Ref ID: 86670

Movements and Habitat Preferences of Adult Post Spawn Pallid Sturgeon Pallid Sturgeon Telemetry Study

2001 Progress Report

by

Wade L. King
Fishery Biologist

and

Ryan Wilson
Biological Technician

U.S. Fish and Wildlife Service
Missouri River FWMAO
Bismarck, North Dakota

January 29, 2002

Introduction

This progress report summarizes telemetry research field activities conducted in the 2001 field season in accordance with the US Fish and Wildlife Service's (USFWS), Post Spawn Pallid Sturgeon Telemetry Study. Funding for this project has been provided by Western Area Power Administration (WAPA), the US Army Corps of Engineers (USACE) and the USFWS.

Due to limited amounts of data concerning post spawn movements of pallid sturgeon, the USFWS initiated a long term study in an attempt to answer some of the unresolved questions about these unique, native river fish.

The main goals of this study are to monitor post spawn migrational movements to help identify pallid sturgeon spawning areas, determine pallid sturgeon response to " Spring Test Flows " out of Fort Peck Dam to see if mimicking natural flows will expand pallid use and habitat into the Missouri River above the confluence of the Yellowstone River, and to evaluate reproductive stages of known post spawn females. We also hope telemetered pallid sturgeon will serve as an important tool for future broodstock capture by utilizing and netting possible aggregations in relation to telemetered fish as Tews (1993) demonstrated during fall tagging. Netting additional fish and marking them with Passive Integrated Transponder (PIT) tags will also serve to help strengthen current population estimates.

Study Area

The pallid sturgeon study area (See Figure 1, for core study area), for the most part, is a semi-confined stretch of approximately 290 river miles encompassing the Missouri River from Fort Peck Dam to the head waters of Lake Sakakawea and from the Yellowstone River confluence (~ RM 1582.0) up the Yellowstone River to the Intake Diversion Dam, Intake, Montana.

Within our study core area, we placed three fixed data logging stations to shorten tracking zones into more manageable reaches. This served dual purposes because it aided researchers in tracking fish and gives us continual movement data within this area.

As suggested in the Post Spawn Telemetry Study Plan, fixed data logging station locations had to be adjusted due to a variety of factors, but eventually all three stations were placed in well suited areas that met the criteria needed to work effectively. Our first station initially was placed up the mouth of the Yellowstone River a few hundred yards (576506 E, 5314283 N) adjacent to or above the confluence on the west river bank below the high water line. Later in the summer, it was moved to the east bank on private property, due to low water conditions. The second station, which is identified as the Fort Union Station (586880 E, 5315030 N), is approximately five river miles up the Missouri River above the confluence, and as its name suggests, lies due east of Fort Union State Park on the north shore of the Missouri River on State owned land . The third station was located down the lower Missouri River approximately 11 river miles below the confluence and is adjacent to the Erickson Island State Game Production Area. The Erickson Island Station is located on the north shore of the management area (572089 E, 5316011 N).

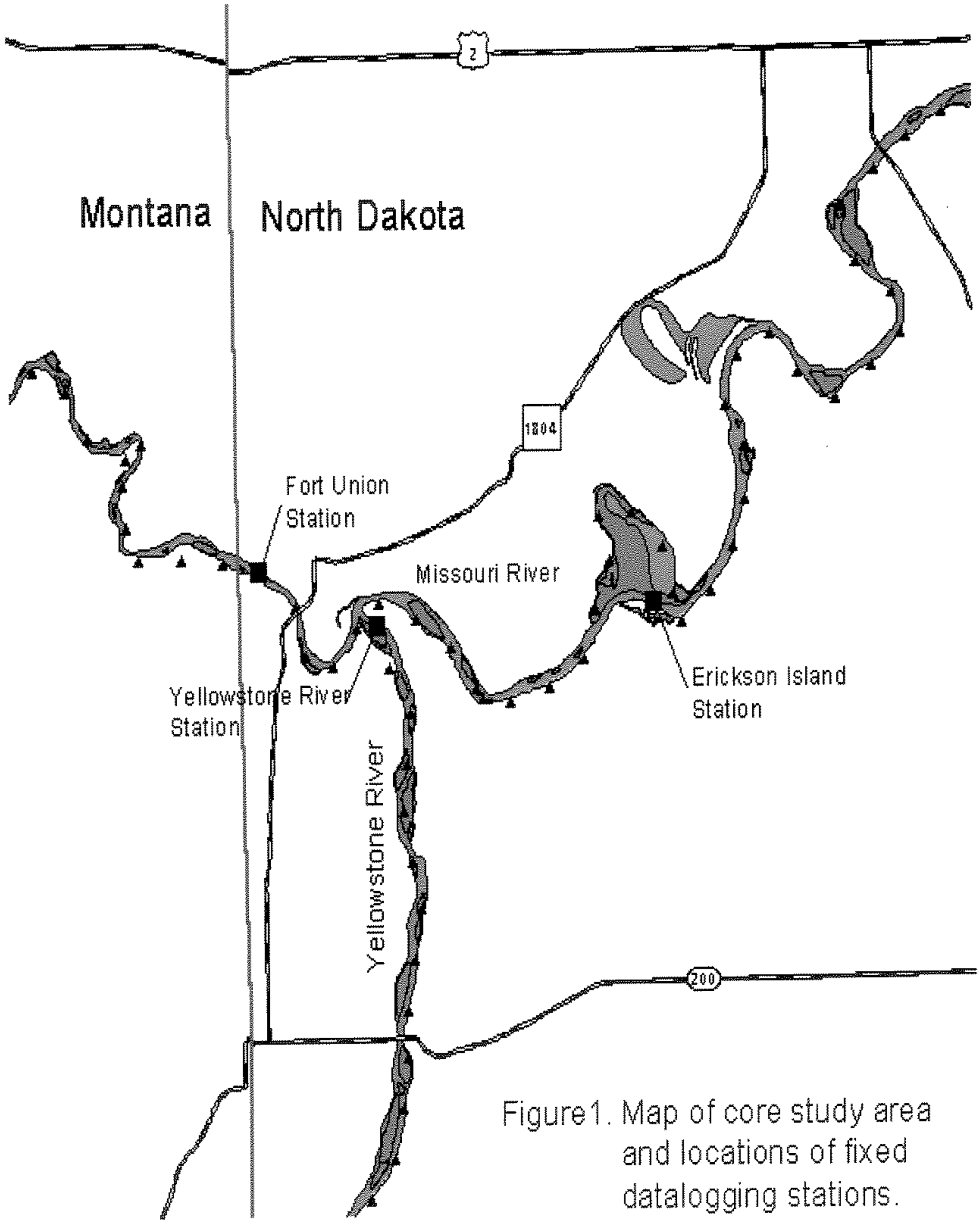

Figure1. Map of core study area and locations of fixed datalogging stations.

Methods

Adult pallid sturgeon used for our telemetry study are products of the 2000 and 2001 spawning activities performed at Garrison Dam National Fish Hatchery (GDNFH 2000), Riverdale, North Dakota, and the Miles City State Fish Hatchery (2001) at Miles City, Montana.

Crews from Montana Fish, Wildlife and Parks (MTFWP), Fort Peck Field Office, and the USFWS, Bismarck, North Dakota, worked cooperatively to provide hatcheries with gravid broodstock pallid sturgeon. Fish were collected by drifting 150' long by 6' high trammel nets with two panels (6" inside panel and 10" outside panel) along the bottom of the river with one end connected to the boat and the other end free floating. Predominantly, most pallid sturgeon were caught within the true confluence of the two rivers or directly downstream in the lower Missouri within a few hundred yards of the confluence, as well as a few hundred yards up the Yellowstone River.

