

**ECOLOGY AND CONSERVATION OF OSPREYS
ALONG THE YELLOWSTONE RIVER, MONTANA**

- 2021 ANNUAL REPORT -



Osprey 81/M wintering in Texas. Photo R. Michaelson

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21 November 2021

BACKGROUND

The Yellowstone Valley Audubon Society (YVAS) in Billings, Montana began monitoring the distribution and abundance of ospreys (*Pandion haliaetus*) along the Yellowstone River in 2009. YVAS wanted to engage its membership on a field project, and selected ospreys as the focal species because they are common, tolerant of research study, and a model for citizen science (see Cushing and Washburn 2014). YVAS also sought to assist wildlife management agencies reduce the increasing numbers of osprey electrocutions and entanglements in baling twine. Over 95% of nests along the Yellowstone River are on power poles or nest platforms and over 60% of nests contain baling twine (Seacor et al. 2014); these two anthropogenic conditions cause osprey mortality annually.

From modest beginnings in 2009, today the collaborative project is the largest, formal citizen science research effort in Montana. It effectively combines the work of over 40 volunteers and five power companies: Beartooth Electric Cooperative, Montana-Dakota Utilities, NorthWestern Energy, Park Electric Cooperative, and Yellowstone Valley Electric Cooperative. The project is regularly featured by the local news media and power company communications.

The osprey project relies exclusively on volunteers who from April to September estimate territory occupancy, egg laying and hatching dates, and fledging success. Since 2012, the project has used standardized monitoring protocols and combined observational and manipulative approaches (e.g., banding, blood sampling) to promote conservation. Volunteers monitor nearly 100 nests along the Yellowstone River from Gardiner to Sidney (Fig. 1).

This *2021 Annual Report* briefly summarizes major results and findings during the 10th season of the project. A grant from the Wolf Creek Charitable Foundation made much of this work possible. Other financial support was provided by donations from private individuals.

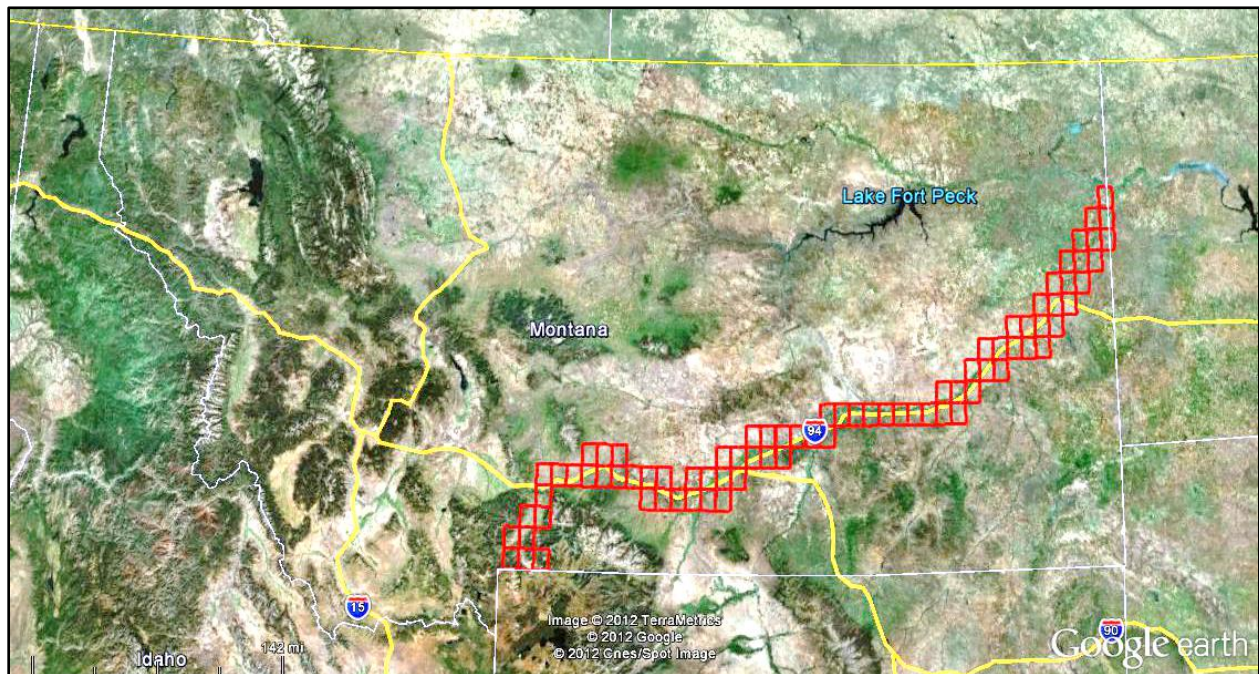


Figure 1. Location of the Yellowstone River study area, which extends 700 km from Gardiner in south central Montana to the North Dakota border. Boxes delineate 10-minute latitude/longitude blocks that are used to locate osprey banding data for the USGS Bird Banding Lab.

