MANAGEMENT
of the
OSPREY
(*Pandion haliaetus*)

IN PENNSYLVANIA

Ten Year Plan
(2015-2025)

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EXECUTIVE SUMMARY

The osprey was never a common nesting species in Pennsylvania. It is a popular bird among Pennsylvania residents and is an indicator of healthy watersheds. The osprey was declared extirpated from Pennsylvania in 1982. Before the population collapse, osprey were reported in summer from 15 of the state's 67 counties and nests were confirmed only from Beaver, Bucks, Clarion, Delaware and possibly Wyoming counties. Osprey reintroductions were initiated by Dr. Larry Rymon and Charles Schaadt at East Stroudsburg University beginning in 1980. Nearly 300 birds were released into Pennsylvania between 1980 and 2007: 110 in the Poconos; 60 in the Tioga/Hammond Reservoir in Tioga County; 95 in Moraine State Park, Butler County; 14 in Raystown Lake, Huntingdon County; 11 in Prince Gallitzin State Park, Cambria County. The osprey's status was changed from extirpated to endangered in 1985, following the first nesting attempt after the population crash. The first osprey nested successfully in 1986. Osprey eventually returned to breed at most of sites where they were reintroduced. The Game Commission's osprey surveys documented a steady increase in the osprey nesting population from 1990 (9 nesting pairs) through 2010 (115 nesting pairs) and were nesting in 5 of the agency's 6 regions by 2010. The second Pennsylvania breeding bird atlas (2004-2008) found ospreys were breeding in 90 atlas blocks, ten times more than the first atlas (1983-1989). Osprey are currently nesting in five distinct clusters each located in different secondary watershed units. The rapid recovery of Pennsylvania's osprey population demonstrates that osprey are a species that has adjusts well to the landscapes dominated by humans.

At the time osprey status was changed from extirpated to endangered, not enough information was available to determine de-listing criteria. Subsequent to the rapid recovery of the osprey population, biologists have acquired better information on which to base de-listing criteria. Based upon experiences in other states and analysis of Pennsylvania data, characteristics necessary to assure a self-sustaining population able to survive natural population cycles and unexpected events is a minimum of50 nesting pairs, distributed across at least 4 watersheds, each containing a minimum of 10 pairs for 2 consecutive statewide surveys. Reaching all these thresholds is evidence of a healthy population, justifying reclassification of osprey from threatened to recovered in Pennsylvania. If the overall population drops below 50 nesting pairs or there are less than 4 clusters with 10 or more nests the Game Commission should take

immediate protective action listing osprey as endangered

A comprehensive state-wide osprey nesting survey will be completed in 2016. The Commission intends to move towards de-listing the osprey immediately following this survey as long as no unforeseen decline in nesting ospreys is found. Public education will continue to promote conservation of ospreys as a successfully recovered species.

MANAGEMENT GOALS, OBJECTIVES, AND STRATEGIES

Mission Statement

To establish and maintain a secure osprey population in Pennsylvania for current and future generations.

GOAL 1. Maintain a stable or increasing breeding population of osprey in Pennsylvania.

Objective 1.1. Monitor statewide osprey populations every 3 years until populations are recovered.

Strategies

1.1.1. Maintain a list of active osprey nests.
1.1.2. Conduct statewide nesting surveys on a 3-year schedule.

Objective 1.2. Delist osprey, changing status from threatened to protected, when at least 10 nesting pairs are found in each of 4 watersheds and at least 50 total nesting pairs are documented in 2 consecutive comprehensive surveys.

Strategies

1.2.1. Work with conservation partners to ensure Pennsylvania legal designation accurately reflects current osprey population status
1.2.2. Prepare official documentation of osprey status as secure and advance a proposal for agency staff review, followed by submission of a Title 58 Pa. Code regulations amendment for consideration by the Board of Commissioners.
1.2.3. Update existing environmental review requirements following delisting.

GOAL 2. Protect and promote osprey and their habitat.

Objective 2.1. Protect the breeding osprey population.