Once a fish was netted, the pallid sturgeon was brought back to the boat ramp where morphometric and meristic data were taken. In addition, the fish was staged by hatchery personnel (Rob Holm, GDNFH) to assess if it was a male or female, gravid or nongravid, and whether the fish would be transported to the hatchery for propagation purposes. If found to be a candidate for propagation, the fish was vaccinated with an antibiotic (Biomyocin) and loaded on a fifth wheel distribution trailer and transported to the appropriate hatchery.

The "Class of 2000" fish were spawned at GDNFH on June 14, 2000, and telemetry transmitters were surgically fitted at the hatchery on August 28. Ten fish, two females and eight males were tagged with transmitters (Table 1). These fish were kept at the hatchery to recover from the induced stress caused by handling at spawning time, as well as the surgical procedures used to deploy tags. The pallids were returned to the confluence on October 10 through the 12, 2000.

Due to the virus issues associated with GDNFH, the Upper Basin Pallid Workgroup decided that 2001 pallid sturgeon spawning would take place at the Miles City State Hatchery in Miles City, Montana. Six fish (Class of 2001, Table 2) were spawned at Miles City hatchery on June 26th, 2001. Due to room shortage at the hatchery, fish were surgically tagged on July 3 and were returned to the confluence on July 9 and 10, 2001. Unfortunately, one of the female pallid sturgeon died after tagging, thus leaving one female and four males to return back to the river for study purposes. (A total of 15 were tracked during the study).

Pallid sturgeon were surgically implanted with Combined Acoustic Radio Transmitters (CART), manufactured by Lotek Engineering Inc. of New Market, Ontario. The transmitter utilized in the study, Model CART 32_1S, is an internal tag with an external antennae (~ 18 inches) with a listed longevity rate of five years, based on a five second burst rate. Diameter of the tag is 32 mm in length, and weighs 61.0 grams (weight in water).

We chose to employ CART tags to utilize the dual aspect of the tags, using the radio aspect in wide shallow reaches of the river or in and around island complexes, and using the sonic aspect in deep, highly turbid areas where radio telemetry would be compromised.

Name	Code	Sex	PIT tag #	Weight in Pounds	Weight in Kilograms	Fork Length in Inches	Fork Length in Millimeters
Art	18	M	1F4849755B	33	14982	51	1295
Al	22	M	1F4A004552	26	11793	52	1335
Annie	25	F	1F47715752	55	24970	62 +	1580
Andre	26	M	7F7B081579	32	14528	56	1444
Alex	34	M	115525534A	36	16344	55	1404
Aaron	38	M	1F477B3A65	45	20430	57+	1468
Arnie	44	M	2202236E31	61	27694	60+	1542
Archie	46	M	1F4A33194B	45	20340	57+	1468
Andrew	50	M	1F4A143350	28	12712	53+	1352
Amber	62	F	115713555A	57	25878	59+	1516

Table 1. Class of 2000. Pallid sturgeon tagged and spawned in 2000 at the Confluence of the Yellowstone and Missouri Rivers. Name, code, sex, Pit tag numbers, weight, and lengths are listed.

Name	Code	Sex	PIT tag #	Weight in Pounds	Weight in Kilograms	Fork Length in Inches	Fork Length in Millimeters
Butch	2	M	1F4A27214F	50	22857	61	1541
Bridget	10	F	220E345E09	61	27971	63+	1615
Bart	14	M	115631222A	29	13257	52+	1340
Bob	116	M	7F7D3C5708	30	13714	55+	1405
Ben	144	M	1F4A111C6A	43	19657	55	1394

Table 2. Class of 2001. Pallid sturgeon tagged and spawned in 2001 at the Confluence of the Yellowstone and Missouri Rivers. Name, code, sex, Pit tag numbers, weight, and lengths are listed.

CART tags also work exclusively with Lotek receivers and fixed data logging stations, allowing researchers to download movement and direction data of individual fish to support manual tracking.

CART tags were surgically implanted using a combination of methods of Bramblett (1996), Clancey (1992), and procedures implemented by researcher's listed in the Hatchery Manual for the White Sturgeon (Conte et al.1988). The only deviation from past researchers methods was the addition of anesthetizing the incision with a local anesthetic (lidocaine), to lesson stress. In addition, an application of SuperGlue was applied to incisions and sutures to help seal tissue together and strengthen suture knots. The use of the local anesthetic seemed to have a positive effect on pallid sturgeon, as most fish seemed to be more docile during the initial incision and insertion of tags.

To ensure CART tags were operating properly, tags were tested on three different occasions with the accompanying SRX_400 W5 Lotek receiver. All tags were tested and cycled upon arrival of shipment in Bismarck, ND, tested upon insertion into the fish at the previously mentioned fish hatcheries, and finally retested again at the boatramp before fish were released back into the wild at the Confluence of the Yellowstone and Missouri Rivers. All fifteen tags performed perfectly on all occasions and hopefully will continue to do so long-term.

We tracked fish from April until October at two different tracking intensities. In April, May, and June, we tracked fish extensively five days per week throughout the entire three month time span to try to maximize locations per fish during spring flows and suspected spawning periods. Beginning in July, we went to a less aggressive tracking regime consisting of tracking for five days every three weeks throughout the rest of the field season until October 8, when fixed data logging stations were removed from the river.

Typical tracking protocol consisted of traveling daily to all three fixed datalogging stations to download movement data which assisted in ascertaining directions of individual fish. This helped determine the section of river to be sampled. For the majority of the tracking season, the acoustic aspect was utilized exclusively for relocating tagged fish. Relocation of fish was accomplished by lowering the 360 degree hydrophone beneath the bottom of the boat, floating for approximately two minutes, then raising the hydrophone and powering down river 300 meters, and repeating this process until we found a fish or finished sampling a study section.

Upon receiving signals from a fish, a handheld baffled 180 degree directional hydrophone was used to home in on the coded pallid sturgeon. Several drifts were then made to get directly above the fish and to obtain a power signal from our SRX_400 receiver of 200 or above with a gain reading of zero percent. Once a power rating of 200 or above was achieved and maintained, we anchored above the fish and started recording data.

Relocation data included fish name, code number, date and military time of location. A Global Positioning System (GPS) waypoint was taken with a Rockwell Precision Lightweight PLGR+96. Waypoint numbers, as well as their corresponding Easting and Northing values were recorded into a field logbook in case PLGR+96 data was lost or erased before it could be downloaded.

A fish's physical location also was noted in the field logbook. Two different categories were used: 1) main channel or side channel, main channel inside bend, and main channel outside bend, and 2) whether the fish was associated with main or side channel island, main or side channel upstream of island, and main or side channel downstream of island.

Additionally, depth, water temperature, and turbidity were also recorded. Turbidity was measured with a handheld Hach 2100P Portable Turbidimeter and data was recorded in NTU's. A laminated field map also was utilized to record rivermiles which were used to backup GPS values and provide quick reference of past locations. Flow data downloaded weekly from the United States Geological Survey's (USGS) Sidney and Culbertson gauging stations was also added to the logs.

Finally, a small, rough map was sketched in the field logbook to help document yardage values to islands, sandbars, nearest shore, far shore, and total distance of river width. Yardages were determined with a Bushnell Laser Rangefinder, model Yardage Pro 1000. All data collected in the field was later entered into an EXCEL spreadsheet which is compatible for exporting files into various statistical programs.

Results and Discussion

Due to different unanswered questions concerning the feasibility of the long term Pallid Sturgeon Telemetry Study, the 2001 field season was converted into a "pilot phase" for upcoming research. Concerns were raised about effectiveness of equipment at the Fort Peck coordination meeting, as fixed data logging stations are somewhat of a new concept for this part of the region and our water quality parameters. Contingent on effectiveness of Lotek's telemetry equipment, another profound concern was whether biologists could relocate individual fish effectively, or enough times to provide adequate samples for statistical analysis. For these reasons, coupled with the fact that USACE warm water flow tests have been delayed due to low water conditions until 2003, a pilot phase at this juncture afforded us time to answer questions and collect important baseline movement data.

