based on extensively tracking from Fort Randall Dam, South Dakota to the head of Lewis and Clark Reservoir during August 2001.



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Figure 8. Pallid sturgeon locations based on extensively tracking from Fort Randall Dam, South Dakota to the head of Lewis and Clark Reservoir during Early September 2001.



Figure 9. Pallid sturgeon locations based on extensively tracking from Fort Randall Dam, South Dakota to the head of Lewis and Clark Reservoir during late September 2001.



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