2021 OBJECTIVES

- Color band nestling ospreys to estimate natal dispersal, lifetime reproductive success (LRS), and long-range movements.¹
- Continue long-term ecological research on the distribution, abundance, and reproductive success of a color-marked osprey population.¹
- Reduce the number of osprey electrocutions in cooperation with power companies.
- Reduce the number of osprey entanglements in baling twine.
- Coordinate and improve the science literacy of YVAS volunteers (i.e., citizen scientists).²

¹ *Research Priorities identified by Poole et al. (2002) and Bierregaard et al. (2016) – Birds of North America Account, Ospreys # 683.*

² *Research Priority identified by AAAS (1993) and NSF (2003).*

OUTLINE OF 2021 METHODOLOGY

I delivered one in-class osprey orientation for volunteers in April in Billings. The 2.5-hour class reviewed osprey ecology/conservation, described how to collect field data and complete project data sheets, and explained use of the “Field Operations Manual,” which was updated prior to the 2021 season. The presentation continued to emphasize that volunteers ensure their research activities do not disrupt normal osprey behaviors following guidance in Fyfe and Olendorff (1976) and Rosenfield et al. (2007).

Beginning in early April, volunteers surveyed the Yellowstone River for nesting ospreys, focusing their efforts in areas historically occupied by ospreys. Each nest was visited about once a week until early September. Volunteers estimated egg laying and hatching dates, brood size, reproductive success, and fledging dates. Volunteers also observed adult ospreys for bands to determine natal dispersal and lifetime reproductive success (e.g., Restani and Harmata 2014).

I color-banded nestling ospreys with leg bands beginning in late June depending on nest chronology. Nestlings were banded when 4-6 weeks old. Nests were accessed with ‘bucket trucks’ provided by power company cooperators and a local tree trimmer. Nestlings were banded with a USGS band on the left leg and a unique alpha-numeric green color band on the right leg, a marker which allowed individual identification from a distance once the bird fledged. The codes on color bands allowed us to determine 1) wintering areas throughout the US Gulf Coast, southeastern US coast, eastern Mexico, and Costa Rica, and 2) migratory flyways through Colorado, Indiana, Kansas, Nebraska, Wisconsin, and Wyoming.

When ospreys colonizing new areas attempted to construct nests on energized power poles (see 2021 Photo Gallery, page 9), we contacted power companies immediately to remove the hazard sticks and to erect nest deterrents and/or nesting platforms. The project’s 42 volunteers who monitored nearly 100 nests along the 700-km study area were very effective in finding colonizing ospreys quickly and called me immediately when conflicts were discovered. We also reported entanglements in baling twine and electrocutions to Montana Fish, Wildlife and Parks (MFWP) and the US Fish and Wildlife Service (USFWS). Finally, we also responded to reports from the public regarding ospreys building nests on energized poles and possible entanglements.

2021 RESULTS AND DISCUSSION

Population Increase and Reproductive Success

Ospreys did not nest along any rivers in southeastern Montana prior to the 1980s (Swenson 1981). Since then, ospreys have adopted power poles and bridges as nest sites and have expanded their range east along the Yellowstone River.

Our data demonstrate that the Yellowstone River osprey population has increased significantly the past few years (Fig. 2). Productivity rebounded in 2020 and 2021 from lows recorded the previous two summers when productivity dipped below a level needed to sustain continued growth.