An important aspect of the pilot study phase of this project was to evaluate the functionality of the fixed datalogging stations, assess their proper placement to fragment study zones, and to measure overall usefulness in remotely collecting large amounts of data during times of the year when biologists are not on the river. On April 17 and 18, fixed datalogging stations were installed with the help of a multi-agency effort on the Missouri and Yellowstone Rivers. Personnel from MTFWP, USGS, and the North Dakota Game and Fish Department (NDGFD) all played roles in the deployment of stations. WAPA provided funding to our telemetry project by covering expenses for technological representatives from Advanced Biotelemetrics Inc. (ABI) from New Market, Ontario, to help in the initial setup of the telemetry station equipment. Doctor Richard Booth and Eric Bombardier of ABI spent four days aiding in fixed datalogging station setup, assisting in the calibration of station receivers, providing technical support concerning trouble shooting problems, and rendering much useful information on tips and techniques pertaining to our project.

The Fort Union and the Yellowstone Stations were set up to monitor both acoustic and radio frequencies, while the Erickson Island Station was set up experimentally to monitor acoustic only. Overall, all three stations performed to our satisfaction and much valuable movement data was collected throughout the course of the tracking field season. The Erickson Island Station proved to be our most consistent and trouble-free unit throughout the field season, most likely because of its location and single frequency scanning. The other two stations performed well, except for a couple of different time spans when we experienced technical difficulties with power sources and receivers shutting down. Unfortunately, during one of the time spans, both of the stations shut down simultaneously, resulting in the loss of valuable directional and movement data for a few fish over a 60 to 90-day period. We believe we have resolved the power source issue for the upcoming field season and will monitor it closely.

As mentioned previously in the report, our tracking regime primarily used the acoustic aspect for relocating tagged pallid sturgeon, with the exception of a brief period in October when water quality parameters were conducive to using radio frequency. Although the dual combined acoustic/radio aspect is supposed to be the strong point of Lotek's CART tag; unfortunately, we were unable to utilize the radio frequency most of the time due to water quality factors. This was most prevalent in the Yellowstone River where turbidity, total dissolved solids, and conductivity levels proved to be too high for optimum efficiency, therefore, we questioned the effectiveness of this aspect to locate fish.

However, within a short window of time this past fall we had varied success using the radio frequency to locate pallids by use of a boat under power (3000 rpm's). We ran the Missouri River from the confluence down to the Highway 85 bridge and found eight pallids using radio only. Using buoys to mark transmitters, we conducted some distance/depth tests to get a better grasp on the pros and cons of these tags. Relative to range, upstream detection of the tags was relatively poor, around 50 to 80 yards, while approaching the fish from downstream resulted in detection ranges of 150 to 330 yards. The most likely explanation might be that the fish were pointed upstream, thus blocking the signal with the body, versus coming from behind the fish and getting a better signal from the more exposed dangling antenna. Favorable water quality parameters were probably responsible for the limited success at that time; conditions were definitely more favorable than they had been all season.

All radio observed fish were found in eight feet of water or less, turbidity averaged around 20 NTU's, and the conductivity hovered around 560 to 590. Unfortunately, we don't see these kind of physical characteristics very often. Although the radio aspect has limitations, there are definitely applications when it could prove to be useful, especially during low flow and low turbidity conditions. Another useful application of the radio aspect is for diel movement information once we are on top of a fish. Using it for close range telemetry should not be a problem.

Manual tracking acoustically is more labor and time intensive, but proved to be highly effective for relocating fish in both river systems. Typically, we could start detecting signals of fish 300 to 400 yards away, and have occasionally picked up signals as far away as 600 yards. With these types of ranges, we felt highly confident about our method of acoustic sampling.

Two hundred thirty seven observations were made during the 2001 pilot study field season, 72 relocations by boat and 165 observations at fixed datalogging stations. This number of observations probably is a fairly low representative of relocation numbers that should be achieved in the future, based on the fact our manual tracking didn't officially start until May and we had several problems with our boat and hydrophones late in the summer.

Fourteen of 15 fish surgically implanted with internal CART tags were relocated during the pilot study. The only fish unable to be located was Aaron (# 38), a 27-pound male from the class of fish released in 2000. Upon his release in the fall of 2000, he was followed for a couple of days along with the rest of the study group and exhibited the same behavior as other tagged and released pallid sturgeon. A few possible explanations for the absence of #38 in 2001 exist. The fish may have moved out of the study area into reaches of the Upper Missouri River or the head waters of Lake Sakakawea or, simply the CART 32_1S tag may have stopped working after the fall of 2000. Another theory existing may be that the tag was expelled from the fish and buried in sediment or sand.

A large majority of the study group stayed within the confines of the lower nine miles of the Yellowstone River. Most spent considerable amounts of time around the confluence, and ranged down the lower Missouri River to the Highway 85 Bridge near Williston, North Dakota. Although Annie (# 25), was never located by boat in the Yellowstone River, she roamed extensively and set the upper limits for a boat relocated fish furthest up the Upper Missouri River (RM 1592.3) and the lower limits for a fish below the confluence, down the Lower Missouri River (RM 1551.4). We located two different males at RM's 9.5 and 9.6 on the Yellowstone River which marks the farthest point up the Yellowstone for boat relocations. However, during the periods when our stations shut down we are fairly confident two males went up the Yellowstone River above Sidney, Montana. We did not relocate them until late summer when they returned back to the confluence area.

One anomaly worth mentioning from this season's field notes was the behavior of the study's three females, Annie (# 25), Amber (# 62), and Bridget (# 10). Throughout the tracking season, a total of ten observations occurred in the upper Missouri River above the confluence; nine of the ten observations were by the above mentioned females. One male (# 34) selected the upper Missouri for a day and returned back to the confluence.

Data collected in 2001 provides baseline information for our long term study, but is insufficient for any statistical or correlation analysis. Data collected in the 2002 field season will be added to this years data and will be preliminarily analyzed for the 2002 progress report submitted to all agencies providing funding, including: USACE, WAPA, Upper Basin Pallid Workgroup, as well as the Bureau of Reclamation and the NDGFD which will be providing funding in 2002. Northern Prairie Wildlife Research Center will assist in data analysis, development and critical review of models, and aid in future project design and assessment of discrepancies.