Strategies

2.1.1. Provide Best Management Practices (BMPs) for nesting osprey.
2.1.2. Encourage provision and maintenance of nesting structures in areas with nesting osprey or habitat that could support nesting osprey.
2.1.3. Provide guidance to reduce electrocution threats to osprey nests on transmission towers.
2.1.4. Publicly acknowledge individuals and organizations that follow BMPs, and improve the outlook for osprey.

Objective 2.2. Prosecute illegal killing and harassment of osprey.

Strategies

2.2.1. Make public the prosecution of illegal killing and harassment of osprey through a variety of media including digital and print.
2.2.2. Publicly acknowledge the effort of PGC staff and those who assist the agency in identifying individuals who harm osprey and in stopping associated illegal activities.

GOAL 3. Engage in public outreach to improve understanding and appreciation of osprey.

Objective 3.1. Instill the importance of osprey conservation in the general public.

Strategies

3.1.1. Provide the public with a detailed account of the history of conservation efforts for osprey through a variety of media including digital and print.
3.1.2. Provide the public with natural history, biological and habitat information on osprey through a variety of media including digital and print.
3.1.3. Distribute conservation-oriented educational materials at state wildlife-related activities, venues, and popular viewing locations.
3.1.4. Provide information to the public about viewing opportunities in the state and encourage the public to watch ospreys and contribute to monitoring this flagship species and other species that live in the same habitat.

Objective 3.2. Develop osprey specific classroom educational materials to teach about watershed health, environmental contaminants, and conservation.

Strategies

3.2.1. Meet state mandated educational goals and standard practices for appropriate grade levels.
3.2.2 Provide classroom materials in an easily accessible digital format.

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Dr. Larry Rymon and Dr. Charles “Hoagy” Schaadt of East Stroudsburg University of Pennsylvania embarked on their ambitious osprey restoration efforts in 1980 wondering if the hacking procedure would work and in particular whether hacked birds would know how to feed themselves having been raised by people rather than ospreys. It is safe to say the program worked beyond their wildest dreams and we have their pioneering and persistent efforts to thank for reestablishment of this once-extirpated species within the borders of our state and beyond. The enduring legacy of the osprey program is not only those idyllic scenes of an adult osprey hunting over the glassy and reflective surface of a lake, but also of a successful conservation effort involving the cooperation of numerous entities including the Pennsylvania Game Commission, Pennsylvania Audubon, Pennsylvania Power and Light, and The Metropolitan Edison Company. Once the hacking procedure was refined, others, including Gary Witmer, Joe Hummer, Richard Koepple, and Don Neibert took up the hacking effort at Tioga/Hammond Lake in 1990, Moraine State Park in 1993, Raystown Lake in 2003, and Prince Gallitzin State Park in 2007.

As a result of these efforts and subsequent population expansion from within and adjacent to our borders, we are now at the stage of ensuring the security of the species within the state. A major part of that process is this management plan, the first draft of which was written and reviewed in 2001 by Dan Brauning, Jerry Hassinger and Eileen Butchkoski of the Game Commission. As we have watched the population grow in the intervening years, the hope of delisting the species has compelled the completion of this management plan establishing productivity targets that, when met, will allow for a safe and justified delisting of the species. Many portions of the current plan remain intact from the original 2001 draft and we have those authors and editors to thank also for the general plan outline.

The current plan has benefited greatly from the suggestions and editorial review of Patricia M. Barber, Douglas Gross, and Daniel Brauning of the Game Commission; who kept the authors focused and on-track throughout the process. The plan also benefited from editing by Melanie Weaver of the Game Commission. Their patience during the process has been much appreciated.

Coauthor and assistant in this project, Stefani Cannon, was instrumental in rounding up references, checking on the status of local osprey nests in and around the Poconos, constructing a database of osprey nesting activity, and also editing early drafts of this plan. The process has provided a valuable experience for her.

SECTION I: OSPREY MANAGEMENT

Mission Statement

To establish and maintain a secure osprey population in Pennsylvania for current and future generations.

