

FINAL REPORT

State: South Dakota

Grant Number: T-10-R-1

Project Title: Reintroduction of osprey into suitable sites along the Missouri River in South Dakota

Objectives: By December 31, 2010

1. Reintroduce 20-30 osprey chicks per year from 2004 through 2010 at selected sites in southeastern South Dakota and prepare evaluation of the results of this activity. (Activity 1)
2. Document the timing, distance, and routes of migration for juvenile osprey hacked from selected sites in South Dakota. (Activity 2)
3. Identify wintering areas and arrival and departure dates. (Activity 2)
4. Evaluate characteristics of the migration routes and wintering areas and attempt to identify potential threats to the osprey based on this evaluation. (Activity 2)

Part 1 - Accomplishments for Objective 1:

Introduction and Methods:

This project followed a pilot project funded through the Wildlife Conservation and Restoration Program (WCRP). The WCRP project (Reintroduction of osprey into suitable sites along the Missouri River in South Dakota; Project R-5; approved effective July 1, 2002) evaluated potential osprey (*Pandion haliaetus*) reintroduction sites, selected two sites for reintroduction, and made preliminary plans for reintroduction. This project was contracted to Wildlife Experiences, Inc. (WEI) of Rapid City, South Dakota. Once South Dakota Game, Fish and Parks (SDGFP) secured the necessary state and federal permits, WEI worked with biologists and power companies in Minnesota to obtain 9 osprey chicks. Chicks were placed in 2 hack sites on July 21, 2003. Hack sites were located along the Missouri River in southeastern South Dakota; one site was located at Clay County Lakeside Use Area, a public area maintained by the Parks and Recreation Division of SDGFP. The second site was on private land in Yankton County. Birds were banded with U.S. Geological Survey (USGS) bands and temporary color leg tape.

Procedures followed typical hacking methodology, after consultation with representatives of several state agencies that had successfully completed osprey reintroduction projects. Young birds were placed at potential future nesting areas, released from the hack boxes when judged ready to fledge, provided with fish during and after being allowed to fly free, monitored in the release area for potential problems, and rescued when necessary. Three of the 9 birds reintroduced during the pilot project died of West Nile Virus at the hack site. The remaining 6 birds fledged successfully (Horton 2003).

Because of the logistical challenges associated with obtaining osprey chicks from Minnesota, SDGFP decided to request osprey chicks from the State of Idaho, following coordination with Dr. Wayne Melquist, State Nongame Manager, Idaho Fish and Game. Dr. Melquist has been monitoring the osprey population in northern Idaho for many years and indicated that the nesting

habitat appeared to be saturated, with pairs nesting on powerlines and other sites that posed problems (W. Melquist, personal communication). Once SDGFP secured the necessary state and federal permits, the source population shifted to the Coeur d'Alene, Idaho area, with extensive assistance provided by Dr. Melquist and many others in the area.

The remainder of this report deals with reintroduction of chicks originating from Idaho to South Dakota from 2004-2006 and 2008-2010 (Table 1).

Results:

2004

Twenty chicks were collected in the Coeur d'Alene, Idaho area on July 16-17, 2004 in cooperation with the Idaho Fish and Game Department (Idaho Scientific Collecting Permit #040519; U.S. Fish and Wildlife Service {USFWS} Special Purpose Permit #MB071675-1) and local biologists and volunteers. While being held, birds were vaccinated against West Nile Virus. Birds were flown to Yankton, South Dakota on July 17 and placed at 2 hack sites after being sorted by size. Birds were banded with USGS bands under the South Dakota Nongame Program's Master Station Banding Permit (Permit No. 21966). While being banded, birds were examined for *Capillaria* infection and treated if needed.

Four birds were fitted with platform transmitter terminals (PTTs), with assistance from Mark Martell of Audubon Minnesota. Part 2 of this report provides further details on the use of PTTs and associated results. Birds were monitored, with some birds needing retrieval while learning to fly and forage. Fish continued to be provided at the hack site as long as birds continued to return. Avian malaria was diagnosed by a local veterinarian by a blood smear. The diagnosed bird responded well to treatment. Known dispositions of chicks from all years of reintroduction are described in Table 2.

2005

Twenty chicks were collected in the Coeur d'Alene, Idaho area on July 15-17, 2005, in cooperation with the Idaho Fish and Game Department and local biologists and volunteers. Birds were flown to Yankton, South Dakota on July 18 and placed at two hack boxes, after being sorted by size. Birds were banded with USGS bands. An osprey from the 2004 release cohort was identified near Smithville, Missouri in September, 2004, based on the presence of temporary leg tape. The tape color combinations, intended to help identify birds in the vicinity of the hack sites, were not proving to be temporary. Following coordination with the USGS Bird Banding Lab and USFWS permitting personnel, uniquely-identified anodized color bands were ordered from Acraft Sign & Nameplate Company, Edmonton, Alberta (Figure A). Color leg bands were used in 2005-2006 and 2008-2010 instead of temporary leg tape. A color leg band was placed on the alternate leg from the leg banded with the USGS band.

Ten birds died at the hack sites. The majority of deaths were attributed to avian malaria, based on necropsy on 2 carcasses by a veterinarian in Sioux Falls, South Dakota. Of the 10 PTTs placed

on chicks in 2005, 5 were removed from birds that died at the hack site and 2 were removed from birds because they were causing abrasions.

2006

Because of a concern about the loss of chicks during 2005, a decision was made to request fewer chicks in 2006 to reduce potential stress of crowding at the hack sites. Also, if disease was detected again in 2006, hack site attendants would be better able to care for and monitor the chicks' health status.

The Clay County Lakeside Use Area hack site was replaced by a new site adjacent to the Yankton Chamber of Commerce facility. This site, called Paddlewheel Point, was selected because of the potential to provide enhanced public viewing and volunteer opportunities.

Twelve chicks were collected in the Coeur d'Alene area on July 17-22, 2006, in cooperation with the Idaho Fish and Game Department and local biologists and volunteers. Birds were driven to Rapid City, South Dakota, where they were vaccinated against West Nile Virus and administered anti-malarial and anti-parasitic drugs. Blood was also drawn and tested by a Rapid City veterinarian. At least 1 bird was diagnosed with active avian malaria. Birds were then driven to Yankton, South Dakota to 2 hack sites in Yankton County, following sorting by size prior to placement in hack boxes. Four birds were fitted with PTTs.

2007

WEI informed SDGFP that the organization would not be able to perform hack site coordination duties during 2007. In addition, unseasonably warm weather during the early summer of 2007 in the Coeur d'Alene area caused concern about the potential to negatively impact the nesting population by monitoring nesting status and removing chicks. SDGFP decided to forego reintroduction during 2007 to allow assessment of the experiment to date and make any needed changes.

2008

Significant changes during 2008 included the use of a new, more sophisticated hack tower along Lake Yankton, adjacent to Gavins Point Dam and the selection of Janie Fink of St. Maries, Idaho as the hack site coordinator. This was the single site used for 2008-2010. The hack tower design incorporated several features to improve feeding and medical care and allow more intensive, but remote monitoring with the use of an observation camera mounted on a pole in front of the hack tower (Figure B). The camera allowed early detection of health issues prior to the use of drop-down doors that allowed birds to leave the tower but return to the same familiar compartments to feed while learning fly and forage on their own (Figure C). The camera also allowed hack site attendants to read color leg bands by projecting the live camera image on a computer screen (Figure D). The tower design provided 4 separate compartments for the birds, with a separate area for hack site attendants to mount the tower and deliver food or medical care with minimal disturbance to the birds.

The tower was 23 feet high and held 4 8' x 8' boxes to allow segregation of chicks by size. One compartment was sometimes used as a "sick bay" to isolate chicks receiving medical care. The "birds-eye view" was directed toward Lake Yankton (Figure E). The hack tower was constructed on U.S. Army Corps of Engineers (Corps) property, allowed under a Special Use Permit issued by Gary Ledbetter, Lake Manager, Gavins Point Project, Yankton, South Dakota. The Corps agreed to this arrangement with the understanding that the hack tower would be dismantled when the reintroduction project concluded in 2010. The release area was roped off and signed to prohibit the public from entering an area 200 feet around the tower. This minimized disturbance to the birds while they were held in the hack tower and while learning to fly.

Twenty chicks were collected in the Coeur d'Alene area from July 16-22, 2008, in cooperation with the Idaho Game and Fish Department and local biologists and volunteers. Birds were treated for *Capillaria* prior to release. Birds were not vaccinated against West Nile Virus. Birds were flown to Yankton, South Dakota on July 23, 2008 and placed into compartments at the hack site after being sorted by size and approximate age. Most birds were held for 1-2 weeks before release. In addition to the usual banding with USGS and color leg bands, a nontoxic paint was applied, with different colors assigned to release groups. The first release group was marked with orange paint, the second group marked with blue, the third group marked with yellow, and the fourth and the final group marked with pink. This practice allowed hack site attendants and volunteer observers to identify the release group of a bird if it was observed flying near the hack site, but the color leg band code could not be read (Figure F).

2009

Twenty-one chicks were collected in the Coeur d'Alene area from 16-23 July, 2009, with cooperation from the Idaho Fish and Game Department and local biologists and volunteers. Birds were cared for at the Birds of Prey Northwest raptor facility in St. Maries, Idaho until they were flown to Yankton, South Dakota on July 28, 2009. Similar procedures were followed as in 2008 regarding use of nontoxic paint and banding with USGS bands and color leg bands. Birds were held for at least 10 days at the hack tower before release. Fish continued to be supplied as long as birds were returning.

Preliminary planning was completed for nesting platform design and locations.

2010

Twenty chicks were collected in the Coeur d'Alene area from July 19-26, 2010, with cooperation from the Idaho Fish and Game Department and local biologists and volunteers. An added challenge during 2010 was the construction of a hiking and biking trail near the hack tower. The U.S. Army Corps of Engineers agreed to temporarily close the trail during the duration of the reintroduction process in 2010 (Figure G).

Based on input from Wayne Melquist and Janie Fink on platform design and placement, 3 nesting platforms were erected near the release area to provide potential nesting and perching sites for future nesting attempts (See Figure 20a in Part 2 of this report).

Coordination activities

In addition to coordination and permitting related to the collection and transfer of chicks from Idaho to South Dakota, this project involved extensive public involvement to inform people about the effort, to gain volunteers, and to lay the groundwork for subsequent reporting of banded birds and future osprey nests in southeastern South Dakota, northeastern Nebraska, and northwestern Iowa. Articles were published in the “South Dakota Conservation Digest” magazine (March/April 2009, pages 4-7) and “South Dakota Magazine” (March/April 2009, pages 20-25). Several local newspapers published stories about the project, and local radio stations publicized the effort. News of the reintroduction was shared with the South Dakota Ornithologists’ Union’s list-serve to inform birders and encourage them to report sightings of banded birds. Birders will continue to be reminded of the project to hopefully detect resightings of banded birds and nesting attempts. SDGFP developed a banded bird report form that is downloadable from the agency’s website (Figure H) and continues to maintain a link on the SDGFP Wildlife Diversity Program’s website about the project (<http://gfp.sd.gov/wildlife/management/diversity/osprey-recovery.aspx>). SDGFP will continue to inform biologists in neighboring states of the presence of banded birds in the area in case they receive reports of color banded ospreys or new osprey nests attended by color banded birds.

Conclusions

SDGFP and its partners successfully completed 6 years of osprey reintroduction. Shifting to a new source population in northern Idaho greatly increased the ability to secure the desired number of chicks each year, thanks to the dedicated efforts of Dr. Wayne Melquist and many others. This project benefitted from the flexibility to use lessons learned from each year’s release to make changes in future years. Because of the poor survivorship of young osprey in general, it was necessary to reintroduce as many chicks as possible each year, but this created challenges at the hack site regarding potential stress to the birds and exposure to mosquito-borne diseases. The use of a plane to quickly transport birds from Coeur d’Alene, Idaho to Yankton, South Dakota was a wise investment of resources because of the reduction in stress to the birds. Using a remote camera to view birds in the Lake Yankton hack tower prior to release to detect problems quickly and to monitor individual birds as they learned to fly was critical. In addition, the hack tower’s drop-down doors were very useful in providing a smoother transition to flight and independence.

To date, nesting has not yet been documented as a result of this reintroduction project. However, SDGFP and its partners believe that everything possible was done during this project to fledge healthy young ospreys with a good chance for survival and eventual nesting.