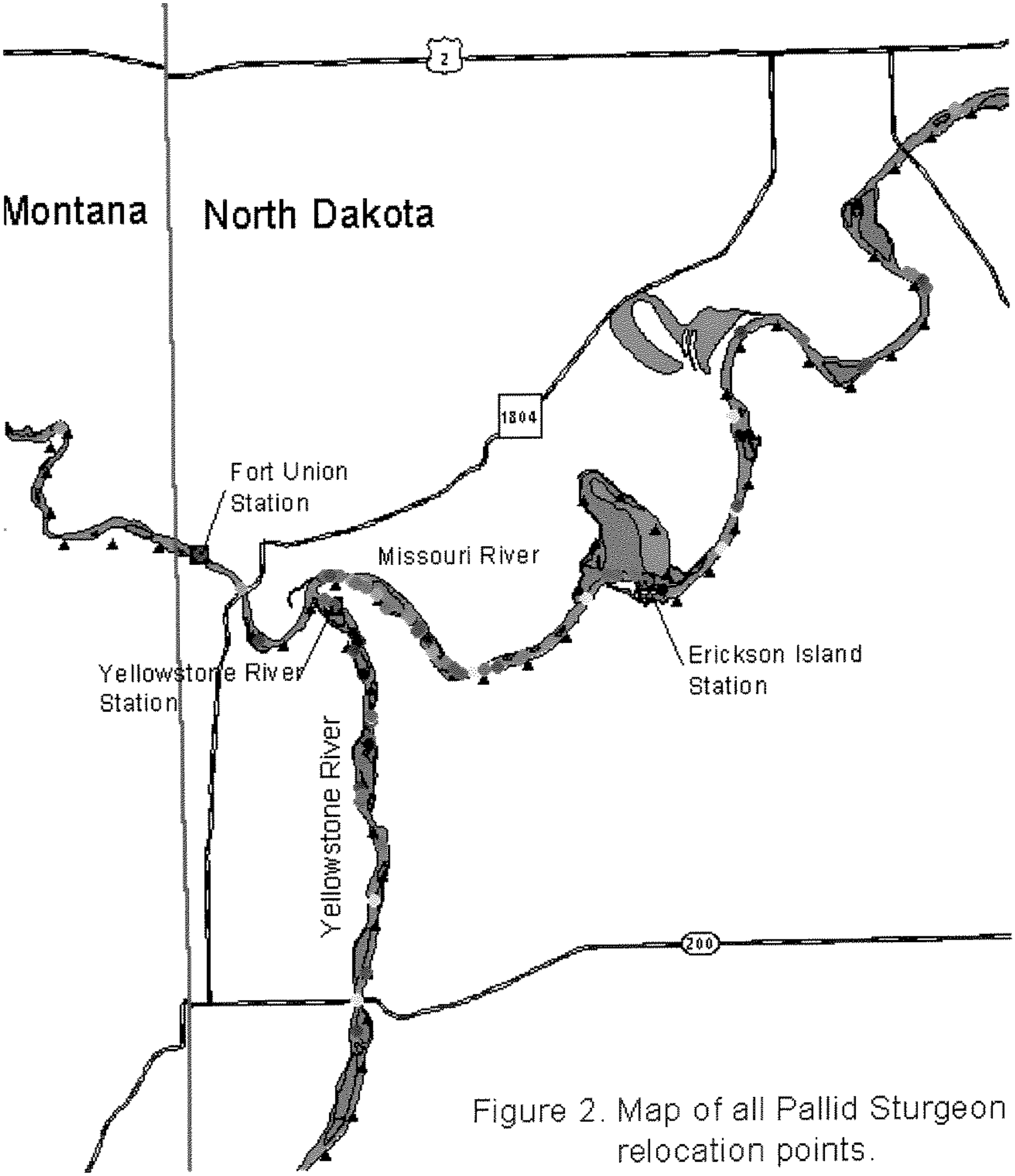

Figure 2. Map of all Pallid Sturgeon relocation points.

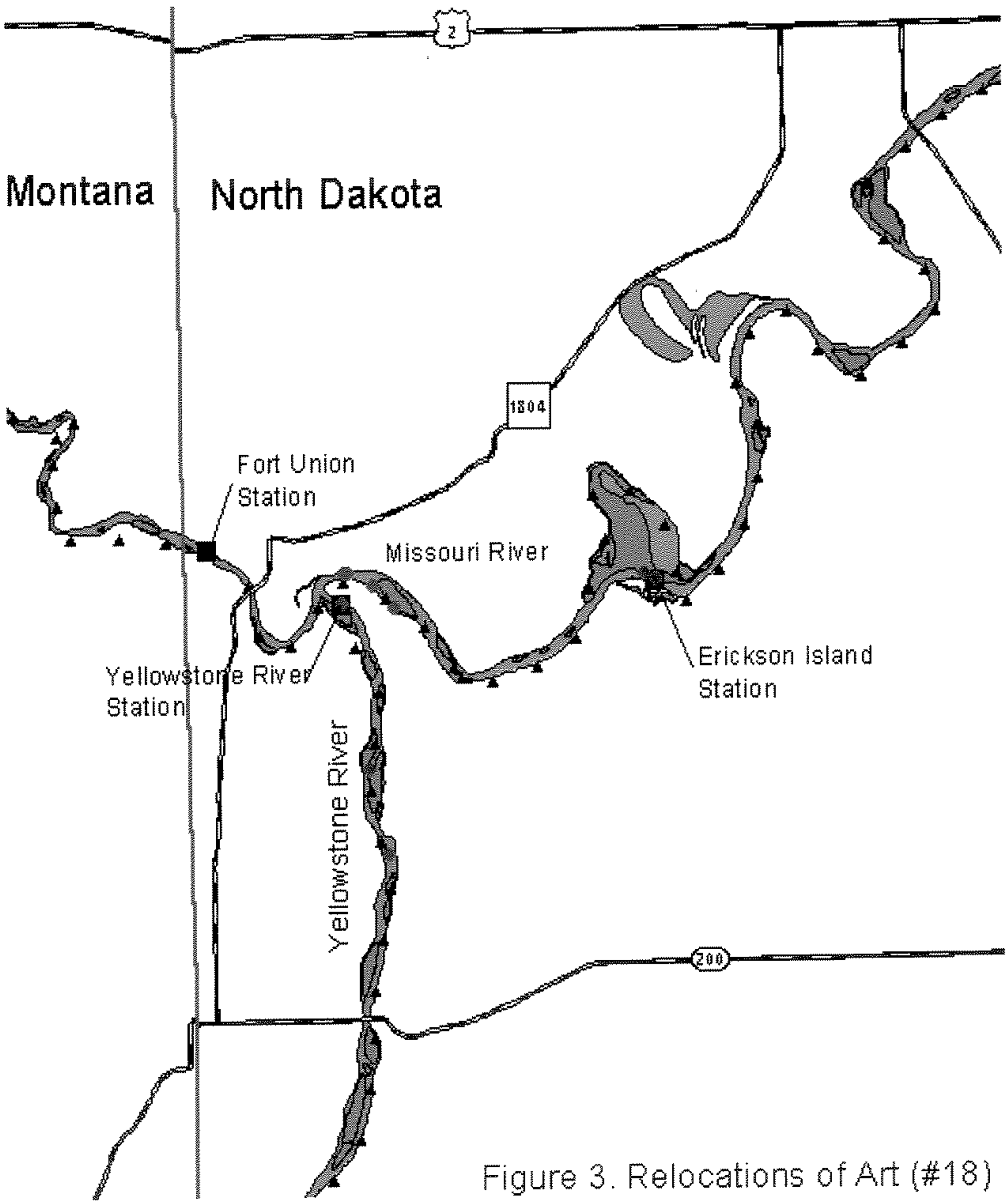

Figure 3. Relocations of Art (#18)