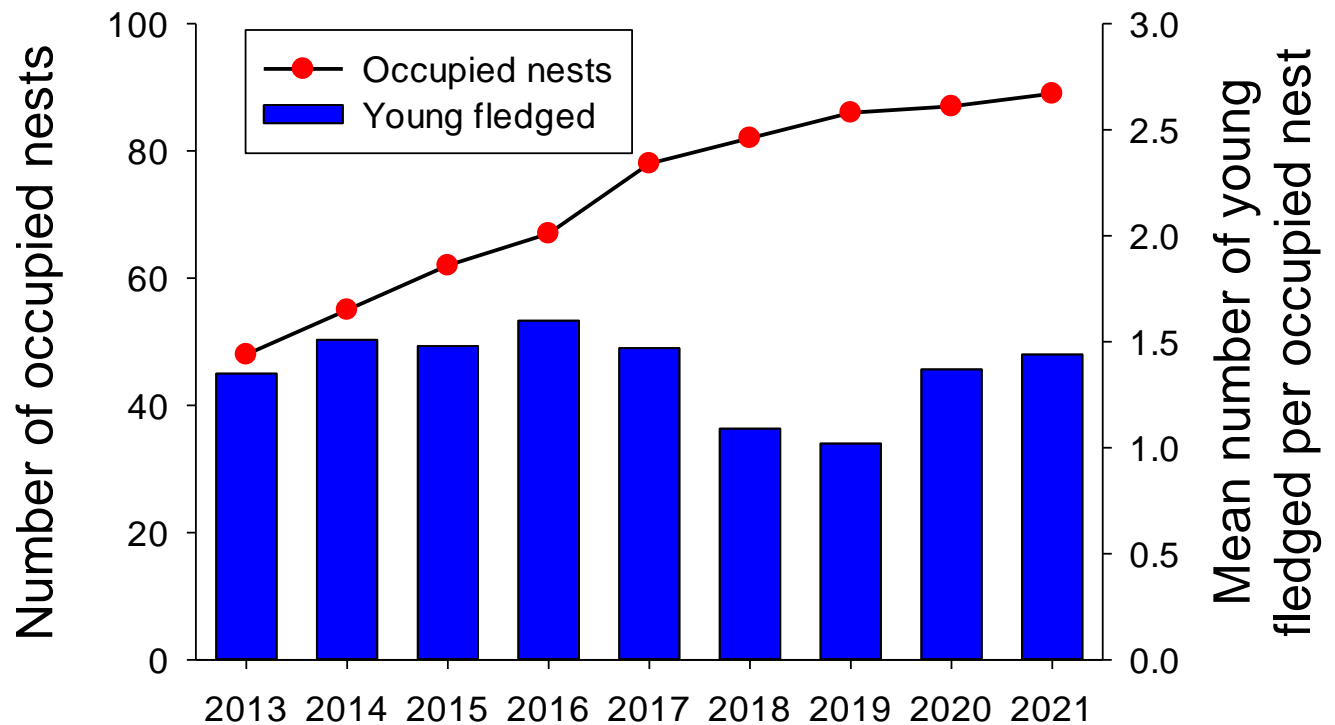


Figure 2. Population growth and reproductive success of ospreys along the Yellowstone River.

Electrocutions and Entanglements in Baling Twine

Over 95% of ospreys breeding along the Yellowstone River nest on power poles or artificial nest platforms and the number of conflicts between the expanding osprey population and utilities and agriculture is increasing annually. For example, each year ospreys are electrocuted in newly colonized areas when they construct nests on energized power poles. Twenty-three ospreys (15 adults and 8 fledglings) have been electrocuted on our study area from 2012-2021.

Two fledgling ospreys were electrocuted in 2021. We worked closely - and quickly - with power companies to erect perch deterrents and/or nest platforms to reduce electrocution hazards when and where conflicts arose. Our work with power companies was an unequivocal success because the proportion of the osprey population that is electrocuted annually is decreasing despite the large population increase along the Yellowstone River.

Adult ospreys incorporate discarded baling twine into their nests and each year volunteers find ospreys entangled in twine (Restani 2014, Seacor et al. 2014). Without human intervention these birds suffer an agonizingly slow death from constriction, infection, and starvation. The extent of this problem has become apparent through our nest monitoring and banding (over 60% of nests contain twine). From 2012-2021, 27 ospreys became entangled at nests. We rescued 16 nestlings and one adult that certainly would have died without our intervention.

During 2021, five nestlings became entangled in baling twine and were rescued (see 2021 Photo Gallery, page 10). One of these nestlings was badly injured. We banded it and observed it the remainder of the nestling period. It survived but was only seen twice post-fledgling. The other four rescued nestlings fledged normally. Two adults became entangled at their nests but were able to free themselves from most twine.