Acknowledgments

The length of this section demonstrates the complexity and coordination involved with translocating wild birds of prey for reintroduction and the willingness of natural resource professionals and volunteers to lend a hand. First, we would like to thank the Idaho Department of Fish and Game for agreeing to provide nestling ospreys for this restoration effort, and their Nongame Program for the use of a boat to collect ospreys. The University of Idaho administered the contract with South Dakota for most of the work associated with this project. The Coeur

d'Alene Tribe allowed us to collect young ospreys from nests on Tribal lands at the south end of Lake Coeur d'Alene. Numerous individuals and companies were instrumental in the success of this project. A special thank you is extended to Dr. Donald Johnson, Professor Emeritus, University of Idaho, for assisting in the collection of birds for South Dakota. In 1969, Dr. Johnson was the first to initiate scientific studies of ospreys in northern Idaho. Avista Utilities, Kootenai Electric Cooperative, and Northern Lights, Inc., kindly provided crews and lift trucks to collect ospreys from their power poles. The Avista crew from Saint Maries, Idaho, assisted in the collection of ospreys every year of the project; it was a pleasure working with them. Jane Fink, Birds of Prey Northwest, because of her knowledge and experience with a variety of raptors, was crucial to the success of this effort. Jane assisted in the collection of young ospreys, held them at her facilities, fed and monitored their condition, assisted in the attachment of transmitters, and during the last 3 years of the project, flew with the birds back to South Dakota and coordinated the successful release of the birds. Paul Cantwell assisted in many ways while birds were being held prior to transport to South Dakota. Lars Eidnes, of Eidnes Furs, provided boxes to transport the ospreys from Idaho to South Dakota. Dr. William Latshaw used his personal boat to shuttle ospreys from nests to the holding facilities during the first year of the project. Ross Walkshaw expertly piloted his pontoon boat to collect ospreys from the northern part of Lake Coeur d'Alene and the Spokane River. We appreciate the tolerance and interest exhibited by the pilots from the State of South Dakota who flew State planes to Idaho to pick up and transport the birds to the release area. Mark Martell, Audubon Minnesota, attached the satellite transmitters to the ospreys in 2004. Greg Kaltenecker, Boise State University, also assisted in attaching transmitters to ospreys. Both Mark and Greg have years of experience working with birds of prey. Veterinarians in Idaho, Iowa, South Dakota, and The Raptor Center at the University of Minnesota provided important medical care and advice. Staff of Wildlife Experiences in Rapid City, South Dakota, particularly Melissa Horton and Jodi Biers, coordinated the release of the ospreys in 2004-2006 and assisted in attaching transmitters to some of the birds. SD Game, Fish and Parks staff assisted in many ways, including collecting and delivering fish, assisting with hack site duties, accommodating hack site workers at state park campgrounds, loaning freezers for fish storage, and loaning a trailer to house a computer monitor for remote viewing of birds. In particular, Silka Kempema, Jeff Van Meeteren, Shane Bertsch, Ryan Raynor, Kyle Potter, Robert Hanten, Bruce Johnson, Todd St. Sauver, Mark Ermer, Jason Sorensen, Al Bender, Erin Moehring, Nathan Baker, and Corey Huxoll provided help when needed. Staff with the Gavins Point National Fish Hatchery, in particular Herb Bollig, provided fish for the project. Gary Ledbetter with the U.S. Army Corps of Engineers kindly allowed us to construct the hack tower at the Lake Yankton site and temporarily closed a new recreational trail to benefit the birds. Bon Homme-Yankton Electric Association helped place support poles for the hack tower at Lake Yankton and nesting platforms. The City of Yankton allowed construction of a hack tower at the Paddlewheel Point site. Minnesota Department of Natural Resources allowed collection of birds from Minnesota during the pilot study from which this project benefitted. Pat Schlarbaum, Iowa Department of Natural Resources, provided advice based on his experience with translocations in Iowa. Many volunteers provided time and enthusiasm to this project. In particular, we recognize the dedication of Don Miller, Gordon and Sondra Kuklish, Deb Palmer (deceased), Mary Gertsma, Doug Winstead, Wanda and Don Veltkamp, Gail and Don Kudrna, and Roger Dietrich. We thank the hunting and fishing license buyers in South Dakota for providing the nonfederal match for this effort and the anonymous anglers who generously donated fresh fish to the project. Finally, we would like to thank the

people of northern Idaho for allowing us to share some of “their” ospreys with South Dakota in an effort to establish a new nesting population in that part of the country. We apologize to anyone we inadvertently forgot to mention in our efforts to acknowledge their role in this translocation effort.

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Photos by Eileen Dowd Stukel or provided by hack site attendants

Table 1. Summary of osprey reintroductions in South Dakota from 2004-2010

Year	# Chicks	Source	Markers and platform transmitter terminal (PTT) attachments
2004	20	Idaho	Temporary color tape combinations; USGS metal band on right leg; 4 PTTs
2005	20	Idaho	Blue metal band on right leg; USGS metal band on left leg; 10 PTTs
2006	12	Idaho	Blue metal band on left leg; USGS metal band on right leg; 4 PTTs
2007	0		
2008	20	Idaho	Green metal band on left leg; USGS metal band on right leg; 5 PTTs
2009	20	Idaho	Green metal band on right leg; USGS metal band on left leg; 2 PTTs
2010	19	Idaho	Orange metal band on left leg; USGS metal band on right leg
Total	111		

Table 2. Known disposition of ospreys released in South Dakota from 2004-2010

Year	# Chicks	Known disposition
2004	20	<ul style="list-style-type: none"> ▪ One bird was found shot in September 2004 and taken to a raptor rehabilitator in Elmwood, Nebraska. The bird could not be successfully rehabilitated and it was humanely euthanized. ▪ A band from a member of this cohort was found on March 29, 2009 in Cherokee County, Iowa. The reporter saw no other evidence of the bird at the band recovery location. ▪ A third bird, equipped with a PTT, was photographed alive at a reservoir at Smithville, Missouri, on September 27, 2004. This bird was identified by the presence of color tape, which had been intended to be temporary.
2005	20	<ul style="list-style-type: none"> ▪ 10 birds died at hack sites; majority of deaths attributed to avian malaria, based on necropsy of 2 carcasses by a Sioux Falls, SD veterinarian.
2006	12	<ul style="list-style-type: none"> ▪ One bird was found dead near hack site; cause unknown. ▪ One bird observed and identified by its color leg band near the Platte River between Lincoln and Omaha, NE, SW of Gretna, Sarpy County, July 2009.
2008	20	<ul style="list-style-type: none"> ▪ One bird was euthanized because of a fatal lung disease, aspergillosis. ▪ A second bird was also diagnosed with aspergillosis. The bird did not successfully fledge in 2008. It was returned to Idaho under the care of Janie Fink.
2009	20	<ul style="list-style-type: none"> ▪ Two birds were determined to be nonreleasable because of injuries and were euthanized. ▪ A third bird had a wing injury that likely originated from collection. This bird was returned to Idaho under the care of Janie Fink. ▪ One bird was found dead in Terrebonne Parish, LA, September 10, 2009, under a powerline, indicating the possibility that the bird was electrocuted.
2010	20	<ul style="list-style-type: none"> ▪ Three birds died of aspergillosis. ▪ Two birds determined to be nonreleasable and returned to Idaho under the care of Janie Fink. ▪ One bird was identified by color leg band and photographed at the Celestun Biosphere Preserve in the Yucatan in October and December 2010; this area is presumed to be this individual's wintering site.



Figure A. Samples of 3 color bands used during osprey reintroduction in southeastern South Dakota.



Figure B. Hack tower used at Lake Yankton, SD reintroduction site from 2008-2010. Note the drop-down doors at the upper right portion of the structure and the observation camera (indicated by arrow) mounted on the separate pole at the extreme right. Access to the rear compartment of the tower (left side of this view) allowed hack site attendants to deliver food and medical care. The ladder was used by hack site attendants and was removed after each use. Horizontal boards allowed birds to land on the structure as they learned to fly. Predator guards at the base of the support poles discouraged predators from climbing the tower.



Figure C. Close-up view of hack tower compartment drop-down doors at Lake Yankton reintroduction site. This design allowed birds to return to the tower to feed and rest as they learned to fly and forage on their own.

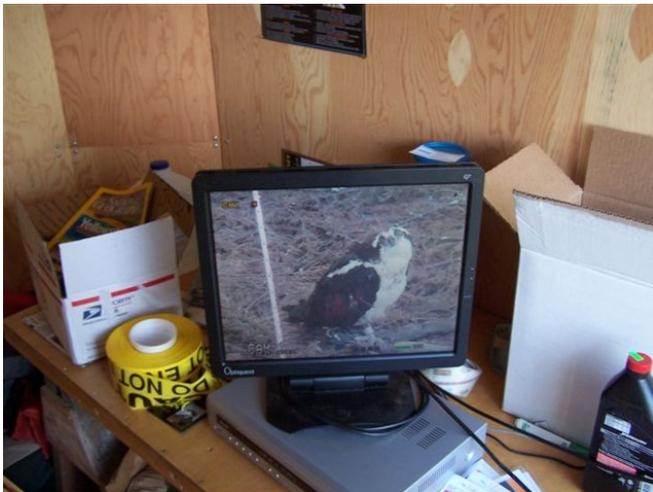


Figure D. Computer monitor view of a bird in a hack site compartment made possible with the observation camera.



Figure E. A rear view of the Lake Yankton hack tower showing the visual barrier that allowed access by hack site attendants to feed birds and provide regular health checks and medical care.



Figure F. Photo of 2 birds awaiting release. The nontoxic paint is visible. These birds have also been fitted with PTTs.



Figure G. Sign indicating temporary closure of hiking and biking trail near the hack tower during the 2010 reintroduction.

How to Report a Banded Osprey



Beginning in 2004, young ospreys from Idaho were reintroduced near Yankton, South Dakota.

If you observe an osprey with a band on its leg, record the date and location of your observation. Take note of band color and leg placement.

Please report this information to Eileen.DowdStukel@state.sd.us, Silka.Kempema@state.sd.us, or by calling 605-773-3387.

Wings Over Water

Date: _____

Time: _____

Location: _____

Band color: _____

Left leg or right leg: _____

Your name: _____

Your phone or e-mail: _____

Figure H. Banded osprey report form for public use.

FINAL REPORT

State: South Dakota

Project Number: T-10-R-1

Project Title: Reintroduction of ospreys into suitable sites along the Missouri River in South Dakota

Study Title: Migration routes and wintering areas of reintroduced ospreys

Part 2 - Accomplishments for Objectives 2-4:

Justification and Need:

South Dakota's endangered and threatened species law mandates efforts to restore state listed species. SDCL 34A-8-6 reads as follows: "The Department of Game, Fish and Park and the Department of Agriculture shall perform those acts necessary for the conservation, management, protection, restoration and propagation of endangered, threatened and nongame species of wildlife." The osprey (*Pandion haliaetus*) is a state threatened species, and the species has been included on this list since the first state list was formulated in 1978 (Chapter 41:10:02:02).

In 1991, a pair of ospreys successfully nested below Pactola Reservoir in the Black Hills of South Dakota, producing 2 fledglings (Dowd 1992, SDNHD 2002). This was the first known successful osprey nest in South Dakota since a nest was documented along the Vermillion River, in Clay County, in May 1883 (Tallman et al. 2002). At present, approximately 12 osprey nests are found in the Black Hills of South Dakota (SDNHD 2010).

The osprey is a poor pioneer species. Individual birds that return to their natal area typically do not move more than 78 miles beyond that site, even if suitable habitat exists (Palmer 1988). Based on contacts from surrounding states, there appeared to be no known nests near South Dakota prior to this reintroduction effort. The closest nesting attempt known at the time was in Dickinson County, Iowa. The Iowa Department of Natural Resources began reintroducing ospreys in 1997, which has resulted in an increasing number of nesting pairs in the State (<http://www.iowadnr.gov/wildlife/files/ospreyrestr.html>). Therefore, even with a small population nesting in the Black Hills, it is unlikely that other areas of South Dakota will be inhabited by nesting ospreys without assistance from a reintroduction.

Status:

The South Dakota Department of Game, Fish and Parks (SDGFP) shares legal responsibility with the South Dakota Department of Agriculture for recovery of threatened and endangered species (SDCL 34A-8-6). The osprey is presently listed as a state threatened species, and it is unlikely to be removed from the state list until a substantial number of nests are found in the state. The poor pioneering ability of this species made reintroduction a logical solution to enhance the species' status. Hacking is an established technique to aid in reestablishing osprey nesting populations (Palmer 1988, Colorado Division of Wildlife 1991, U. S. Army Corps of Engineers 1991).

SDGFP contracted with the Wildlife and Fisheries Sciences Department at South Dakota State University to conduct a feasibility study on the reestablishment of bald eagle and osprey nesting populations in South Dakota (Usgaard 1994; Usgaard and Higgins 1995). The authors reported that bald eagle hacking was not warranted in South Dakota because of the likelihood of natural expansion of this species. However, Usgaard (1994) recommended that ospreys be hacked in conjunction with construction of artificial nesting structures at the following sites: on lakes with semipermanent and permanent fisheries in Day, Marshall, and Roberts counties; on Lewis and Clark Lake, a Missouri River reservoir; and along the unchannelized Missouri River below Fort Randall and Gavins Point dams, with priority given to the unchannelized Missouri River below the Fort Randall and Gavins Point dams and Lewis and Clark Lake. Whether ospreys establish naturally or through a reintroduction, Usgaard and Higgins (1995) concluded that the birds would be successful along the unchannelized Missouri River, the area where this release project took place.

SDGFP completed a pilot evaluation (Federal Aid Project R-5-2) during 2002-2003 (Horton 2003), in which techniques and procedures were completed and evaluated. Based on the success of the pilot program, SDGFP proposed to continue and expand osprey hacking along the Missouri River in southeastern South Dakota.

Successfully hacking ospreys in South Dakota is paramount to establishing additional nesting populations. Information on the patterns of osprey migration and the locations of wintering areas will help wildlife managers identify and possibly reduce potential risks to the birds. Ospreys must be able to withstand the rigors of migration and survive threats on the wintering grounds if they are to be successful in returning to their breeding areas.

If successful in establishing new nesting pairs of osprey outside the Black Hills, this project will assist SDGFP in a long-term goal to remove this species from the state list of threatened species because of its recovery. Reintroduction of this species has generated support from the general and local publics, and this positive coverage can potentially help in gaining support for other rare species recovery efforts.

This report describes accomplishments for ospreys translocated from Idaho from 2004-2009. This activity does not pertain to ospreys translocated from Minnesota during 2003.

Objectives (Activity 2):

2. Document the timing, distance, and routes of migration for juvenile ospreys hacked from selected sites in South Dakota.
3. Identify wintering areas and arrival and departure dates.
4. Evaluate characteristics of the migration routes and wintering areas and attempt to identify potential threats to the ospreys based on this evaluation.

Methods:

The use of satellite-received platform transmitter terminals (PTTs) is the only practical method for tracking long-range movements of various wildlife species, and the technique has been used successfully with ospreys (Houston and Martell 2002, Martell et al. 2002, Martell et al. 2001). PTTs for this project were purchased from North Star Science and Technology¹ Battery PTTs weighed 1.05 ounces, while the solar transmitters weighed 1.4 ounces each. The transmitters were attached with Teflon ribbon (Bally Mills, Bally, PA) using backpack methods previously developed (Steenhof et al. 2006, Martell et al. 2001). We used either suture material or waxed dental floss to join the Teflon ribbon. Both male and female juvenile ospreys were fitted with backpack PTTs prior to opening the hack boxes, allowing researchers the opportunity to observe the birds for any problems associated with the attachment of the transmitters, including premature harness failure (see Steenhof et al. 2006). Each PTT that was not solar-powered was pre-programmed for a variety of duty cycles with the intent of extending battery life long enough to document the return migration of instrumented birds (22 months, minimum).