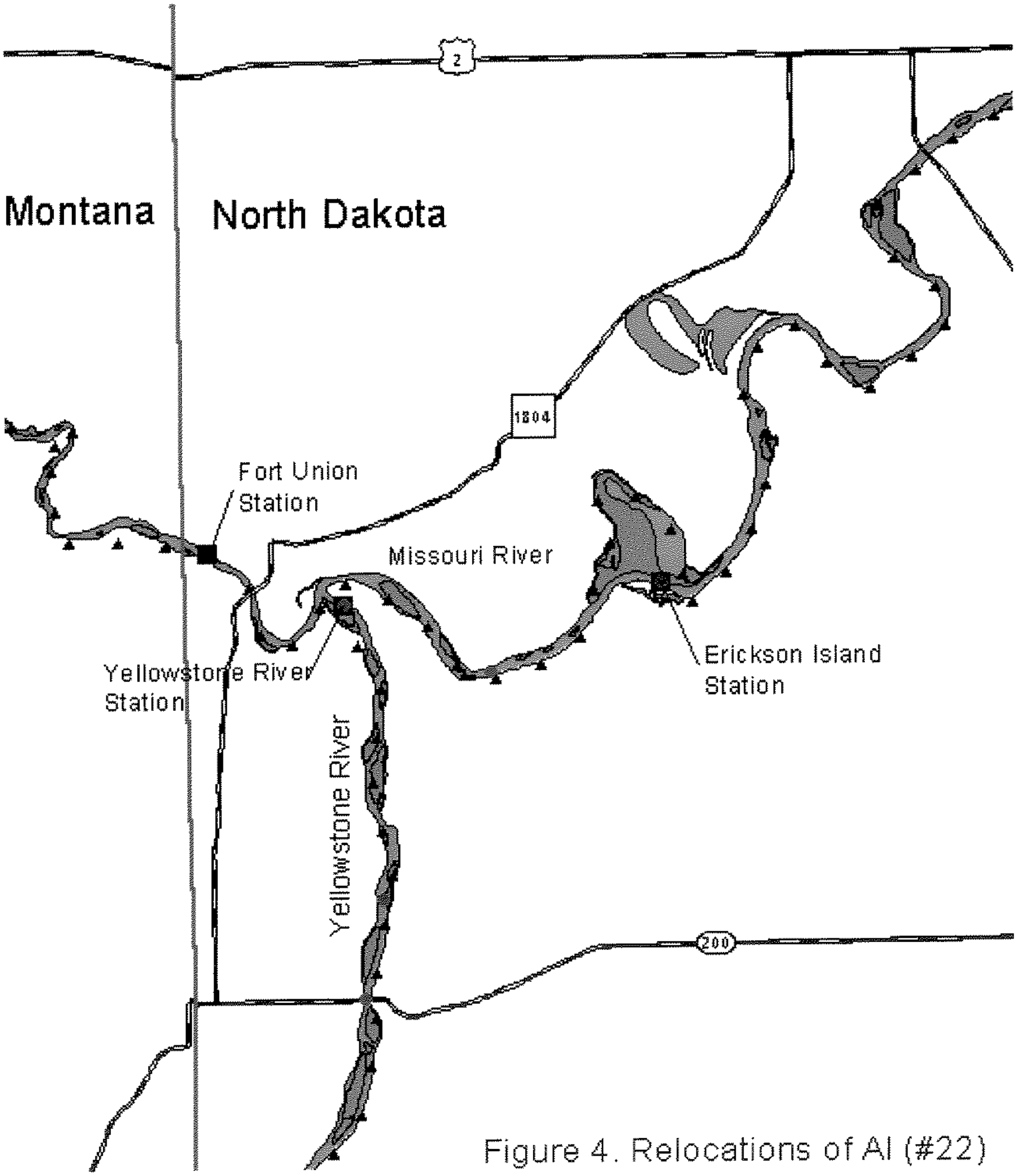

Figure 4. Relocations of Al (#22)

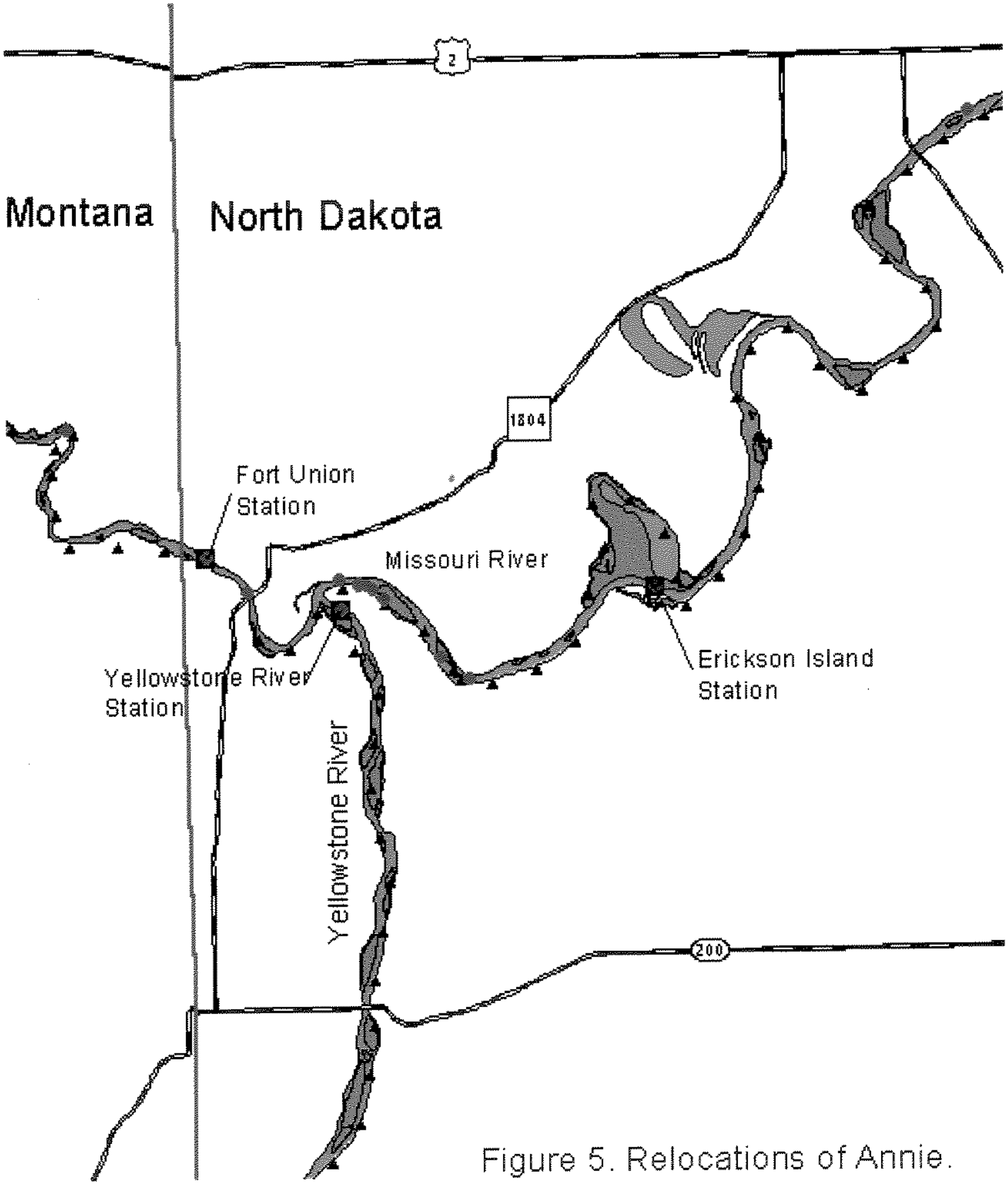

Figure 5. Relocations of Annie.