Natal Dispersal

In addition to evaluating general breeding ecology (e.g., reproductive success, settlement patterns), we are determining natal dispersal of osprey (i.e., movement from place of hatch to place of first breeding). Despite decades of intensive research on ospreys, only five studies have reported information on natal dispersal, a behavior closely linked to ecology and evolution (Henny et al. 1983, Spitzer et al. 1983, Poole 1989, Postupalsky 1989, Martell et al. 2002). For example, natal dispersal affects population dynamics (e.g., growth), population genetics (e.g., mate choice), and species distribution (e.g., colonization). Moreover, in ospreys, it might also provide insight into the propensity for imprinting on power poles or the use of baling twine in nests. Ospreys reach sexual maturity at 2-3 years of age and since 2012 we have banded 686 nestling ospreys with unique alpha/numeric codes (see 2021 Photo Gallery, pages 11 and 12). Subsequent observations of these bands have allowed us to track individuals and gather valuable data on natal dispersal (see 2021 Photo Gallery, page 13).

During summer 2021, we determined the natal dispersal of 7 new male ospreys. To date, we have information on 46 males that are now breeding on the Yellowstone River. Three other males have been discovered breeding off of the Yellowstone River in western Montana: one near St. Xavier, one near Silver Star, and one near Bozeman. We determined the natal dispersal of 5 new females in 2021. To date, we have information on 21 females that we banded as nestlings that are now breeding on the Yellowstone River. We discovered three females banded by other researchers in western Montana that have bred on our study area.

As a benefit to our research on natal dispersal, we anticipate being only the second osprey project in North America to obtain estimates of lifetime reproductive success (LRS; see seminal paper by Postupalsky [1989] for Michigan ospreys). LRS, the number of offspring produced by an individual over its lifespan, is exceedingly difficult to determine for large vertebrates in the field because it requires the ability to identify individuals and to measure reproductive effort. Ospreys make an ideal LRS subject because they are tolerant of close approach during nesting, thus uniquely color-banded individuals can be identified and their reproductive success estimated. Along with natal dispersal, LRS has important implications for population dynamics. The continuation of our long-term study, which completed its 10th season in 2021, will yield LRS information that will be useful for discovering life history patterns in large raptors and for assisting management in areas where ospreys come into conflict with humans.

Science Literacy of Volunteer Nest Monitors and the General Public

Only 28% of US adults are scientifically literate (Hobson 2008). How well the public understands key scientific concepts and the process of science has direct implications for policies regarding climate change, human health, and natural resource development and conservation (Miller 2004). To achieve scientific literacy, members of the public must practice independent, critical thinking as they become proficient in interpreting evidence and understanding data uncertainty. Direct interactions with scientists and involvement in ongoing research are the most valuable experiences promoting science literacy according to the public (Evans et al. 2005, Bonney et al. 2009, Freitag and Pfeffer 2013). Thus, both the American Association for the Advancement of Science (AAAS 1993) and the National Science Foundation (NSF 2003) are formally encouraging and - sometimes - requiring that professional scientists make research opportunities available to the public.

Our osprey project is a 'contributory' citizen science study whereby volunteers collaborate with an Emeritus Professor of Ornithology to improve their knowledge of science and conservation. The 40+ volunteers who monitored nests were provided information on osprey ecology and behavior, were annually trained in proper data collection and use of a 32-page 'Field Operations Manual', and were active in all fieldwork (e.g., monitoring, banding, and rescues of entangled ospreys). Moreover, they were taught basic methods to analyze and interpret data.

I delivered a presentation to 1) the monthly meeting of the Seacoast Chapter of New Hampshire Audubon in October 2021, and 2) the Butte Exchange Club in October 2021. The project was also featured prominently in the online newspaper the *San Antonio Report* in January 2021 and in the newspaper the *Livingston Enterprise* in August 2021. Aspects of the osprey project were also reported in four issues of the YVAS monthly Flyer.