Satellite tracking data were obtained from Service Argos (now CLS America, Largo, MD, USA). Argos is a satellite-based data collection and geo-location system dedicated to monitoring and protecting the environment. Location data are derived through Doppler or Global Positioning System (GPS) and displayed as Latitude and Longitude. Service Argos places these data in location classes based on the type of location, estimated error, and number of messages received during the satellite pass (Table 1). The estimated error is calculated for each location that has at least 4 messages received during a satellite pass. Unless indicated, location data for mapping osprey movements were based on location Class 1, 2, or 3. Whenever possible, Class 3 coordinates, the most accurate class, were used to map osprey movements.

Location data were recovered for each instrumented osprey through an electronic file download and plotted on maps. When possible, general habitat and other physiographic features associated with the migration route and wintering areas were described. These data, especially for wintering areas, were evaluated along with associated human activities to determine potential risks to ospreys.

Translocated birds received numbered U.S. Geological Survey (USGS) aluminum bands on either their right or left leg (Table 2, Figure 1). Permanent alpha-numeric colored bands, color-coded by year, were attached to the opposite leg on all birds except the initial 20 birds

¹ **Disclaimer of Endorsement:**

Reference herein to any specific commercial products, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the South Dakota Department of Game, Fish and Parks. The views and opinions of authors expressed herein do not necessarily state or reflect those of the Department of Game, Fish and Parks, and shall not be used for advertising or product endorsement purposes.

translocated in 2004. Colored bands and numbered USGS leg bands provided useful information on birds found dead, observed alive, or photographed by people.

Results:

Between 2004 and 2010, 111 nestling ospreys from Idaho were transported to release sites in South Dakota. No birds were translocated in 2007. The nestlings were collected from nests when the young birds were approximately 36-53 days old; 3-10 days prior to when they could fly. Satellite-tracked backpack transmitters were attached to 25 of these birds between 2004 and 2009, although 9 were removed because the birds were sick (8) or died (1). Consequently, 16 fledged ospreys carried backpack transmitters (Table 3).

Timing, Distance, and Routes of Migration

Sixteen instrumented ospreys provided information on when migration from the release area was initiated, the rate of migration, distances traveled, migration routes, and wintering areas. Unfortunately, none of the PTTs transmitted long enough (≥ 22 months) for us to document the return of any of the birds to possible nesting areas. Narratives of individual ospreys follow.

2004 Release

On 22 July, the doors to the release boxes at the Clay County hack site were opened and 2 of the 4 ospreys with satellite-tracking transmitters made their first flight. By 27 July, 3 of the 4 instrumented birds had fledged, and by the end of August, all hacked birds had fledged and were observed foraging on their own. The 4 instrumented ospreys initiated fall migration at different times between 12 and 31 August, 3-5 weeks after the hack box was opened. Migration patterns for each of these birds are described below.

Osprey 52975

Osprey 52975 was at the Clay County hack site on 11 August 2004. Between 11 and 21 August the bird had flown approximately 400 straight-line miles southeast from the hack site to about 40 miles northwest of St. Louis, MO, along the Mississippi River (Figure 2). On 31 August, the bird was approximately 190 miles farther south in Kentucky near the Mississippi River, south of the confluence with the Ohio River, and close to the border with Mississippi and Tennessee. The bird remained in this area until at least 16 September. Three days later, on 19 September, the bird was located approximately 420 miles south in the Biloxi/Gulfport, MS, area on or near the Gulf of Mexico. On 22 September, the bird was located approximately 120 miles to the southwest in the Houma, LA, area of the Mississippi River Delta. The signal continued to transmit from this general area until 15 February 2005, when no further satellite signals were received. We were unable to determine whether or not the bird perished in this area, or if the transmitter was somehow detached. In previous telemetry work on ospreys, Mark Martell (personal commun.) did not document United States ospreys wintering in this part of the Gulf.

Osprey 52976

Osprey 52976 left the hack site after 21 August 2004 (Figure 3), and was in the vicinity of the Missouri River near Jefferson City, MO, 380 miles southeast on 31 August. On 1 September, the bird was 120 miles farther southeast near the Current River, just north of the Arkansas border and west of Poplar Bluff, MO. The osprey continued south 135 miles and on 6 September was located in the St. Francis River area (a tributary of the Mississippi River), 25 miles from the Mississippi River near Marianna, AR. On 9 September osprey 52976 had moved 280 miles southeast to the Alabama River, approximately 100 miles north of Mobile, AL, and the Gulf coast. Interestingly, the osprey then reversed its migration and 3 days later was 130 miles northwest of the previous location. It continued this reverse migration and on 16 September was located 390 miles to the northwest, north of the Arkansas border, west of Poplar Bluff, MO, and again in the Current River drainage, approximately 15 miles south of where the bird was on 1 September. The osprey remained in this area for more than a month (16 September to 19 October) before resuming its southeast migration to a wintering area. On 22-29 October, the bird was located approximately 35 miles to the south in the Black River drainage area in northeast Arkansas. On 1 November it was 210 miles to the southeast in northeast Mississippi in the upper Tombigbee River drainage near the Alabama border. From there, the bird continued southeast 225 miles to the Conecuh River drainage, east of Brewton, AL near the Florida border where it was located on 5 November. Then 3 days later, on 8 November, the bird was located approximately 875 miles away in central Cuba. The bird remained in central and southeast Cuba at least through 5 February 2005 (last signal received), where other Midwest and eastern ospreys have been known to winter (Martell et al. 2001, Rodriguez et al. 2001). Rodriguez et al. (2001) also contend that ospreys migrating through Cuba do so in about 3 days, suggesting that our bird wintered in Cuba.

We don't know whether the bird followed the Florida coast before crossing open water to Cuba, or went across the Gulf from the location it first reached the coast, probably in the Florida panhandle. If the osprey did cross the Gulf to Cuba rather than follow the coastline, its flight probably took it no farther than approximately 100 miles from the Florida mainland and over the Florida Keys.

Osprey 52977

Osprey 52977 fledged from the Clay County hack site and remained in the area at least through 21 August 2004, but more likely closer to 30 August (Figure 4). On 31 August, the bird was approximately 40 miles southeast of the hack site along the Missouri River, suggesting it had just started its migration. From 1-6 September, the bird was approximately 125 miles east of the previous location and about 40 miles northwest of Des Moines, IA. From there, the osprey moved 175 miles south to the Smithville Lake area north of Kansas City, MO. The bird was observed and photographed by Linda Williams and her father at Smithville Lake, a reservoir, on 27 September 2004 (Figure 5). Location data suggest the transmitter quit moving after 6 October. The bird either perished or slipped the backpack transmitter, even though the transmitter continued to transmit from Smithville Lake until 29 April 2005.

Osprey 52978

Similar to osprey 52977, osprey 52978 probably initiated migration on 30-31 August 2004, as it was located approximately 30 miles southeast of the hack site on 31 August (Figure 6). From there the bird turned east and was located northeast of Lakeview, IA, on 1 September, approximately 95 miles from where it was located the previous day. The bird continued east and on 2 September, it had traveled another 100 miles to just north of Marshalltown, IA. This bird then turned southeast and was located 155 miles away near Galesburg, IL, on 6 September. The bird continued southeast 140 miles and was located in the Danville, IL, area near the Indiana border from 9-22 September. From there, the bird flew south 160 miles and was located on 26 September along the Ohio River on the Indiana and Kentucky border, near Owensboro, KY. Osprey 52978 was last heard from on 29 September approximately 195 miles farther south along the Elk River, a tributary of the Tennessee River, east of Florence, AL, near the Tennessee border. The PTT apparently quit transmitting, as there were no further satellite data retrieved. We don't know if the bird slipped the transmitter or perished.

2005 Release

In 2005, solar-powered backpack transmitters were attached to 10 of the 20 ospreys translocated to South Dakota for release. Because many of these birds contracted malaria and/or West Nile virus, 8 of the transmitters were removed from birds, leaving only 2 with PTTs.

Osprey 52979

We suspect this bird never left the hack site area. The last signal received from the solar-powered transmitter was on 4 August 2005 from the vicinity of the release area.

Osprey 52983

We suspect this bird never left the hack site area. The last signal received from the solar-powered transmitter was on 5 August 2005 from the vicinity of the release area.

2006 Release

Solar-powered transmitters were attached to 4 of the young birds released in 2006. One of the 4 birds died and the transmitter was removed, 2 migrated, and 1 may have just started to migrate when the signal was lost.

Osprey 52981

This bird remained at the hack site area through at least 11 September 2006 (Figure 7). Shortly thereafter, the osprey migrated southeast to the Kansas/Missouri/Nebraska border area along the Missouri River, where it was located on 13 and 15 September. On 16-18 September, it was a short distance to the east near Maysville, MO. From 19-23 September, the bird was southeast of Kansas City, MO, in the Lake of the Ozarks area. Multiple signals between 25 September and 18 October suggested the bird visited different arms of Lake of the Ozarks. On the following

day, the bird was located approximately 300 miles to the south near the Arkansas River in Arkansas, where it remained until at least 20 October. On 23 October, the bird was over the Gulf of Mexico, heading for the Yucatan Peninsula of Mexico. On 25 October, it was near the Guatemala border and continuing south to central Guatemala, where it was located on 26 October. The bird then turned southeast and on 28 October, was in the Golfo de Fonseca area near the southwest coast of Honduras. By 30 October the bird had traveled approximately 275 miles through most of Nicaragua and appeared to be in the Nicaragua Lake area, adjacent to the Costa Rica border. The next day, it traveled another 50 miles and was in Costa Rica. On 2 November, the osprey traveled approximately 25 miles farther to the southeast and was located northeast of San Jose, Costa Rica, near Jimenez in the coastal plains. Between 2 and 24 November, the bird was located in this same general area, suggesting it may have decided to winter here. Unfortunately, the last signal received was on 24 November, so we can't be certain this is where the bird wintered.

Osprey 52982

This bird left the hack site area on 31 August 2006 and was located approximately 40 miles south of there in Nebraska on 1 September (Figure 8). The osprey then moved west approximately 60 miles and was located in the vicinity of O'Neill, NE, on 3 and 6 September. The last signal from the transmitter was received on 6 September, approximately 73 miles southwest of the release site. Osprey 52982 is the only bird that appeared to move west from the hack site. However, it is possible this was pre-migration movement rather than actual migration.

Osprey 52984

This bird was located at the hack site area between Yankton and Vermillion, SD, on 3, 18, and 30 September 2006. The last signal from the transmitter was received on 30 September.

2008 Release

We attached solar transmitters to 5 of the birds released in 2008. Four of these birds were known to have migrated.

Osprey 52980

The transmitter failed on this bird after it fledged, but prior to migration. The last signal received from this transmitter was on 15 August 2008. Unfortunately, we were unable to recapture the bird and remove the transmitter.

Osprey 52985

This osprey, which we believe is a male, remained in the release area through 23 September 2008 (Figure 9). Prior to this, the bird made forays of up to approximately 8 miles from the hack site, including along the James River to the northeast. At 2029 hours on 24 September, the bird was located approximately 95 miles south of the hack site near Columbus, NE, along a tributary of the Platte River, where it remained until at least early morning on 27 September. On 28

September, the bird was located approximately 185 miles to the southeast in the Kansas River area near Topeka, KS. The bird continued southeast and was located north of the Arkansas River in Arkansas on 30 September, 275 miles from the previous location. On 3 October, the bird was now near Heron Bay, AL, on the Gulf of Mexico along Mobile Bay, a distance of approximately 380 miles from the previous location and approximately 930 miles from the hack site. The bird continued east along the Gulf Coast and was in the Saint Vincent Island area, near Apalachicola, FL, on 4 and 5 October. The next day the bird was located in the Apalachee Bay area (south of Tallahassee, FL) along the Gulf. The bird appeared to fly northeast, but turned back south to the Gulf. Then on 8 October, the bird was back in the Apalachee Bay area to the west and southwest of St. Marks, FL. The bird continued down the Florida coast from the Florida Panhandle and was located near Steinhatchee, FL, on 11 October, where it remained until at least 17 November. On 18 November, the bird flew south down the coast approximately 25 mi to the Horseshoe Beach, FL, area, where it remained through 19 November. By 1302 hours, on 20 November, the bird was located just southeast of Fort Meyers, FL, and near a lake immediately west of Immokalee, FL, which is approximately 20 miles inland. Since the previous day, the bird had migrated south past the Tampa, St. Petersburg, Port Charlotte, and Fort Myers metropolitan areas, turned east and crossed Interstate 75 to a small lake near the southern tip of Florida. By 2010 hours, the bird had continued south and back along the Gulf coast to the Everglades National Park, southwest of Miami, FL. On 22 November, the bird was in the Florida Keys near Islamorada and then down to near Marathon, FL. The bird continued moving down the Keys past Key West and out to Marquesas Key, where it was located on 23 and 24 November. On 25 November, the bird reversed directions and back-tracked up the Keys to near Big Coppitt Key, FL. From that general area, the bird flew across the Gulf and Florida Bay, returning to the Everglades near Flamingo, FL, where it was located at 0539 hours on 27 November. The bird remained in the Lostmans Key and Hog Key areas of the Everglades through winter and spring. Unfortunately, the signal was lost on 6 May 2009. Martell et al. (2001) had at least 1 instrumented Midwest osprey winter in Florida.

Osprey 52986

Between 10 and 13 September 2008, this bird exhibited a lot of movement in the vicinity of the hack site, with the longest movement being approximately 4 miles on 11 September. By 2101 hours on 14 September, it was just southeast of Parsons, KS, in the southeast corner of the state, where it remained until at least 0406 hours on 15 September (Figure 10). By 1341 hours on 16 September, the bird was southwest of Magnolia, AR, within approximately 20 mi of the LA border and 75 miles of the TX border. At 2026 hours on 16 September and early morning on 17 September, the bird was just northeast of DeRidder, LA, near the TX border and within 80 miles of the Gulf. At 0813 hours on 18 September, the bird was in the Gulf of Mexico area in the vicinity of Grand and White Lakes. It is likely this bird made it from the hack site to the Gulf in less than 4 days, an average minimum travel distance of 250 miles per day. The bird continued east along the Louisiana coast past Houma, LA, and was near the Grand Isle, LA, delta area on 23 September. On 25 September, the bird was approximately 24 miles to the east near Empire, LA, along the Mississippi River. The bird remained in the Venice, Empire, and Port Sulphur, LA, area for the remainder of the winter. The last signal received was on 28 May 2009, still in the same area the bird had wintered. At this time, the osprey would be approximately 12 months

old. We would expect this bird to remain in the wintering grounds until the spring of its second year, or about 21 months old.