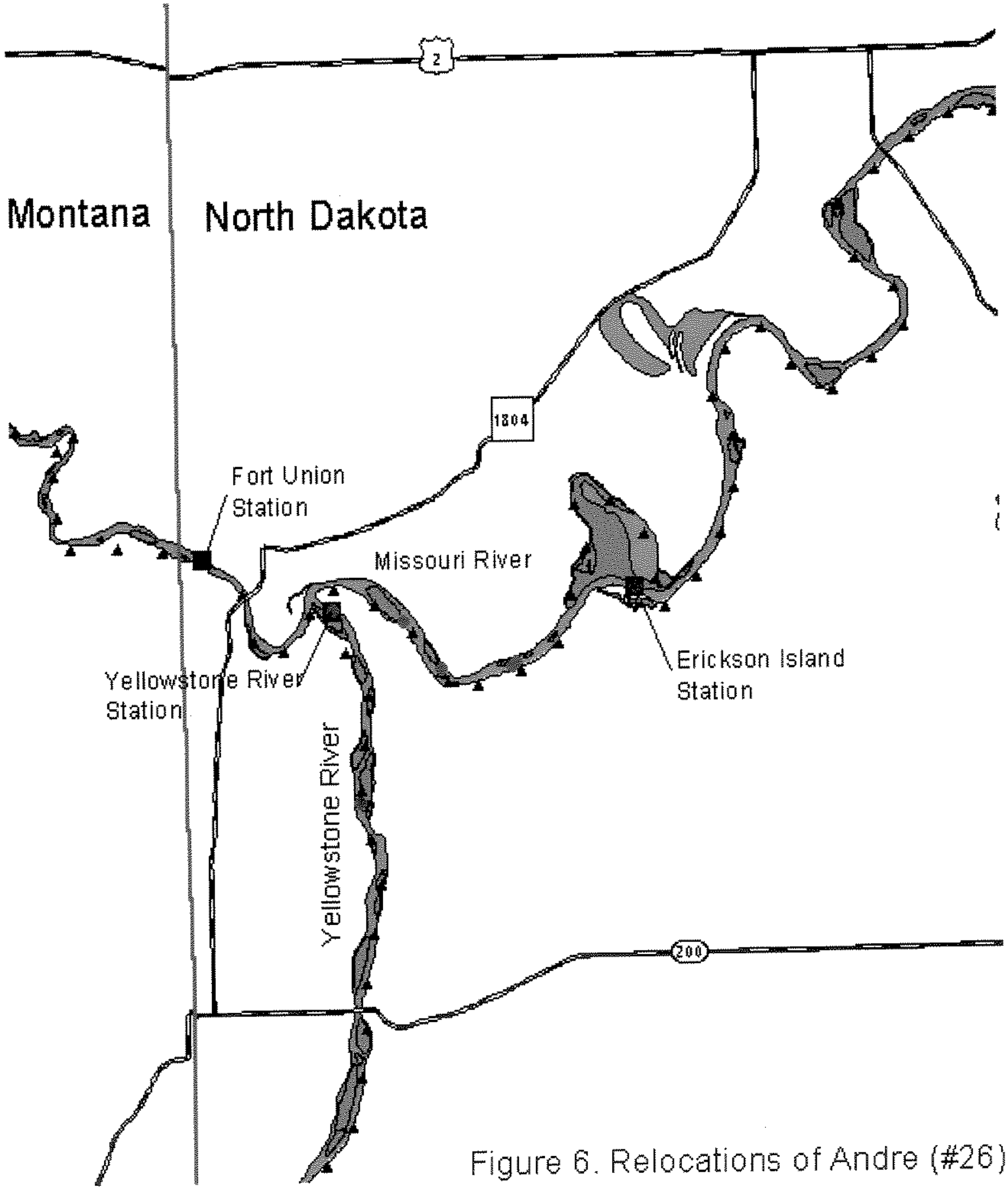

Figure 6. Relocations of Andre (#26)

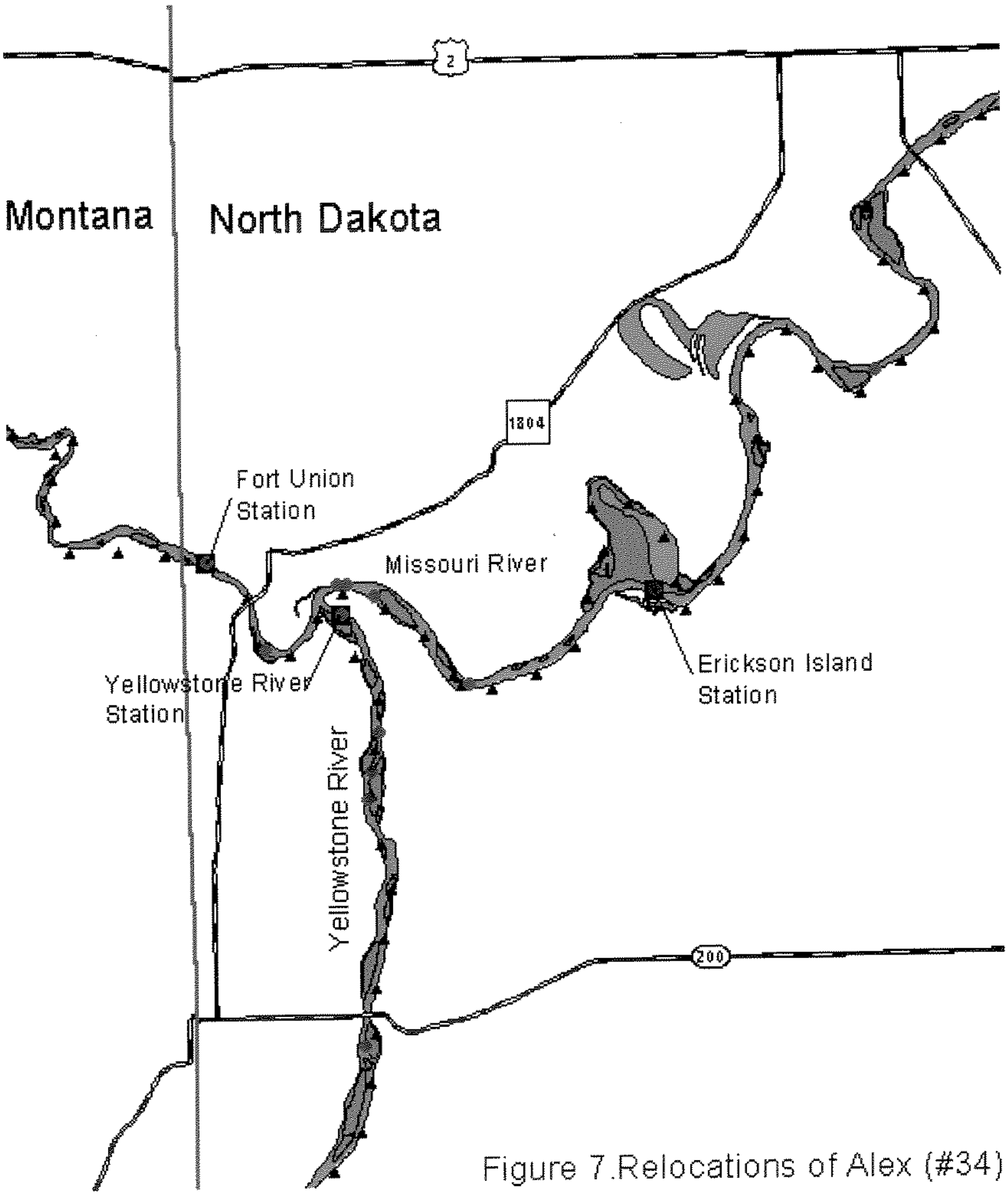

Figure 7.Relocations of Alex (#34)