GOAL 1. Maintain a stable or increasing breeding population of osprey in Pennsylvania.

This plan focuses on maintaining a sufficient number of nesting sites to adequately recruit replacements as adult breeders are lost. The distribution of nesting osprey in Pennsylvania shows an affinity for areas already supporting breeding adults, suggesting immigrating adult osprey will have a strong attraction to areas with active nests. World-wide, osprey have the well-documented tendency to cluster their nests where nesting structures and abundant food resources are readily available, sometimes to the point of having "colonies" of nests (Poole et al. 2002). This plan builds on a self-sustaining breeding population of osprey of at least 50 nesting pairs consisting of at least 4 watershed-based nest clusters of 10 nesting pairs or more in each. These minimums in numbers and distribution will allow the population to retain the resilience needed to survive natural population cycles and stochastic events by attracting replacement breeders quickly before smaller clusters are lost. By meeting these conditions for 2 consecutive comprehensive surveys 3 years apart and observing a stable or increasing trajectory, the Pennsylvania population will demonstrate its stability and justify a recovered status. Nesting clusters are defined by secondary drainages, specifically hydrologic unit boundaries (HUC6), reflecting the ospreys' close association with water and aquatic biological resources. Currently, clusters are in the upper Delaware, lower Delaware, upper Ohio-Beaver, upper Susquehanna (Tioga-Hammond and Cowanesque Lakes), and lower Susquehanna drainages. The diverse geographic distribution represented by the drainages ensures the persistence of the species in Pennsylvania if there is a severe local mortality event at any one of the clusters (Fig. 1). During the second Pennsylvania breeding bird atlas (2004-2008), over 100 osprey nests representing 5 clusters of more than 10 nests were found. Although the Atlas included multiple breeding seasons, established breeding osprey exhibit high nest site fidelity, these results suggest that meeting the geographic target for

upgrading its status to recovered will be successful.

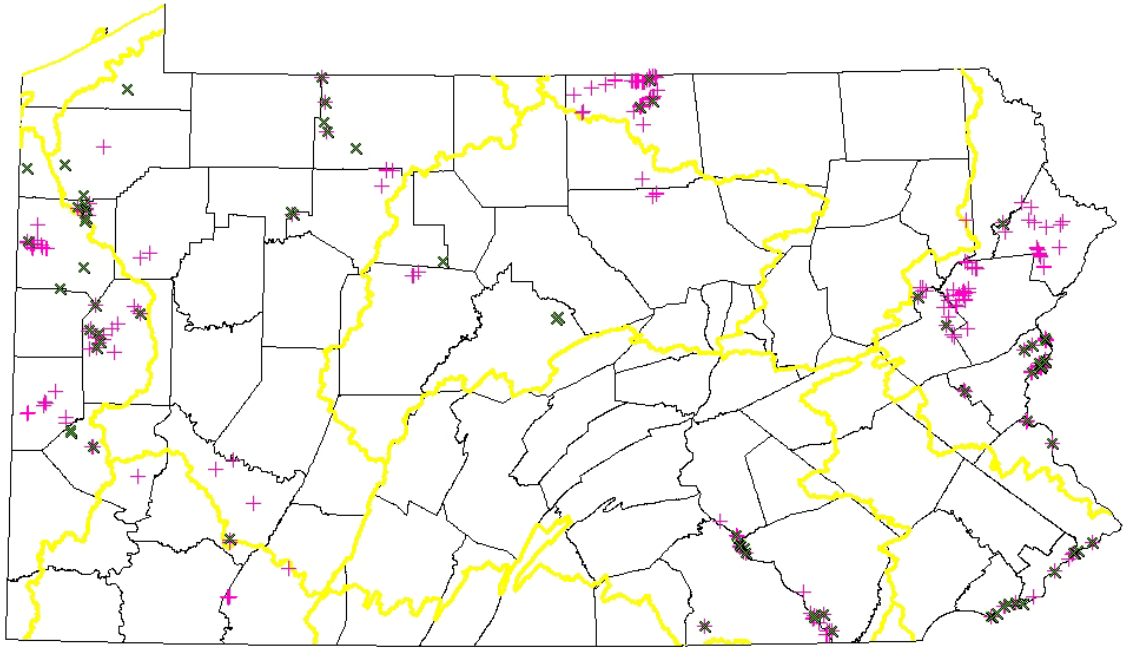

Figure 1. Distribution of Pennsylvania osprey nests and associated secondary drainages. Nests active in 2014, x, or active at least one year since 1990, +. Hydrologic unit boundaries (HUC6), yellow lines. County boundaries, black lines.