Osprey 52987

This bird likely left the hack site area early on the morning of 13 September 2008, because by 1009 hours, it was approximately 55 miles south near Pierce, NE (Figure 11). By 1138 hours, it was another 30 miles south near Madison, NE. The bird continued its movement slightly southeast, and the following day at 2239 hours and on 15 September, was located near Eufaula, OK, in the Eufaula Lake area, a large reservoir with many “arms.” From there, the osprey turned southeast, and at 0518 hours on 18 September, it was approximately 25 mi west of Kingsville, TX. Continuing south, the osprey was located in the La Pesca, Mexico, area on 20 September. La Pesca is approximately 140 miles south of the U.S. border. From 20 September until 20 May 2009, when the signal was lost, the osprey wintered in a 23 mile stretch of coast south from La Pesca. One interesting observation occurred on 13 March 2009, when a Location Class 1 (accuracy range of 385 yards to <1,100 yards) location was received out in the Gulf, in an area where there are no islands. On 12 and 15 March, the bird was back in its wintering area. The straight-line distance between the locations on 13 March out in the Gulf and on 12 and 15 March in the bird’s wintering area was 366 miles.

Osprey 52988

This bird probably initiated migration on 7 or 8 September 2008, as it was located northwest of Woodbine, IA, approximately 105 miles from the hack site, on 8 September (Figure 12). On 9 September, it was just north of Lawrence, KS, near a small meandering stream and holding pond; there is a reservoir to the west. The Kansas River, which drains into the Missouri River, is within 2 miles south of the bird’s location. The bird remained in this area through at least 13 September. At 1926 hours on 14 September and on 15 September, the bird was near Grubbs, AR. Between 16 and 18 September, the bird migrated southeast across Alabama, and was located in the border area of Phenix City, AL, and Columbus, GA, on 21 September. This is an urban area where the Chattahoochee River forms the border between the States. In this area, the River has 2 dams forming Lake Oliver and Lake Harding. The bird was still here when the last signal was received on 21 October, a month after arriving in the area. The status and welfare of the osprey are unknown.

2009 Release

This was the final year we instrumented translocated ospreys. We attached battery PTTs to 2 of the birds; both migrated.

Osprey 96432

This bird left the hack site after 13 September 2009, but prior to 17 September, when it was located approximately 78 miles southeast of the release area in Nebraska (Figure 13). On 23 September, the bird was approximately 50 miles south of Lawrence, KS. By 29 September, the bird had reached Pointe Coupee, LA. The following day and on 1 October, the bird was on the

Gulf southwest of Houma, LA. It then moved east to the Port Sulfur area, along the Mississippi River and approximately 60 miles upstream from the mouth, where it was located on 2 October. On 4 October, the bird was located just north of Venice, approximately 30 miles upstream from the mouth of the Mississippi River. A short distance downstream from Venice is “Head of Passes” where the main stem of the River branches off into 3 distinct directions at its mouth in the Gulf of Mexico. Between 4 October and 26 December, the bird remained in the Venice, LA, area, indicating that this was likely the area it was going to winter. After 26 December, all signals from the transmitter were Class “A” and “B,” which are unreliable (see Table 1). No further reliable locations were received.

Osprey 96433

Between 18 and 28 September 2009, the bird exhibited frequent movements in the hack site area. Even though hack site attendants observed this bird at the hack site on 1 October, it probably initiated migration later that day, as it was located in the northwest corner of Missouri near the Iowa border at 2200 hours on 2 October (Figure 14). On 4 October the bird was near Bagnell Dam, Lake of the Ozarks, Lake Ozark, in central Missouri. The bird remained in the vicinity of Lake Ozark, MO, through at least 16 October. At 0515 hours on 17 October, the bird was located north of the Arkansas River, east of Pine Bluff, AR. The Arkansas River drains into the Mississippi River just southeast of where the bird was located. At 2000 hours on 18 October, a reliable signal was received off the coast of northern Belize over the Caribbean Sea and straight east of the islands of Banco Chinchorro, which is the southern tip of the Yucatan Peninsula, Quintana Roo, Mexico. The distance from the location on 17 October in Arkansas, to the location off the coast of Belize late on the 18th and early on the 19th was approximately 1200 miles. The osprey migrated west of the island of Roatan, and was on the north coast of Honduras at 0909 hours on 20 October. The bird flew east, but remained along the coast of Honduras through 23 October. On 25 October, the osprey was near the Nicaragua border in the vicinity of Puerto Lempira, and on the next day, it was in Nicaragua near the coast. The bird then moved back north a short distance and was again in Honduras, along the coast near Raya on 28 October. Location data for November and December indicate the bird settled in this area for winter. Because there was little deviation in the signal location since December, we suspect that the bird has either slipped its transmitter or died in early 2010. The last signal received from this transmitter was on 29 August 2010.

Summary of location data from instrumented ospreys

Initiation of migration

The 16 instrumented ospreys initiated migration to wintering grounds as early as between 12-20 August and as late as 1 October (Table 4). Spring conditions on the nesting grounds in Idaho influence the initiation of egg-laying by ospreys and, in turn, the time in which the young fledge. In some years, many of the nestlings are fledging by 15-20 July; in other years, it may be 10-15 days later. This was certainly the case for ospreys translocated to South Dakota in 2004. The birds were flown to the release sites on 15 July 2004, and 3 of the 4 instrumented birds had fledged by 27 July. In subsequent years, young ospreys were not translocated to South Dakota until 23-28 July, because of their young age. And these birds were often held for more than a

week before the hack boxes were opened. The length of time they were held in the hack boxes depended on their age and condition.

Those ospreys that initiated migration during August were the 2004 birds. All ospreys released in subsequent years initiated migration between 3 September and 1 October. Once fledged, most young ospreys remained in the release area for approximately 4-7 weeks before initiating migration.

Rate of migration

The juvenile ospreys arrived at their wintering grounds between 22 September and 27 November, a journey of between 9 and ≥ 70 days from the time they departed the release area (Table 4). There did not appear to be any clear pattern in their rate of migration or different rates between sexes. In most cases, rapid movement was interspersed with periods when the birds lingered in 1 or more areas. Birds that took 24-70 or more days to reach their wintering grounds often remained at migration stops along the way (Figures 2, 3, 7, 9, 14). Osprey 52976 actually reversed its migration prior to reaching the Gulf coast, then spent at least 44 days near the Missouri and Arkansas border prior to completing its migration to Cuba on 8 November, a period of ≥ 70 days since leaving the release area (Figure 3).

However, a 70-day, or more, migration to the wintering grounds is misleading and does not reveal an osprey's capability for rapid migration. On 5 November 2004, osprey 52976 was in Alabama near the Florida border. Three days later, on 8 November, it was located in central Cuba, a distance of at least 875 miles; a movement of nearly 300 miles per day. Migrating over open water, such as the Gulf of Mexico, also required long flights for ospreys 52981 (Figure 7) and 96433 (Figure 14). Osprey 52981 was in central Arkansas on 20 October 2006, and on 23 October, it was recorded over the Gulf and north of the Yucatan peninsula, a distance of approximately 800 miles. This osprey had traveled a similar distance of 800 miles during the previous 39 days since leaving the release site. At 0515 hours on 17 October 2009, osprey 96433 was near Pine Bluff, AR. At 2000 hours on 18 October and shortly after midnight, this osprey was recorded east of Belize and over the Caribbean Sea, a distance of approximately 1,200 miles. In just under 39 hours, the osprey had covered the 1,200 miles; an average of at least 31 miles per hour. Prior to that, the bird had migrated approximately 750 miles since leaving the release site on 1 or 2 October, an average movement of approximately 50 miles per day.

Distance traveled

The straight-line distance for the 3 ospreys that wintered in the Louisiana delta was approximately 1,000 miles from the release site. The migration distance for osprey 52985, which wintered in southern Florida, was approximately 1,500 miles. Osprey 52976 wintered in Cuba, a distance of approximately 1,800 miles from the release site. However, because both osprey 52976 (Figure 3) and osprey 52985 (Figure 9) back-tracked along their migration route prior to arriving at their wintering areas, the actual migration distance was considerably longer. The additional distance for 52976 and 52985 was approximately 780 miles and 260 miles, respectively. Osprey 52987 wintered along the Gulf coast in Mexico, south of the Texas border,

which was approximately 1,300 miles from the release area. The wintering grounds for osprey 52981 in Honduras, near the Nicaragua border, was approximately 2,100 miles from the release area. Osprey 52981 wintered the farthest distance from the release area. This bird wintered in Costa Rica, approximately 2,400 miles from the South Dakota hack tower.

Migration routes and wintering areas

The majority of the instrumented ospreys migrated southeast from the hack sites along the Missouri River near Yankton and Vermillion, South Dakota (Figure 15). While the Missouri River flows southeast from the release area, there is no way of determining whether or not this influenced their initial movements. Several of the birds actually migrated to the west and parallel to the Missouri River during the initial part of their migration. Osprey 52977 initially followed the Missouri River a short distance before turning east to central Iowa, and then south again where it joined the Missouri River. Osprey 52978 was the only bird that migrated east a considerable distance (to eastern Illinois near the Indiana border) before turning south again. The telemetry signal for both of these birds was lost prior to the time they reached a wintering area. Most of the ospreys continued on a southeasterly migration pattern to their wintering areas. One exception was osprey 52987, which turned southwest once it reached the eastern part of Oklahoma and didn't actually reach the Gulf of Mexico until it arrived near its wintering grounds along the Mexican coast.

The Gulf of Mexico did appear to influence the movement of some of the ospreys. The 3 instrumented ospreys that wintered in the Louisiana delta arrived at the Gulf to the west of where they finally wintered. Osprey 52985 followed the Gulf coast from Alabama to the tip of Florida. And, although the location data don't clearly show it, osprey 52976 may have followed along the Florida coast prior to crossing the Gulf to Cuba.

Even though the ospreys may not have clearly followed a major waterway to their wintering grounds, they appeared to be influenced by the Mississippi River and its major tributaries. At least 5 of the ospreys either wintered near the mouth of the Mississippi River, or passed through this area on their way to wintering grounds across the Gulf.

Based on the directional migration patterns of the ospreys, the Gulf of Mexico may influence where the ospreys eventually winter (Figure 16). Once the ospreys reach the Gulf of Mexico, they have several options that ultimately determine where they winter. The first option is to winter in the vicinity of where they reached the Gulf (ospreys 52975, 52986, 96432). A second option is to turn east and move down the coast of Florida where they could choose to winter (osprey 52985), or continue across the Gulf to Cuba (osprey 52976), and the chain of Caribbean islands that eventually leads to the South American continent. A third option would be to continue across the Gulf, at the point it is reached, to wintering grounds in the Yucatan of Mexico (osprey 5E, Figure 17) and Central America (ospreys 52981 and 96433). Finally, the fourth option would be to migrate along the west side of the Gulf down the coast of Mexico (osprey 52987) and perhaps on to Central America.

Nesting of released ospreys

To date, there is no evidence that the translocated ospreys have nested in South Dakota or neighboring states. Minnesota birds released in 2003 and those from Idaho released in 2004 either did not have any colored leg bands (2003) or permanent colored leg bands (2004), making field identification of those birds difficult. However, Nebraska biologists twice observed a 2006-released banded osprey (blue leg band 6U) feeding near the Platte River in Nebraska, approximately 135 miles southeast of the South Dakota hack site, on 20 and 28 July 2009 (Brown et al., personal commun.). This 3-year-old bird would have been sexually mature and provides encouraging evidence for the likelihood that some surviving released ospreys will eventually return to nest.

In April 2010, a pair of ospreys was reported nesting on a transmission tower on the Missouri River below Big Bend Dam (Bossman, personal commun., Grassel, personal commun.). This location is approximately 130 miles northwest of the release site near Yankton, SD. The birds were periodically observed into August and were not successful in their nesting attempt. One of the pair had a “silver leg band” on the left leg, suggesting it was a USGS band. The only ospreys released in South Dakota that did not have a permanent colored leg band on the opposite leg were those released in 2003 and 2004. And the birds released and known to survive in those years had USGS bands attached to their right leg. Consequently, it does not appear that the banded bird could have been 1 released in South Dakota. Nonetheless, birds from other areas that choose to establish a nesting territory in South Dakota could also attract 1 of the released birds as its mate.

Potential threats to the ospreys

Shooting.

Inadvertent shooting of ospreys by unscrupulous individuals has long been a problem in the nesting area, during migration, and on the wintering area. An osprey (USGS band #788-23980) hacked from the Yankton release site was recovered near Lyons, Nebraska, in mid-September with a compound fracture of the wing resulting from a shotgun wound. Lyons is situated approximately 20 miles west of the Missouri River and 75 miles southeast of the Yankton hack site. The instrumented ospreys, and presumably all the released ospreys, migrated over large and small communities and rural areas. And because ospreys associate with aquatic areas to forage, they could be vulnerable to hunters during autumn migration. Ospreys wintering in Mexico, the Caribbean, and Central and South America are especially vulnerable, as laws protecting wildlife are weak and not well enforced. Melquist et al. (1978) and Melquist and Johnson (1984) reported that 13 of 29 band recoveries were ospreys that had been shot. All 13 of the shot birds were from outside of the United States, including Mexico (7), El Salvador (2), and 1 each from Costa Rica, Guatemala, Honduras, and Panama. Rodriguez et al. (2001) reported that 43 of 91 osprey band recoveries in Cuba were birds that had been shot. Several of the instrumented ospreys also wintered in Costa Rica, Cuba, Mexico, and Honduras, where they too could be vulnerable to shooting.

Electrocution and suspended lines.

Ospreys nesting on power poles are at obvious greater risk of electrocution than birds selecting natural nest structures (primarily live and dead trees). Ospreys that migrate and spend time in both rural and urban areas, especially where hydroelectric dams have created reservoirs, are certainly at risk of hitting a variety of suspended lines. An osprey released in 2009 was reported “found dead” on 10 September 2009 near Houma, LA (band encounter reported to the USGS Bird Banding Lab). The individual reporting the bird found it below power lines, suggesting it was probably electrocuted. Whether or not the bird had selected this area to winter, or was migrating through is not known. Nonetheless, suspended lines are a real danger to these inexperienced birds, often resulting in broken wings or electrocution.

Severe storms.