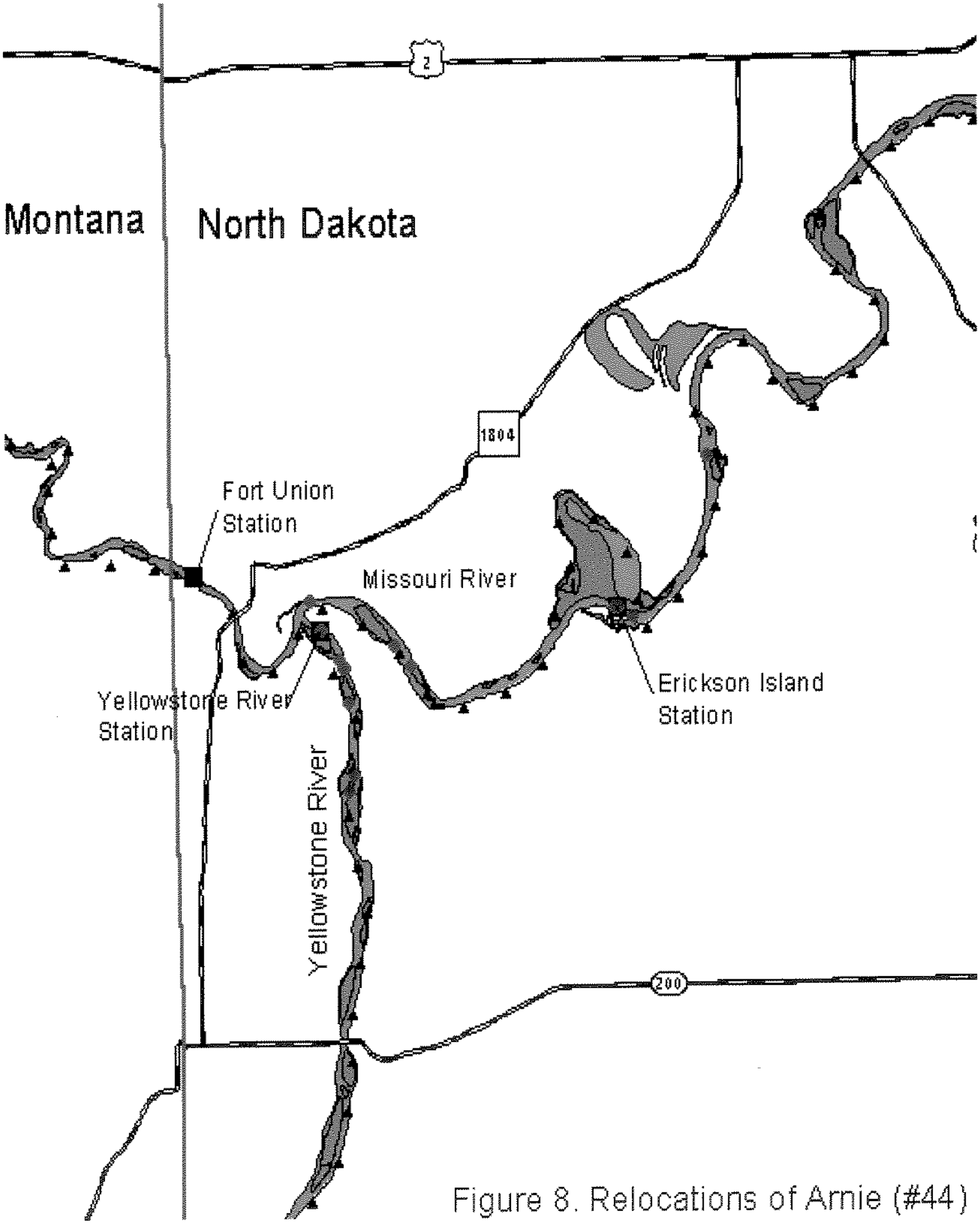

Figure 8. Relocations of Arnie (#44)

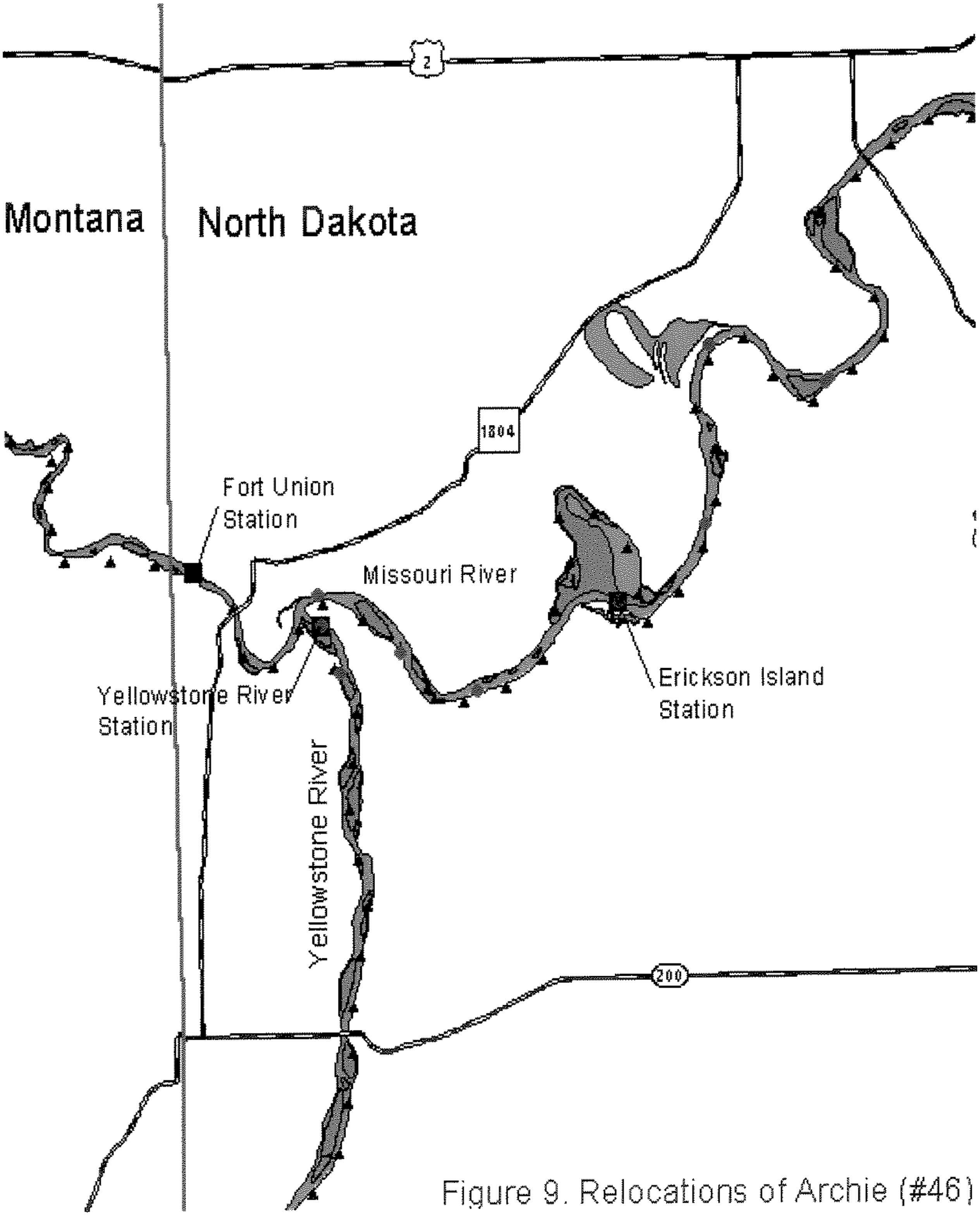

Figure 9. Relocations of Archie (#46)