Concurrent with reaching these nesting targets is the protection of suitable nesting habitat, 97% of all nests in Pennsylvania are on artificial structures (Brauning 2012) and overall habitat monitoring in situations where water-borne contaminants are suspected of affecting productivity.

The lack of historical information makes it difficult to use historical populations to determine a goal based on past distribution and abundance. Many of the bodies of still water that now support osprey nesting populations did not exist in pre-settlement or pre-industrial Pennsylvania. In a 2010 study, it was found that 57% of the known Pennsylvania nests were associated with reservoirs with many others associated with dammed portions of rivers (Haffner and Gross 2011). Those sections of the Delaware, lower Susquehanna, and Ohio Rivers with osprey nests are strongly associated with human activity and the former two clusters “represent natural expansions from the robust populations in the Delaware and Chesapeake bays” (Brauning 2012, Watts and Paxton 2007). About 90% of Pennsylvania osprey nests are built on artificial structures rather than natural sites, which is unlike the pattern of the bald eagle, which nests

mostly in large trees and uncommonly on artificial structures (Haffner and Gross 2011, Gross and Brauning 2011). By comparison, Vermont's osprey recovery plan specified 30 nests as a target (Parren 1997), which is relevant because it also is an inland state with no seacoast where ospreys flourish. Using shallow water foraging habitat as a surrogate for the area that could support breeding pairs, and extrapolating to the corresponding area of open water in those aquatic areas, an equivalent target for Pennsylvania would be 49 pairs of nesting osprey. There would need to be at least 45 nests for the state to conserve at least 3 groups of 3 nests in each of the 5 secondary watershed units (HUC6), coming to a similar conservation target.

The population of nesting ospreys has well-exceeded the recovery target, but the recovery target shouldn't be confused with the number of nesting osprey Pennsylvania can support, or its carrying capacity. Pennsylvania's carrying capacity for osprey is much higher than the minimum number needed for a self-sustaining population and recovery from threatened status. There still appears to be lot of unoccupied, but good quality habitat available for colonization. The agency intends to keep the osprey population at or above 100 nesting pairs through responsible management and education. Over time the amount and quality of habitat in Pennsylvania is likely to change. Normal population fluctuations and responses to habitat changes shouldn't be a surprise but as long as the minimum population targets are met our osprey should be able to replace themselves, maintaining a healthy resilient population. This charismatic species has adapted well to the modern Pennsylvania landscape and is appreciated and supported by the citizenry of the state. So, there should be excellent potential for the species to continue its successful increase in population through its own abilities to sustain a population and colonize new areas as well as the generous public support for expansion that it enjoys and is fostered by our agency.

If the overall population drops below 50 nesting pairs or there are less than 4 clusters with 10 or more nests the Game Commission should take immediate protective action listing osprey as endangered.

Objective 1.1. Monitor statewide osprey populations every 3 years until populations are recovered.

Comprehensive Pennsylvania Game Commission nesting osprey surveys were conducted in 2010, and 2013. Monitoring the number of nests will be continued by the Pennsylvania Game Commission, and will incorporate observations from agency staff, other governmental organizations, non-governmental organizations, academic institutions and private citizens. Surveys need to be performed regularly and observed nesting activity documented in annual reports (Fetterman and Barber 2014). Growth of the osprey nesting population has made comprehensive monitoring more challenging to complete with limited staff. The participation of volunteers makes the surveys possible with support from staff and minimal expense to the agency (Fig. 2). Since this species has the tendency to nest semi-colonially, future monitoring could be accomplished through a sub-sampling approach to ensure its continued success with reasonable sampling effort.