Late season rainstorms can have a significant effect on osprey reproductive success, resulting in brood reduction (Johnson et al. 2008). Severe tropical storms, such as hurricanes, could impact migrating and wintering birds, resulting in outright mortality. An osprey migrating over the Gulf of Mexico was blown 400 miles off its normal course (Martell, no date), but landed safely in Mexico. Other birds, especially those that choose to migrate across the Gulf of Mexico and Caribbean Sea, may not be so lucky and could become exhausted and perish over water.

Disturbance during nesting.

Ospreys that eventually return to the general release area to nest will face disturbances not unlike those nesting in other parts of the world. Because of their propensity to nest on the tops of trees rather than within the canopy, they will be forced to select artificial sites due to the lack of suitable natural structures. Utility poles and cell towers are typical alternative nest structures for ospreys nesting in areas lacking suitable natural sites (Figure 18). Ospreys can be accommodated at these sites through the placement of nest platforms at the tops of utility poles and cell towers (Figure 19). And, poles with nest platforms can be strategically placed to accommodate ospreys and draw them away from electrified poles where the birds risk electrocution (Figure 20).

In any event, artificial structures inadvertently place birds in close contact with humans and human activities. Where artificial structures are either in or adjacent to water, especially in lakes and reservoirs, nesting birds have to contend with disturbance from boaters, anglers, and other recreationists. Ospreys are reasonably tolerant of humans, and through proper education and the placement of signs at the nest, disturbance can be minimized, especially on low nest structures (Figure 21).

Contaminants.

There are nearly 3,500 oil and gas platforms in the Gulf of Mexico, with thousands of miles of pipeline transporting oil and natural gas to shore (National Geographic Society 2010). The bulk of these platforms occur along the coast of Texas, Louisiana, and Mississippi. The explosion that occurred on the Deepwater Horizon oil rig on 20 April 2010 off the Louisiana coast released

an estimated 4.9 million barrels of oil into the Gulf, resulting in the worst accidental marine oil spill in history (National Geographic Society 2010). Nonetheless, further offshore development and expansion is likely to occur not only near the United States and Mexico, but also Cuba and perhaps other countries. South Dakota ospreys wintering in the Gulf region likely forage in both fresh water and salt water. How the most recent spill and potential future spills have impacted and will impact ospreys is unknown. The key is whether or not fish would be impacted and where.

The impacts of DDT and its metabolites on a variety of birds of prey, including ospreys, are well documented. The ban on DDT in the United States resulted in the recovery of many species of raptors that nest in North America, but winter in Mexico and Central and South America, even though the pesticide continues to be used in most Latin American countries. For example, in northern Idaho, where DDT use had been historically low prior to the ban, the effects of DDT on osprey nest success appeared to be limited (Melquist et al. 1975). This suggests that when exposure occurs primarily in the wintering grounds, the impacts of DDT residues on osprey nest success may be minimal.

Discussion

Satellite telemetry has shown that the young South Dakota ospreys, migrating to wintering grounds for the first time, generally migrated in a southeasterly direction to the Gulf of Mexico. Upon reaching the Gulf, however, the ospreys varied in their selection of wintering areas and how they reached those areas. And while the young ospreys tend to follow the Missouri and Mississippi River drainages to the Gulf of Mexico during migration, the speed at which they can migrate allows them to cross large stretches of land with little water and large bodies of water with few places to perch and rest. There was considerable variation (9 to ≥ 70 days) in the time it took for ospreys to reach their selected wintering areas from the release area. Those ospreys that took 25-70 days to reach their wintering area exhibited migration stops of up to 44 days within the continental United States. These birds appeared to linger in areas (e.g., streams, ponds, lakes, and reservoirs) along the migration route that likely provided an abundance of fish to eat. The advantages or disadvantages of a rapid versus a slow migration to the wintering area are unknown.

The general pattern of migration for the South Dakota ospreys once they have reached the coast was similar to that documented for Minnesota ospreys (Martell et al. 2001). From the mainland, Minnesota ospreys either migrate 1) down the Gulf coast of Mexico, 2) across the Gulf of Mexico to Central and South America, or, 3) through Cuba and the Greater Antilles across the Caribbean Sea to South America. The South Dakota birds followed similar routes, except that several birds chose to winter in the Louisiana Delta (ospreys 52975, 52986, and 96432) and the Everglades area of Florida (osprey 52985). And, while some birds remained in coastal Louisiana and Florida, others migrated to Cuba via Florida, the Mexican Gulf coast south of Texas (52987), and to Costa Rica (52981) and Honduras/Nicaragua (96433) by way of crossing the Gulf. An osprey released in 2010 with orange leg band 5E appeared to be wintering in the Celestun Biosphere Reserve on the northwest tip of the Yucatan peninsula west of Merida, Mexico. Like

ospreys 52981 and 96433, this bird likely migrated across the Gulf, rather than along the Gulf. One instrumented osprey followed the Gulf to the end of the Florida Keys, but returned to the Everglades area, where it wintered. Some unmarked birds that migrate east along the Gulf have probably continued on from Cuba through the chain of islands to South America. Those that turn west or cross the Gulf could end up in various parts of Mexico and several Central American countries, as the marked birds did.

As many as 90% of the ospreys nesting in the eastern United States migrate through Florida, across the Straits of Florida to Cuba and on to South America, although some winter in Cuba (Martell et al. 2001, 2004; Rodriguez et al. 2001; Bierregaard, personal commun.). Osprey 52976 migrated to Cuba and appeared to have wintered there. Migrating through or wintering in Cuba could be problematic for ospreys, as shooting appears to be an important and continuing threat to their survival (Rodriguez et al. 2001).

Idaho ospreys typically migrate in a southerly direction, wintering in west-central Mexico and Central America (Johnson and Melquist 1991, Melquist and Johnson 1984, Melquist et al. 1978). Only 1 return has come from South America (Ecuador). However, 2 hatch-year birds have been recovered in Louisiana (Black Bayou and Catfish Bay) and a 28-month-old osprey was found dead near Corpus Christi, LA, suggesting that some of the birds migrate farther to the east. Migration data from the Idaho ospreys instrumented and released in southeast South Dakota reveal no genetic influence in the choice of migration routes and wintering areas. However, in all likelihood, some migrating Idaho ospreys and migrating South Dakota ospreys (translocated from Idaho) and other Midwest ospreys winter in common areas throughout Central America and perhaps the Gulf of Mexico.

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Table 1. Location classes established by Service Argos for providing satellite telemetry data to user groups.

CLASS	TYPE	ESTIMATED ERROR	NUMBER OF MESSAGES PER SATELLITE PASS
3	Argos	< 273 yards	4 messages or more
2	Argos	273 yards to <547 yards	4 messages or more
1	Argos	547 yards to <1,640 yards	4 messages or more
0	Argos	>1,640 yards	4 messages or more
A	Argos	No accuracy estimation	3 messages
B	Argos	No accuracy estimation	2 messages
Z	Argos	Invalid location	-----

Table 2. Ospreys with satellite-tracked transmitters (PTTs) that successfully fledged, 2004-2009.

PTT #	USGS BAND #	COLOR LEG BAND		YEAR INSTRUMENTED
		RIGHT	LEFT	
52975	788-55507	None		2004
52976	788-55508	None		2004
52977	788-55510	None		2004
52978	788-55509	None		2004
52979	788-55530	D6 (Blue)		2005
52983	788-55524	B5 (Blue)		2005
52981	788-55541		H7 (Blue)	2006
52982	788-55537		R6 (Blue)	2006
52984	788-55531		V6 (Blue)	2006
52980	788-55545		A02 (Green)	2008
52985	788-55543		A00 (Green)	2008
52986	788-55547		A04 (Green)	2008
52987	788-55558		A15 (Green)	2008
52988	788-55544		A01 (Green)	2008
96432	788-55581	A38 (Green)		2009
96433	788-55570	A23 (Green)		2009

Table 3. Summary of fledged ospreys instrumented with PTTs, 2004-2009.

BIRD #	YEAR INSTRUMENTED	STATUS
52975	2004	Migrated; last signal 2/15/05 in Louisiana delta
52976	2004	Migrated; last signal 2/05/05 in Cuba
52977	2004	Migrated; last signal 4/29/05* N of Kansas City, MO
52978	2004	Migrated; last signal 9/29/04 in Arkansas (?) area
52979 (D6)	2005	Last signal 8/04/05; release area
52983 (B5)	2005	Last signal 8/05/05; release area
52981 (H7)	2006	Migrated; last signal 11/24/06 NE of San Jose, Costa Rica
52982 (R6)	2006	Migrated; last signal 9/06/06 near O'Neill, Nebraska
52984 (V6)	2006	Last signal 9/30/06; between Yankton & Vermillion
52980 (A02)	2008	Last signal 8/15/08; release area
52985 (A00)	2008	Migrated to Florida; last signal 5/06/09
52986 (A04)	2008	Migrated to Louisiana Delta; last signal 5/28/09
52987 (A15)	2008	Migrated to Gulf coast, Mexico; last signal 5/20/09
52988 (A01)	2008	Migrated to Georgia/Alabama border; last signal 10/21/08
96432 (A38)	2009	Migrated to Venice, Louisiana area; last signal Dec 2009
96433 (A23)	2009	Migrated to Honduras; still transmitting (poor quality)

*Last movement of 52977 was in late October to early November 2004. Bird either shed transmitter or died with the transmitter attached and the transmitter continued to transmit until 4/29/05.

Transmitters 52975-78 and 96432-33 are standard backpack transmitters.

Transmitters 52979-88 are solar transmitters.

Table 4. Approximate date ospreys left the hack site, arrived at the Gulf of Mexico, and arrived at their wintering area.

OSPREY #	SEX ¹	DEPARTED HACK SITE	ARRIVED AT GULF	ARRIVED IN WINTERING AREA
52975	M	12-20 Aug 04	19 Sep 04	22 Sep 04 (Houma, LA)
52976	F	22-30 Aug 04	5 Nov 04 □	8 Nov 04 (Cuba)
52977	M	30-31 Aug 04	Unknown	Unknown
52978	M	30-31 Aug 04	Unknown	Unknown
52981	F	11-12 Sep 06	19-27 Oct 06	5 Nov 06 (NE San Jose, Costa Rica)
52982	F	3 Sep 06	Unknown	Unknown
52984	M	30 Sep 06	Unknown	Unknown
52985	M	24 Sep 08	3 Oct 08	27 Nov 08 (Lostmans Key, FL)
52986	F	14 Sep 08	18 Sep 08	23 Sep 08 (Grand Isle/Venice, LA)
52987	F	12 Sep 08	16 Sep 08	23 Sep 08 (La Pesca, Mexico)
52988	F	7 Sep 08	N/A	21 Sep 08 (Columbus, GA) ²
96432	M	14-16 Sep 09	1 Oct 09	2 Oct 09 (Venice, LA)
96433	F	1 Oct 09	17 Oct 09	25 Oct 09 (Raya, Honduras)

¹ Sex of the bird not certain; based on weight and physical features (ankle thickness and feather patterns).

² We cannot confirm that the osprey wintered in this area. However, it remained in the vicinity of Columbus, GA, from 21 Sep until 21 Oct, when the signal was lost.

□ Osprey 52976 was approximately 100 mi north of the Gulf (north of Mobile, AL) on 9 Sep. The osprey then reversed course and on 16 Sep, it was located 390 mi to the northwest. It didn't return to the Gulf area until approximately 5 November 2004.

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Figure 1. Juvenile osprey showing green color band on left leg and USGS band on right leg, backpack transmitter (PTT) with antenna extending out from the transmitter, and temporary tail-mount VHF transmitter with antenna extending out from the tail feathers. For ease in identifying individuals at the hack site area, a small area on the wings is painted an individual-specific color or combination of colors. This temporary paint will disappear with molting. Photo courtesy of Deb Palmer.

Figure 2. Autumn migration route of osprey 52975 from the hack site in southeast South Dakota, 2004.

Figure 3. Autumn migration route of osprey 52976 from the hack site in southeast South Dakota, 2004.

Figure 4. Autumn migration route of osprey 52977 from the hack site in southeast South Dakota, 2004.

Figure 5. Osprey 52977 near Smithville Lake, north of Kansas City, MO, on 27 September 2004. Photo courtesy of Linda Williams.

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Figure 15. Migration routes of instrumented ospreys released at hack sites near Yankton and Vermillion, SD, in 2004-2009.

Figure 16. Wintering locations for 9 ospreys released at hack sites near Yankton and Vermillion, SD, 2004-2010.

Figure 17. Osprey 5E, released on 6 August 2010 and photographed in the hack site area (a), was observed and photographed on 31 October (b) and 18 December 2010 near the coast in the Celestun Biosphere Reserve, Yucatan, Mexico. Photographs courtesy of Roger Dietrich (a) and Antonio Nunez Lemos (b).

Figure 18. When suitable nest structures are unavailable, ospreys readily nest on such artificial structures as utility poles (a) and cell towers (b).

Figure 19. Nesting ospreys can be accommodated on artificial structures, including utility poles (a) and cell towers (b) with the placement of nest platforms.

Figure 20. Poles with nest platforms can be installed to encourage osprey nesting where suitable nest structures are unavailable (a), or to coax them away from electrified poles (b).

Figure 21. Ospreys nesting on structures close to the ground or water are more vulnerable to human disturbance and may require signs to discourage people from disturbing the birds.

Photos by Wayne Melquist unless otherwise indicated.



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Figure 2. Autumn migration route of osprey 52975 from the hack site in southeast South Dakota, 2004.