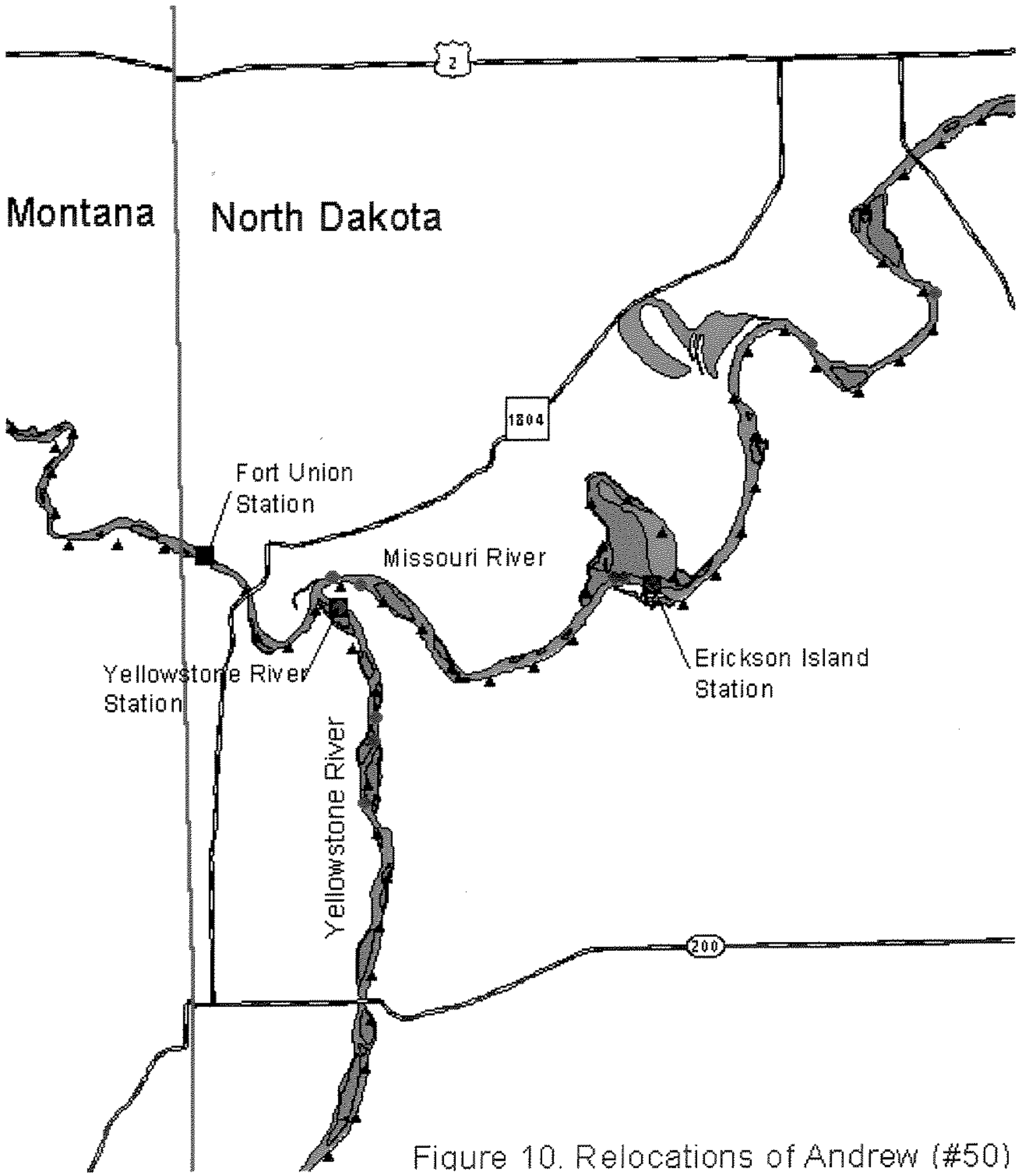

Figure 10. Relocations of Andrew (#50)

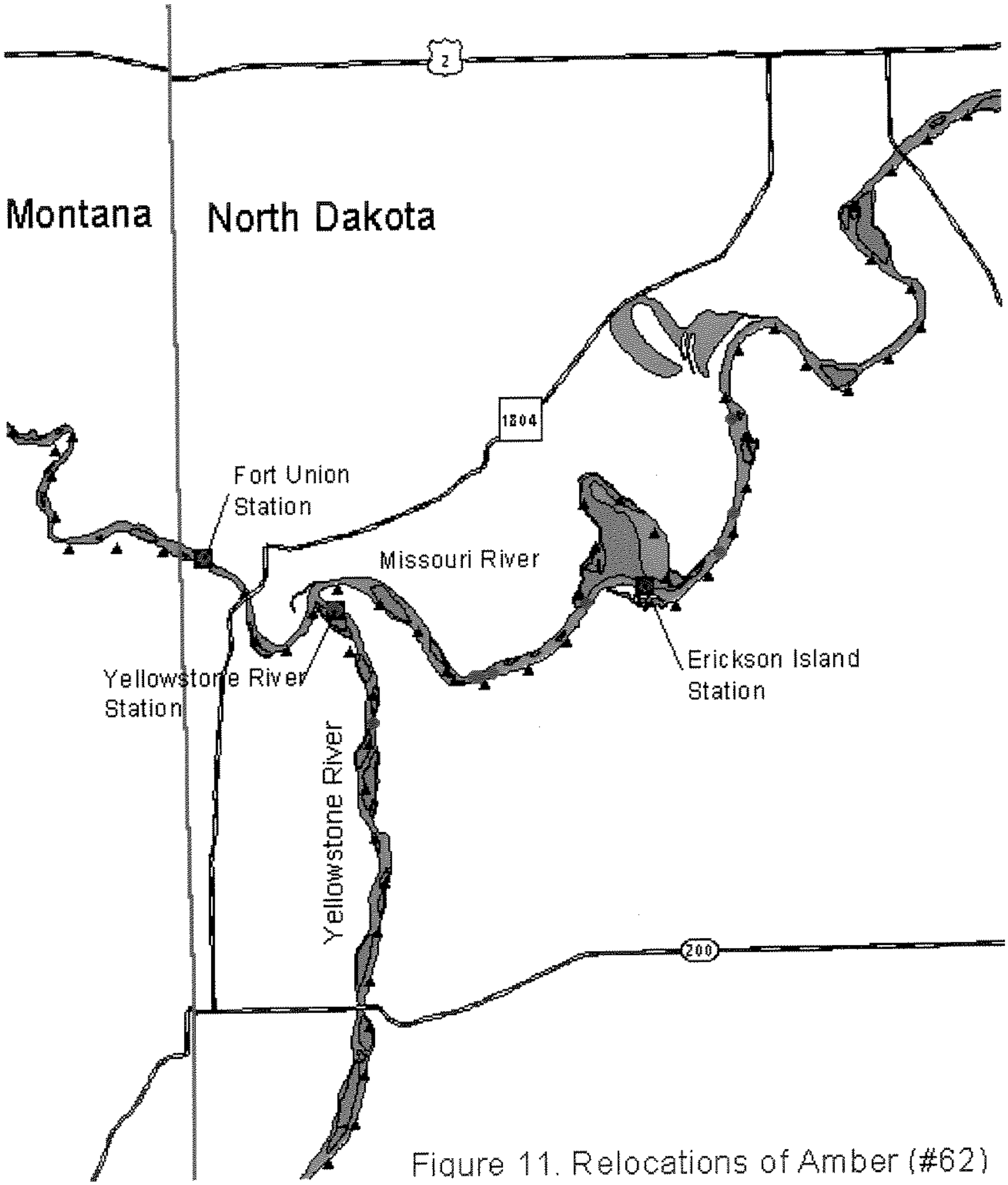

Figure 11. Relocations of Amber (#62)

Literature Cited

Bramblett, R.G. 1996. Habits and movement of pallid sturgeon in the Yellowstone and Missouri Rivers, Montana and North Dakota. Ph. D. Dissertation. Montana State University, Bozeman.

Clancey, Pat. 19992. Fort Peck Pallid Sturgeon Study. Annual report from the Montana Department of Fish, Wildlife, and Parks to the U.S. Army Corp of Engineers, Planning Branch, Omaha, Nebraska.

Conte, F.S., S.I. Doroshov, P.B. Lutes, and E.M. Strange. 1988. Hatchery Manual For The White Sturgeon, *Acipenser transmontanous* Richardson, with Application to Other North American Acipenseridae. Cooperative Extension, University of California, Division of Agriculture and Natural Resources. Publication 3322. Davis, California.

Tews, A. and P. Clancey. 1993. Fort Peck Pallid Study. Final Report. Montana Department of Fish, Wildlife, and Parks.