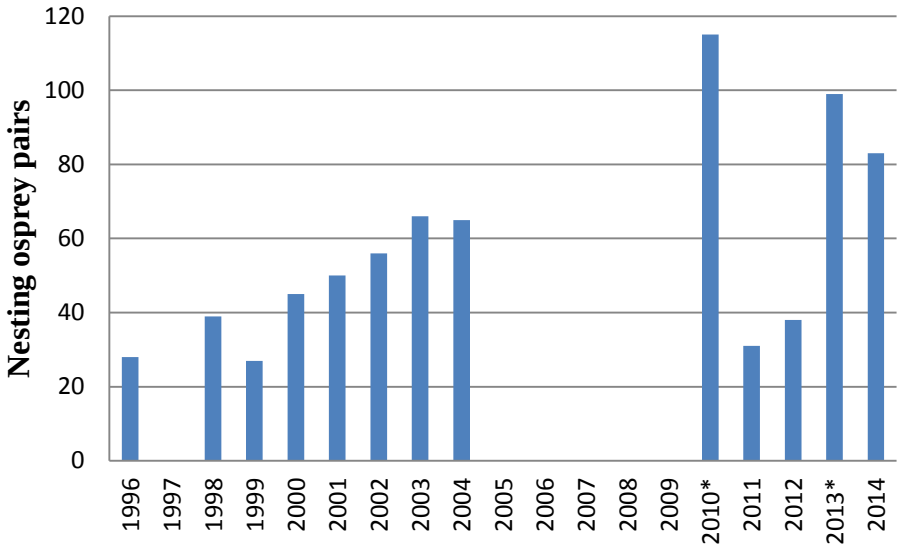

Figure 2. Nesting osprey pairs reported by year. * PGC comprehensive surveys were conducted 2010 and 2013. Observations were opportunistically collected from volunteer reports other years. Pennsylvania's second breeding bird atlas was under way2005 thru 2009; those data can't be added to the data in this table, but support good nesting numbers.

Strategies

1.1.1. Maintain a list of active nests.

Known nest locations are tracked to ensure protection and monitored for productivity and persistence. Because ospreys and their nests are readily identifiable and highly conspicuous, the birding public provides much of the data on observed nests, thus it is important that reports of osprey nests be submitted to the Pennsylvania Game Commission's Bureau of Wildlife Management and evaluated. Reporting nests is easily accomplished on the agency's website.

1.1.2. Conduct statewide nesting surveys on a 3 year schedule.

Comprehensive monitoring efforts will be implemented at 3-year intervals to detect population changes. The first survey toward possible delisting would occur in 2016 and the second in 2019. Osprey nest reports will be solicited by the Pennsylvania Game Commission's Bureau of Wildlife Management and evaluated. Surveys will be performed regularly and observed nesting activity summarized in annual reports. Surveys should collect basic information to facilitate population monitoring, with an emphasis on ground-based determination of the number of nests and nestlings and be both comprehensive and systematic. Additional monitoring may continue as time and resources permit.

Objective 1.2. <u>Delist osprey, changing status from threatened to protected, when at least 10 nesting pairs are found in each of 4 watersheds and at least 50 total nesting pairs are documented in 2 consecutive comprehensive surveys.</u>

Strategies

1.2.1. Work with conservation partners to ensure Pennsylvania legal designation accurately reflects current osprey population status.

Collaborate with the Ornithological Technical Committee (OTC) of the Pennsylvania Biological Survey and solicit internal PGC comments regarding delisting osprey.

1.2.2. Prepare official documentation of osprey status as secure and advance a proposal for agency staff review, followed by submission of a 58 Pa. Code regulations amendment for consideration to the Board of Commissioners.

The Bureau of Wildlife Management will work with the Bureau of Wildlife Protection and the Executive office staff to accomplish this status change.