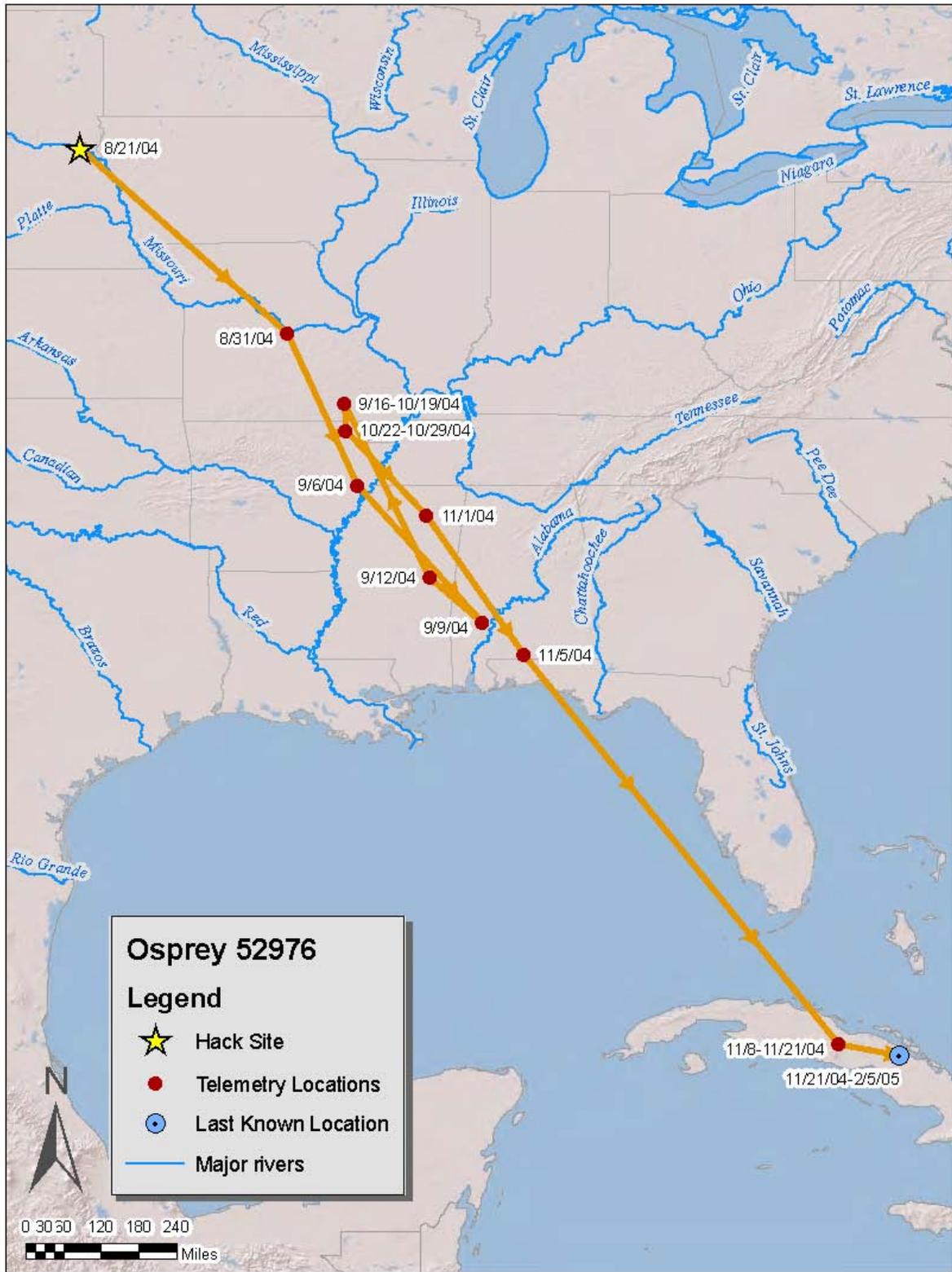


Figure 3. Autumn migration route of osprey 52976 from the hack site in southeast South Dakota, 2004.

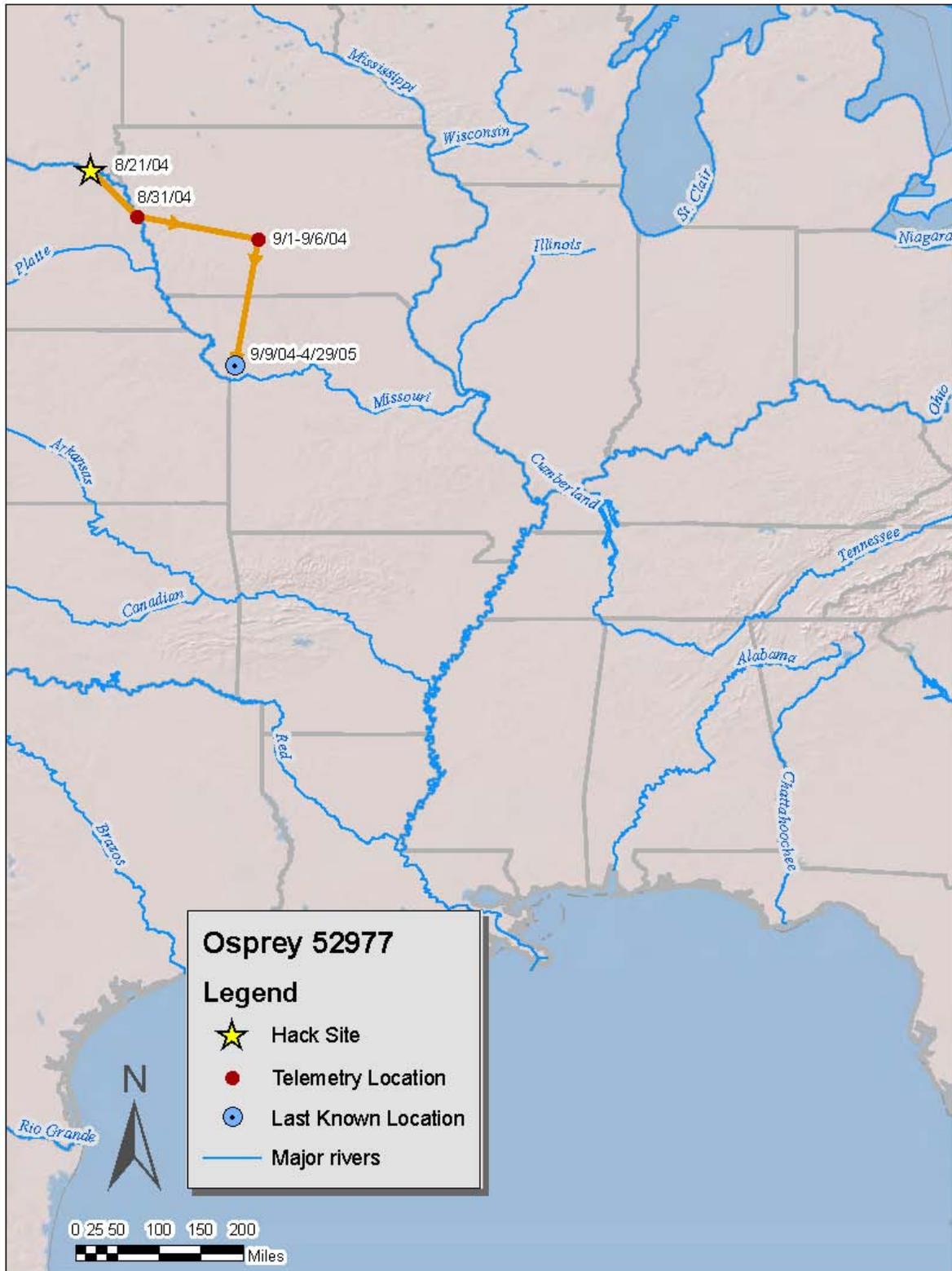


Figure 4. Autumn migration route of osprey 52977 from the hack site in southeast South Dakota, 2004.



Figure 5. Osprey 52977 near Smithville Lake, north of Kansas City, MO, on 27 September 2004. Photo courtesy of Linda Williams.

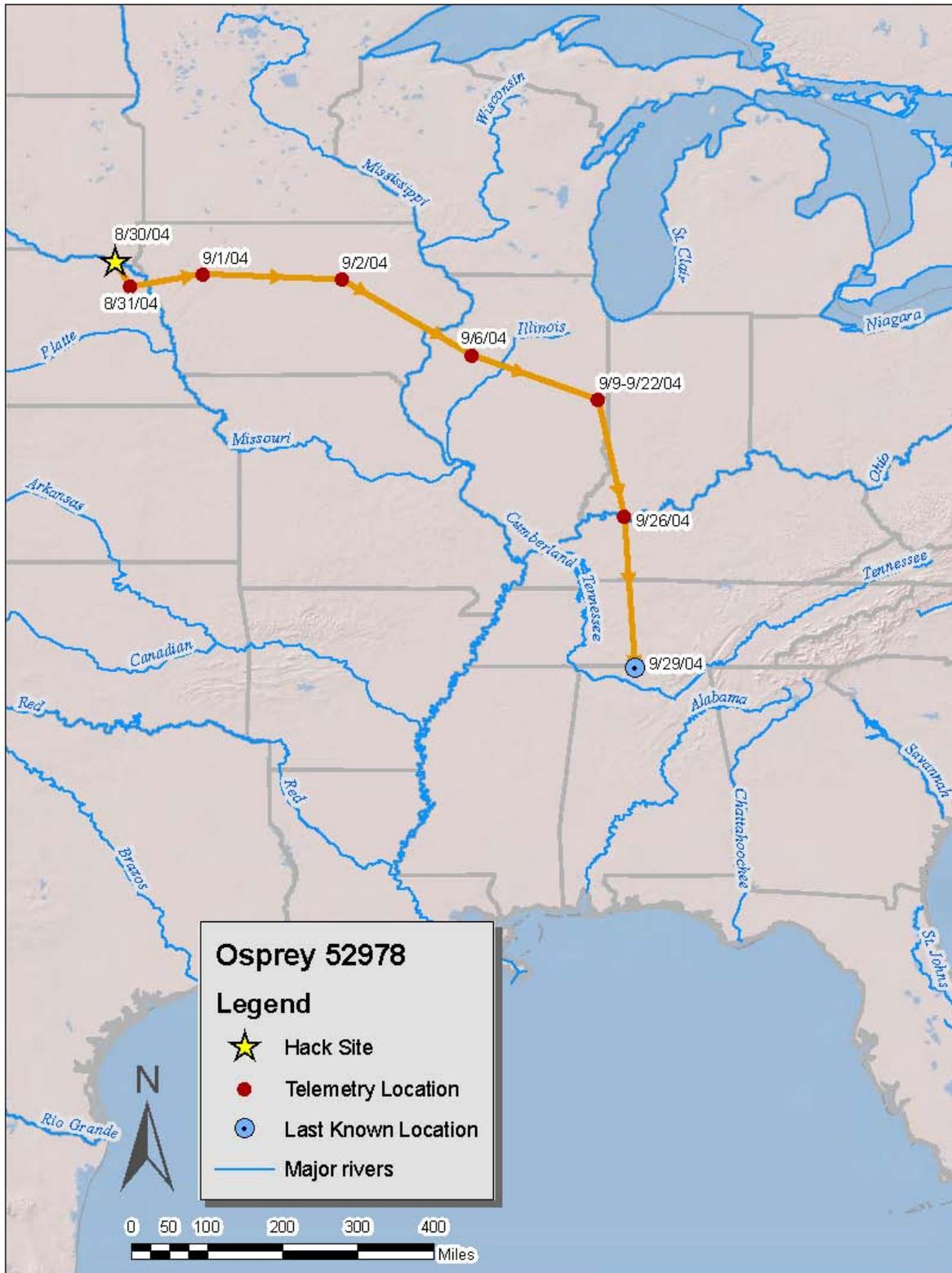


Figure 6. Autumn migration route of osprey 52978 from the hack site in southeast South Dakota, 2004.

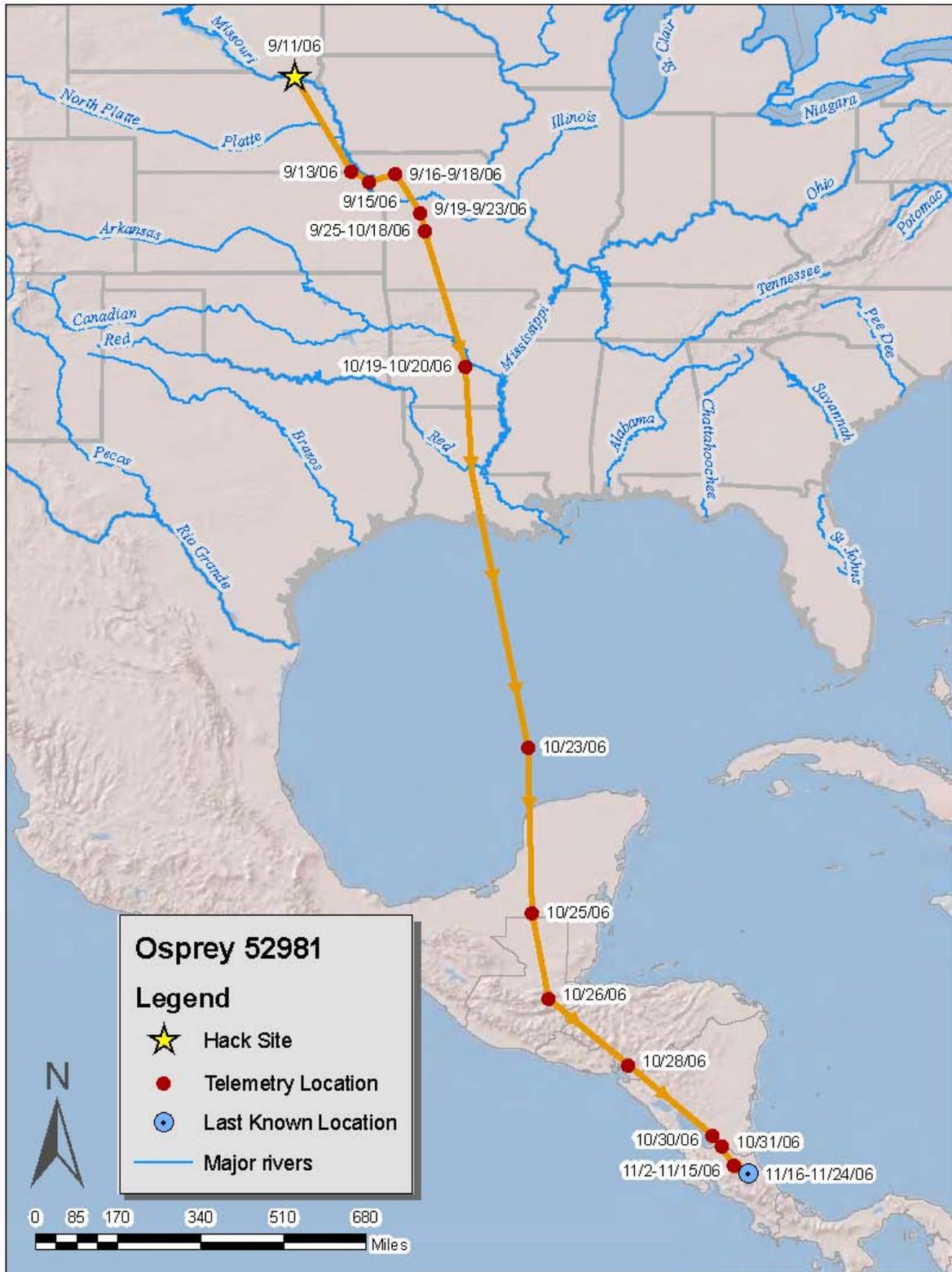


Figure 7. Autumn migration route of osprey 52981 from the hack site in southeast South Dakota, 2006.