MEASURABLE OUTCOMES IN 2021 THAT PROMOTED OSPREY CONSERVATION AND SCIENCE

Electrocutions:

- Reduce the number of electrocutions
 - Two fledgling ospreys were electrocuted in 2021, which was the same number of ospreys lost in 2020 (but both of those were adults). The proportion of ospreys that was electrocuted has decreased each summer as the population has increased. For example, three ospreys were electrocuted in 2013 and two in 2021, yet the population had increased 46% from 48 to 89 breeding pairs during that time period. This decrease in the number of ospreys that was electrocuted each year is testament to how quickly nest volunteers alert me and the power companies to nesting conflicts.
- Increase the number of power poles retrofitted
 - Each power company that participates in the project has developed and implemented an Avian Protection Plan in consultation with the USFWS. Each power company retrofitted power poles we had identified as being hazardous to ospreys in 2021.
- Increase the number of nest platforms erected
 - Two new nest platforms were erected in 2021. Each of these platforms was erected to provide a safe nesting site for ospreys that were placing sticks on energized poles. All new platforms were quickly occupied by nesting ospreys.

- Increase the number of training sessions on osprey nest protection given to power company operations personnel and supervisors
 - I delivered six formal training sessions to NorthWestern Energy personnel. Additional information was delivered during field work with NWE and other power company line crews.

Entanglements:

- Reduce the number of baling twine entanglements
 - Seven ospreys became entangled in baling twine during 2021. One, a nestling, was badly injured. Although it survived the remainder of the nestling period, it was observed only twice post-fledgling. The number of entanglements has varied from year to year but has averaged 3.4 per year since 2012. As with electrocutions, the proportion of entanglements has declined as the population has increased from 2012-2021.
- Increase the number of community education presentations on twine dangers and recycling
 - I gave two in-person presentations about NWE's avian protection program that included information about osprey entanglements in baling twine.
 - The dangers of baling twine to ospreys were featured in Facebook posts belonging to YVAS and NorthWestern Energy.
 - Additionally, ads for the baling twine collection and recycling site were featured in *Raised in the West* and *Western Ag Reporter* magazines and in 63 newspapers distributed across eastern and southern Montana.

Basic Science

- Increase information on the number of natal dispersers
 - We determined the natal dispersal of 7 new males in 2021. To date, we have information on 46 males that we banded as nestlings that are now breeding on the Yellowstone River. Another three males have been discovered breeding off of the Yellowstone River in western Montana.
 - We determined the natal dispersal of 5 new females in 2021. To date, we have information on 21 females that we banded as nestlings that are now breeding on the Yellowstone River.
- Increase information on Lifetime Reproductive Success of individual ospreys
 - This data collection is ongoing with the banding of nestlings each summer. To date we have banded 685 nestlings and one adult female (96 nestlings from 42 nests were banded in 2021). Ospreys are long-lived and to date we are tracking the LRS of 67 individuals.
- Continue to collect data on osprey distribution, abundance, and reproductive success
 - This data collection is ongoing.

Science Literacy

- Continue formal and informal training/educational presentations for citizen scientists
 - I delivered one in-class training session to osprey nest monitors.
 - As in year's past, the 'Field Operations Manual' was revised and updated.

COOPERATORS

This was a collaborative project with the following industry and government cooperators:

- Beartooth Electric Cooperative – in-kind logistics
- Burlington Northern Santa Fe – access
- CHS Refinery – in-kind logistics
- City of Billings – access
- City of Livingston – access
- Montana Fish, Wildlife and Parks – permitting, access
- Montana-Dakota Utilities – in-kind logistics
- NorthWestern Energy – in-kind logistics
- Park Electric Cooperative – in-kind logistics
- U.S. Bureau of Land Management – access
- U.S. Fish and Wildlife Service – law enforcement
- U.S. Geological Survey (Patuxent Wildlife Research Center) – permitting
- Yellowstone Valley Electric Cooperative – in-kind logistics
- Yellowstone Valley Tree Surgeons – in-kind logistics

***** As in years past, volunteer nest monitors donated all of their time and mileage costs. They drove over 31,000 miles in 2021.**

2021 PHOTO GALLERY

An adult female osprey adding sticks to an energized pole with poorly functioning bird deterrents. The electric cooperative was alerted to remove the sticks and to follow-up with better bird protection.



A NorthWestern Energy lineman and the author rescuing a twine-entangled nestling osprey during the 2021 banding season. The bird had minor injuries and fledged normally.



Newly banded nestling ospreys carrying the project's green alpha-numeric bands on their right legs and silver USGS bands on their left legs.



A NorthWestern Energy lineman assisting with banding of nestling ospreys.



A new breeding male discovered in 2021. The bird carries the project's green alpha-numeric band on the right leg (38/K) and silver USGS band on the left leg. The male was banded as a nestling in 2018 and has established a territory approximately 60 km from its natal nest.

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