1.2.3. Update existing environmental review documents following delisting.

Current Environmental Review documents are the basis of the post delisting osprey best management practices (BMPs).

GOAL 2. Protect and promote osprey and their habitat.

Human structures (utility poles, cell towers, large electric towers, buoys, etc.) are readily used making up 50% of occupied nesting sites in the northeastern United States (Poole 1989) and over 90% of sites used in Pennsylvania. Nest sites may be up to 3-4 km from foraging areas and individuals regularly forage to a distance of 14 km from their nests (Hagan 1986). Originally, tall, isolated trees were typically used for nesting. Dead trees in open areas, standing water or on islands were preferred. Ospreys are opportunistic in site selection and will nest on stumps, cliffs, the ground, and a variety of other locations (Poole et al. 2002).

In Pennsylvania, almost all nest sites are close to water, either on structures in standing water, on islands, or overlooking a significant water body. Many sites are associated with impounded small lakes and reservoirs where the species was restored, while relatively few are found along Pennsylvania's major rivers including the Delaware and Susquehanna except impoundments on the Lower Susquehanna. Some nests seem associated with multiple aquatic foraging areas. Both artificial and natural sites are used, including telephone poles, large power line transmission towers, cell towers, live trees, and snags.

After delisting, most of the Game Commission's effort promoting osprey and their habitat will be in the form of BMPs and other guidance documents. All of which will be available on the agency's web site. Interest and use of BMPs will be measured based on individuals accessing the appropriate pages, a process we are already in use demonstrating the public's interest in topics.

Objective 2.1. Protect the breeding osprey population.

Strategies

2.1.1. Provide Best Management Practices (BMPs) for nesting osprey.

After upgrading from threatened to protected, as implied, osprey will continue to be protected in Pennsylvania by the Migratory Bird Treaty Act. An Environmental Review guidance document now directs protections for ospreys from disturbances while they are nesting (Pennsylvania Game Commission 2012). This document and approach would be replaced by voluntary Best Management Practices for avoiding disturbance of active nests after the species is delisted. Currently, seasonal restrictions, 25 March to 31 July, minimize disturbance around active nests and avoid activities that may result in nest failure or abandonment within an 800 foot buffer around active nests (Pennsylvania Game Commission 2012). Activities that may impact nesting osprey include but are not limited to general construction, blasting, quarrying, timbering, road work, pipeline construction, in-stream activities, recreation, pest control, oil, gas, and mineral development and the general use of heavy industrial vehicles associated with many of these activities. The owners of towers that support osprey nests can plan for the protection of these charismatic birds and benefit from good public relations that this protection would enable.

Osprey nests on human structures represent special circumstances. If removal of a nest is necessary, the company requesting the removal of a nest on a human-made structure should demonstrate a need for nest removal either for maintenance, tower removal, human safety issues, or to protect the birds from potential mortality. Any nest removal should follow Pennsylvania Game Commission (PGC) BMPs and be outside the nesting season, between 1 August and 25 March (Pennsylvania Game Commission 2012). Normally, nests are removed with the understanding that osprey will likely rebuild the nest in the same location in the coming nesting season. If the nest is in an inappropriate location, PGC recommends providing a replacement nesting structure (Olendorf et al. 1981, Austin-Smith and Rhodenizer 1983). To improve chances of success, new sites need to be more attractive to the ospreys than the original. A site higher than the original

nest has the best chance of success. If deterrence methods are warranted, three-dimensional cones, pinwheels and PVC piping are recommended (Henny et al. 2005). Two-dimensional perch guards, plastic owl effigies and metal bird spikes are ineffective.

2.1.2. Encourage provision and maintenance of nesting structures in areas with nesting osprey or habitat that could support nesting osprey.

Directions for the construction (Appendix A), placement and maintenance of artificial nesting structures will be available on the agency website to encourage the public to erect nesting structures in areas with the highest potential for use. Guidance will include regular platform maintenance and encouragement for owners to repair and replace platforms as needed.