Figure 8. Autumn migration route of osprey 52982 from the hack site in southeast South Dakota, 2006.

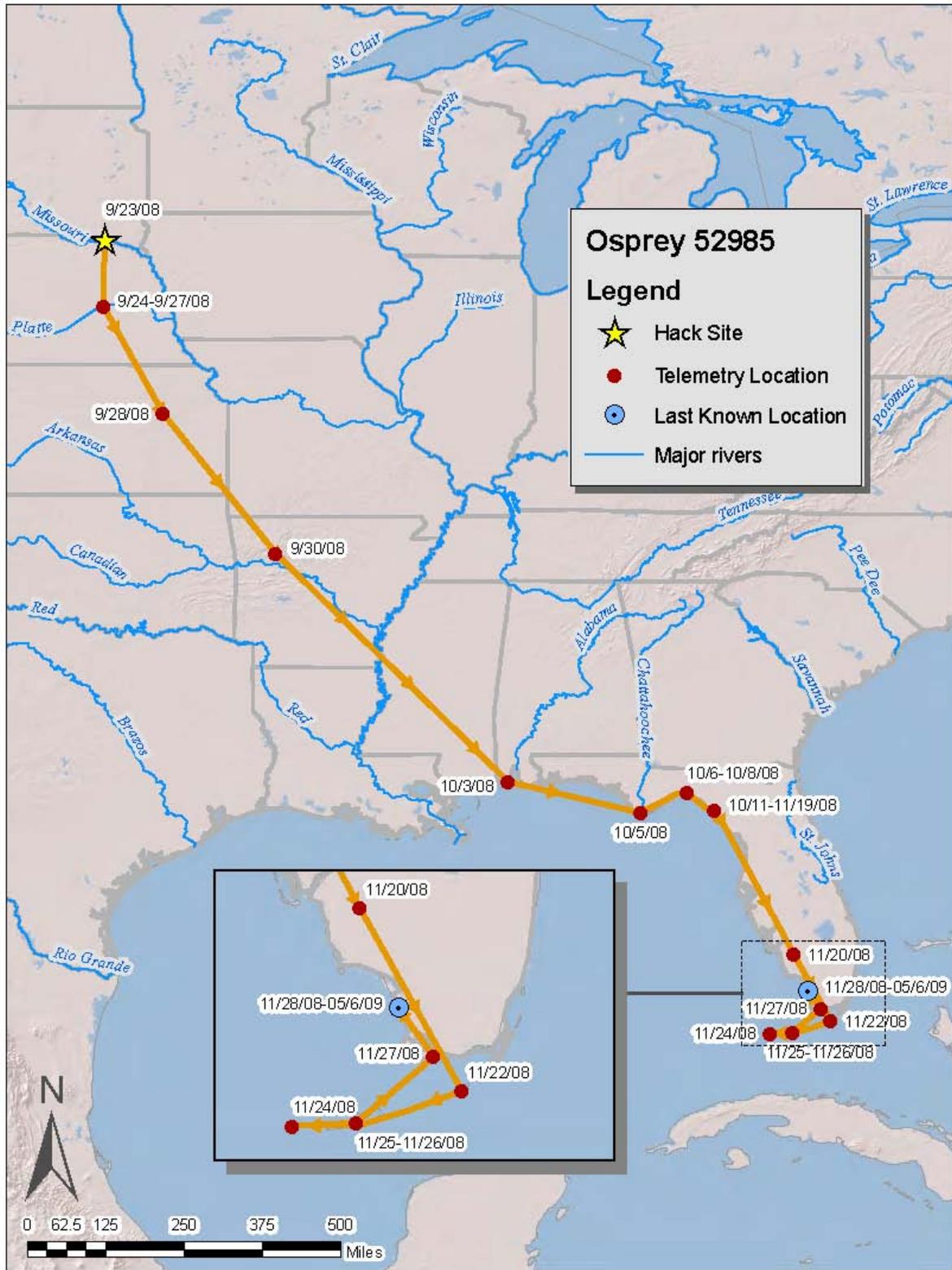


Figure 9. Autumn migration route of osprey 52985 from the hack site in southeast South Dakota, 2008.

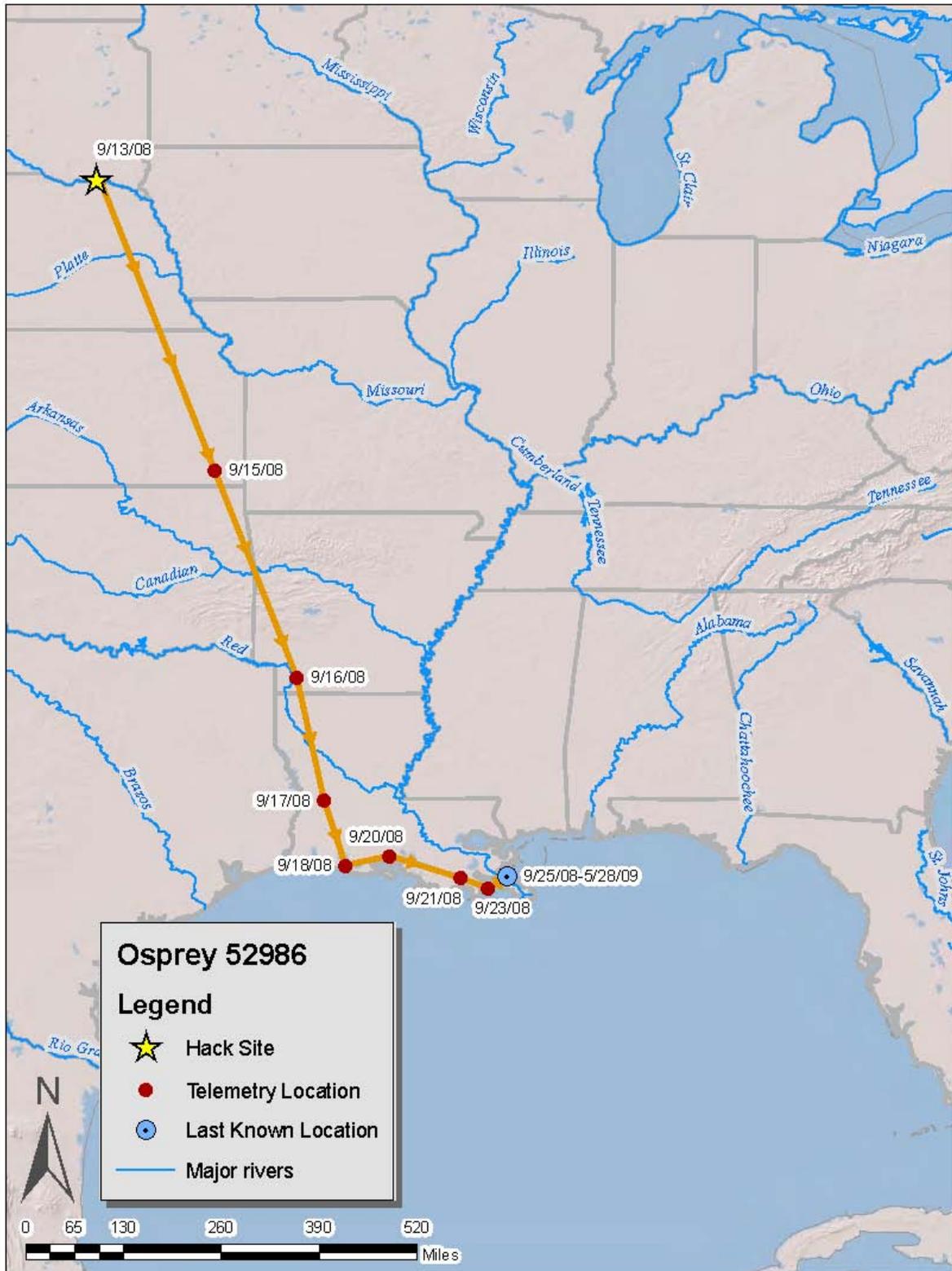


Figure 10. Autumn migration route of osprey 52986 from the hack site in southeast South Dakota, 2008.



Figure 11. Autumn migration route of osprey 52987 from the hack site in southeast South Dakota, 2008.

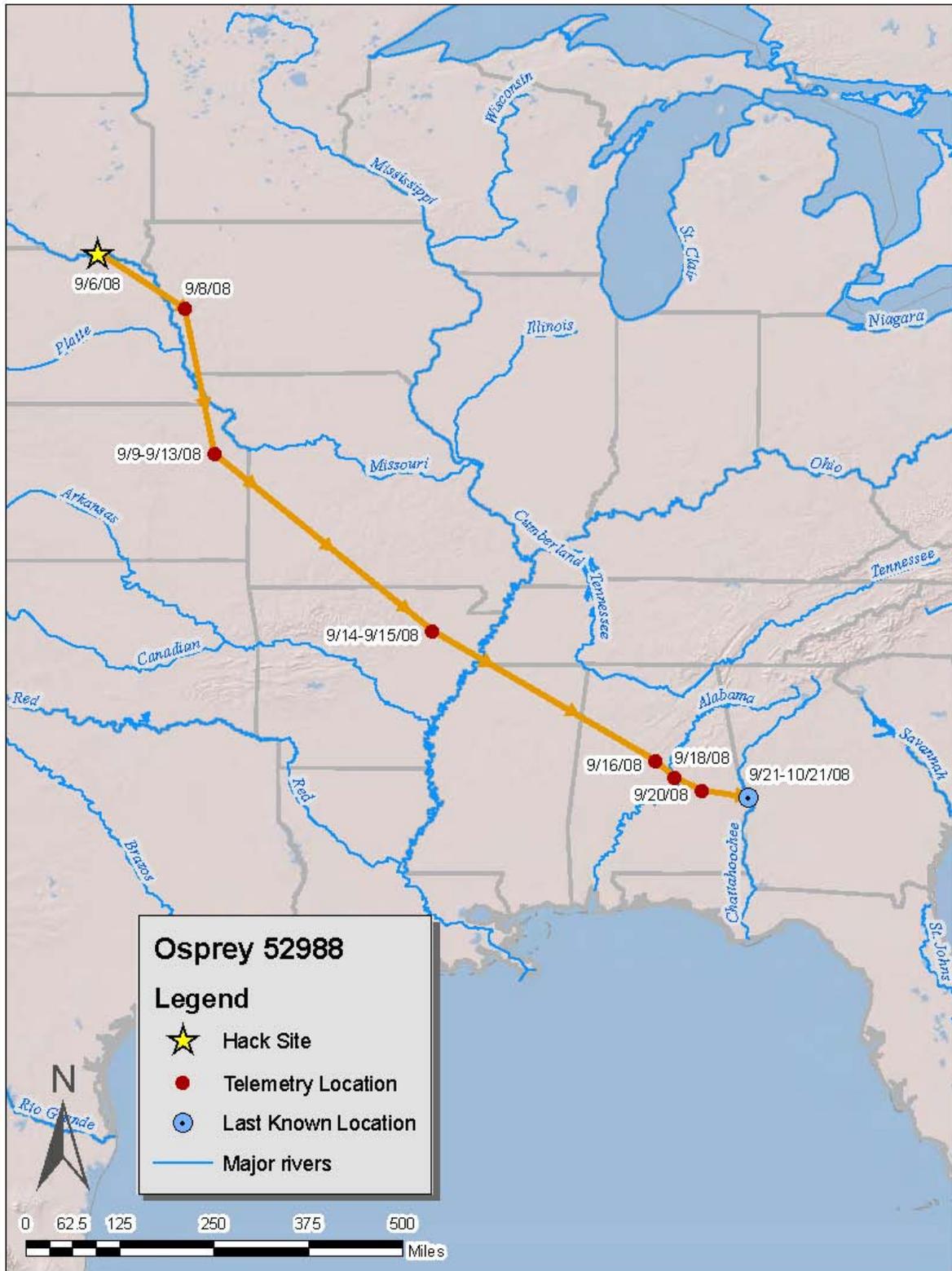


Figure 12. Autumn migration route of osprey 52988 from the hack site in southeast South Dakota, 2008.

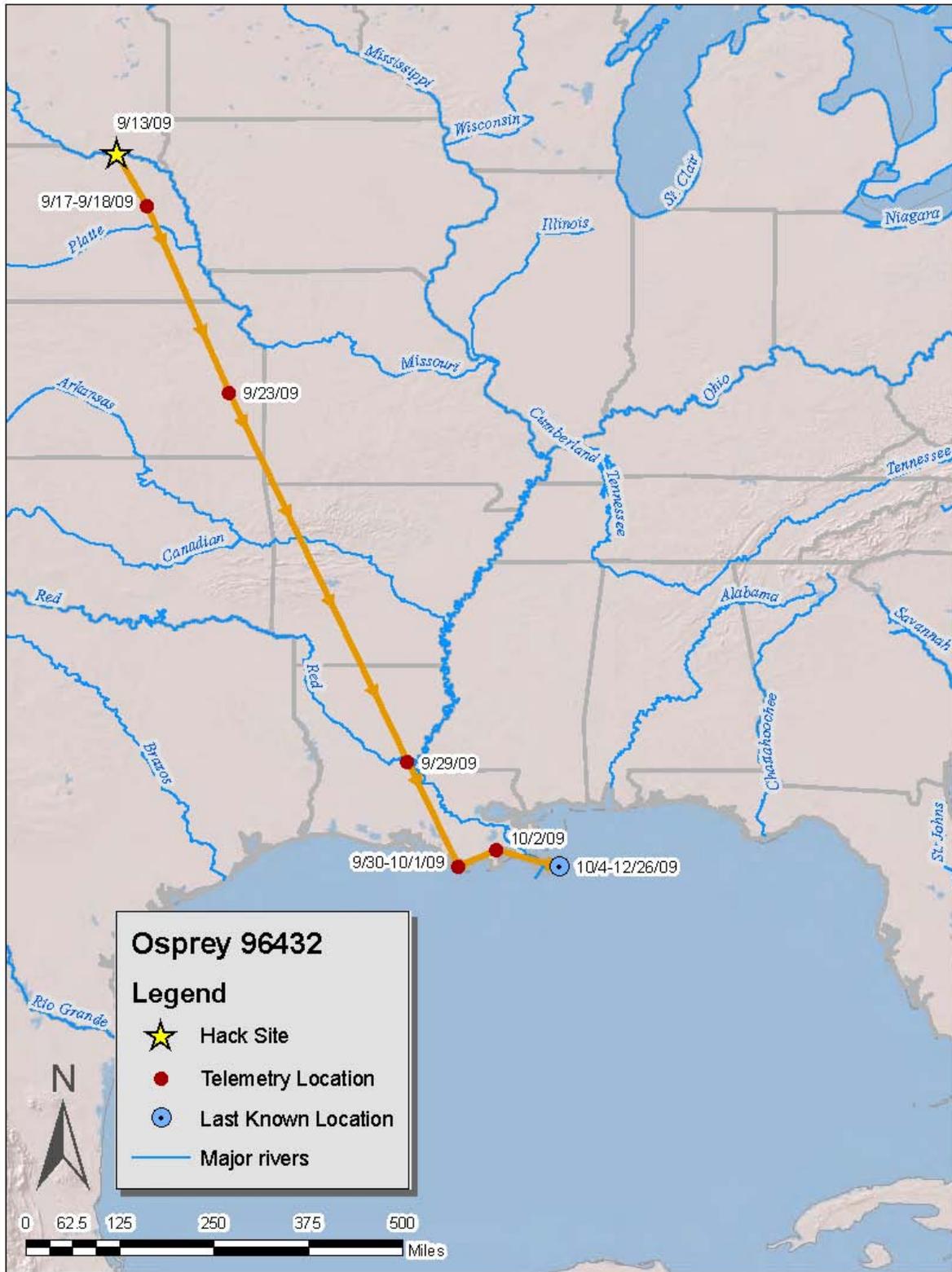


Figure 13. Autumn migration route of osprey 96432 from the hack site in southeast South Dakota, 2009.

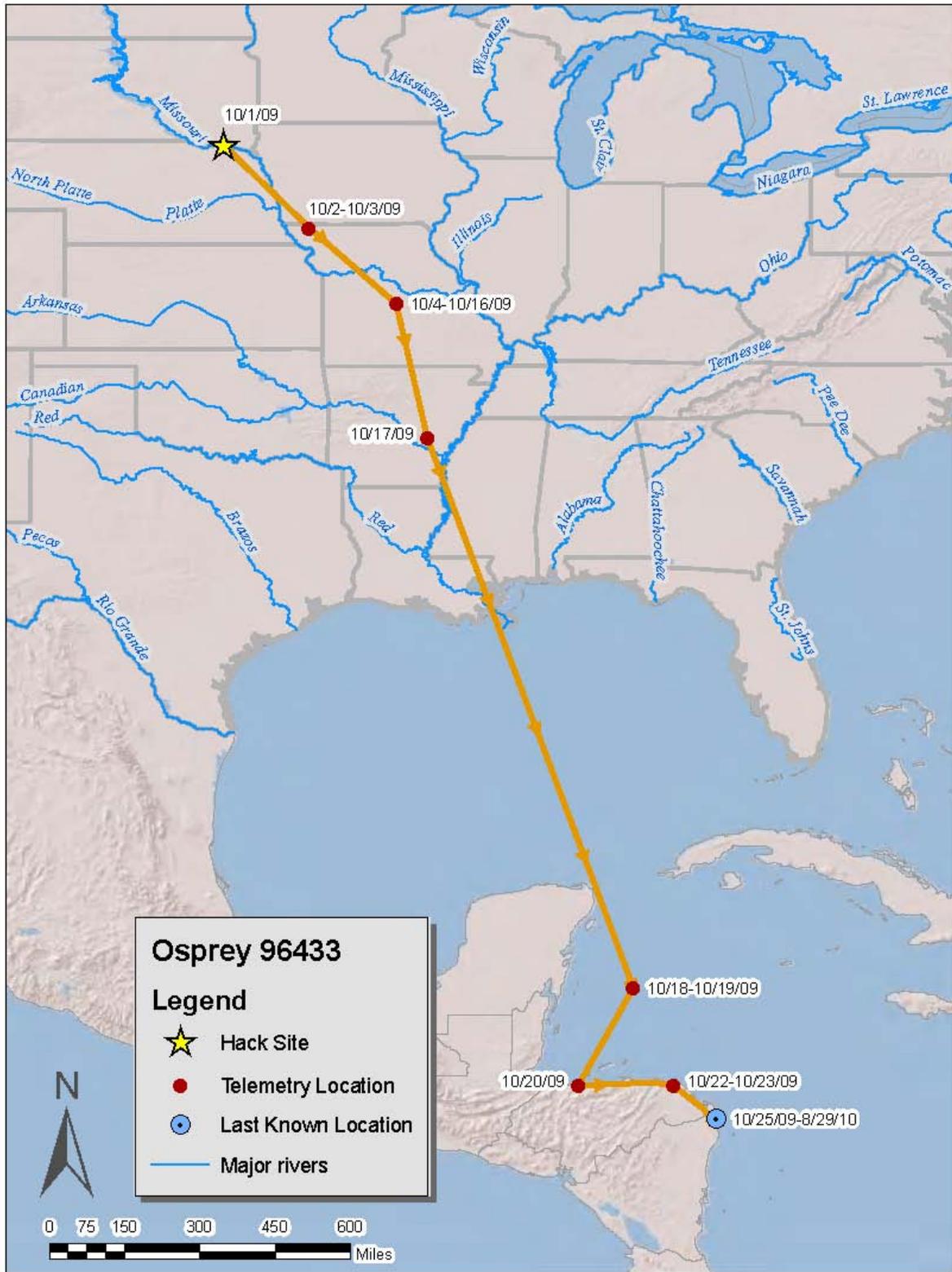


Figure 14. Autumn migration route of osprey 96433 from the hack site in southeast South Dakota, 2009.

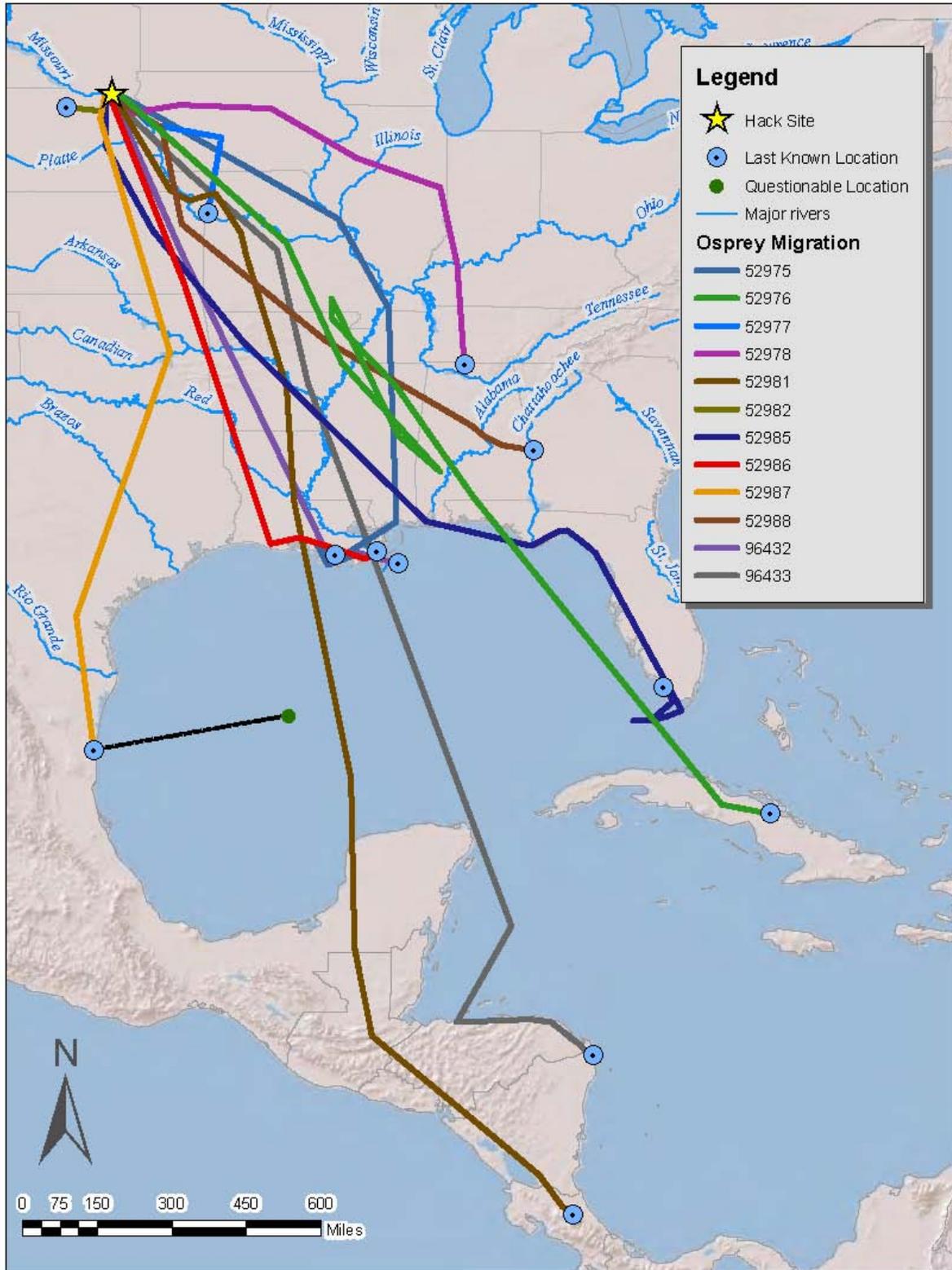


Figure 15. Migration routes of instrumented ospreys released at hack sites near Yankton and Vermillion, SD, in 2004-2009.

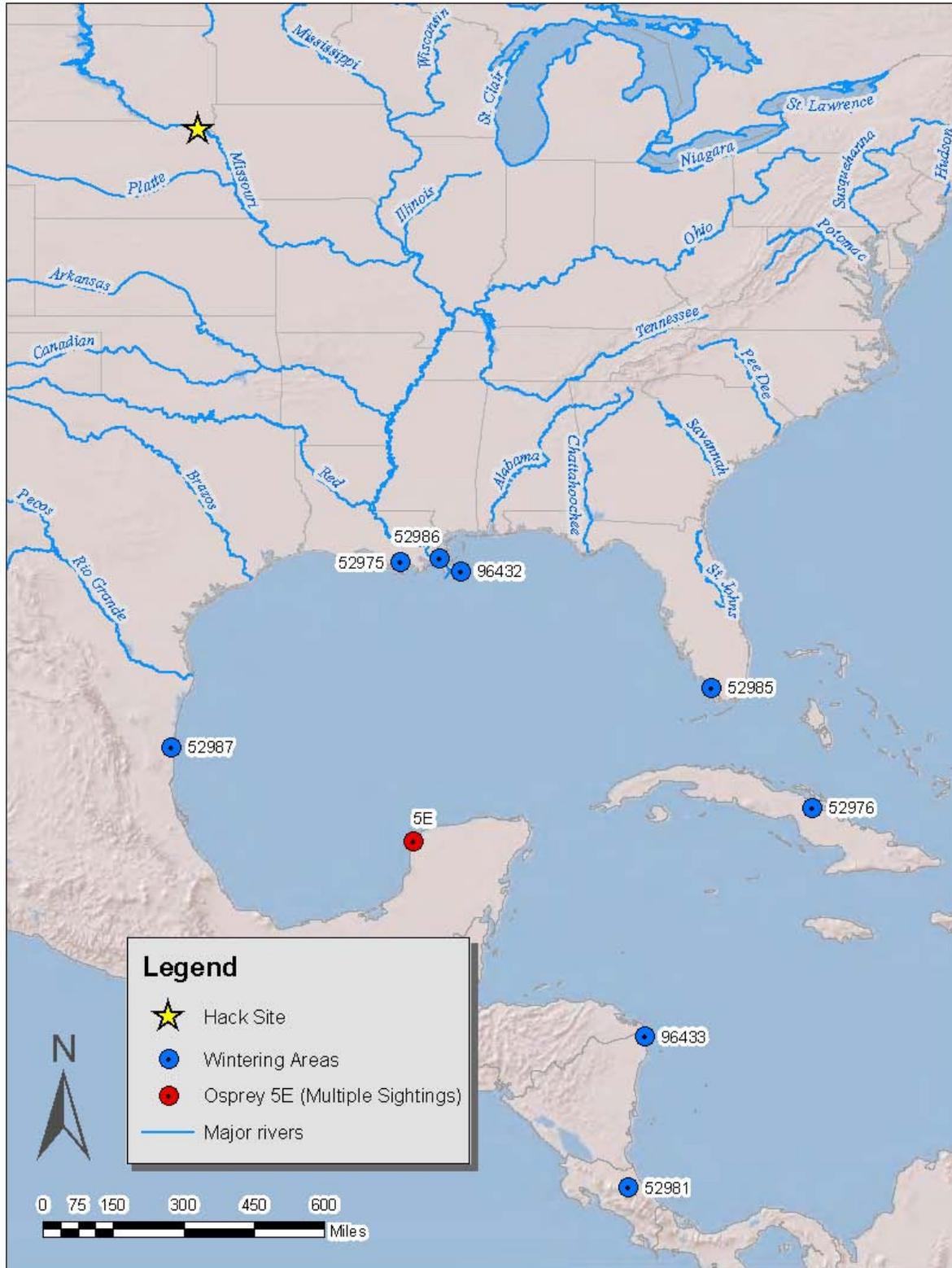


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a.



b.

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a.



b.

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a.



b.

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a.



b.

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