2.1.3. Provide guidance to reduce electrocution threats to osprey nests on transmission towers.

Owners of towers supporting nesting osprey will be encouraged to incorporate safe and attractive sites for nest establishment to ensure nesting success and proactively prevent maintenance issues that may arise from nesting activity. Power line towers/poles with nests should either be designed or retrofitted to prevent electrocutions according to Avian Protection Plan Guidelines (Edison Electric Institute and USFWS 2005, Appendix B).

2.1.4. Publicly acknowledge individuals and organizations that follow BMPs and improve the outlook for osprey.

As the osprey population grows it will be increasingly important for organizations and individuals to embrace the basic needs of osprey and incorporate them into their regular operations. PGC should publicly recognize those that adjust their activities to coexist with osprey to: (1) thank them publicly; (2) encourage more voluntary participation and (3) show that the efforts to accommodate osprey are valuable and appreciated.

Objective 2.2. Prosecute illegal killing and harassment of osprey.

Although osprey are relatively tolerant of humans and often nest near heavy industrial activity, human disturbance at nest sites may result in the loss of a breeding season or

permanent loss of a nesting location. There may be reduced reproductive success associated with disturbed sites (Poole 1989). The level of tolerance is dependent on the timing, frequency and severity of disturbance as well as a pair's degree of habituation to human activity (Poole 1981). Nests are vulnerable throughout the entire nesting season, but disturbance early in the nesting process is most likely to lead to abandonment.

Strategies

2.2.1. Make public the prosecution of illegal killing and harassment of osprey through a variety of media including digital and print.

Protection of osprey populations is essential to continued restoration and population expansion. Led by the Bureau of Wildlife Protection, all illegal osprey take should be prosecuted to the full extent of the law.

2.2.2. Publicly acknowledge the effort of PGC staff and those who assist the agency in identifying individuals who harm osprey and stop associated illegal activities.

Protecting osprey requires not only a well trained professional staff, but also the active participation of the public. PGC should recognize staff and the public that helps ensure osprey are safe and able to nest without disturbance, showing that the agency values these birds and the help of those that protect them.

GOAL 3. Engage in public outreach to improve understanding and appreciation of osprey.

After delisting, most of the Game Commission's effort to improve the public's understanding and appreciation will be available digitally on the agency's web site. Interest and use of educational materials will be measured based on individuals accessing the information on the corresponding pages, a process we are already using to demonstrate the public's interest in various topics.

Objective 3.1. Instill the importance of osprey conservation in the general public.

Strategies

3.1.1. Provide the public with the history of conservation efforts for osprey through a variety of media including digital and print.

The reestablishment of osprey to Pennsylvania was a pioneering effort in many respects and set the stage for restoration of other raptors and mammals within the state. It served as an example that was emulated, not just in Pennsylvania, but in other states as well. This information would enhance a brief summary of the conservation history of the species already available through the Pennsylvania Game Commission website currently placed in the Threatened and Endangered Species section.

3.1.2. Provide the public with natural history, biological, and habitat information on osprey through a variety of media including digital and print.

Since osprey responded very favorably to management practices, it serves well as an example of responsible bird conservation. A continuing public education campaign is necessary to inform the public of the osprey's natural history, ecology and usefulness as a bio-indicator, and to supplement existing general natural history information for this species already available through the Pennsylvania Game Commission website currently in the Threatened and Endangered Species section. Future educational materials would be provided elsewhere on the website, probably in the "Birding and Bird Conservation" or equivalent section. Such information is easily accessed by the public at minimal cost to the agency. An engaged and educated public will support voluntary protection of the osprey and its habitat.

3.1.3. Distribute conservation-oriented educational materials and programming at state wildlife-related activities venues and popular viewing locations.

Pennsylvania has a large number of outdoor recreation and wildlife-oriented programs, festivals and expositions. Since many events are announced electronically, there are opportunities to provide educational information as part of the announcement. Since ospreys are associated with aquatic resources, there will be educational opportunities

associated with the Pennsylvania Fish and Boat Commission and the Department of Conservation of Natural Resources; especially at boat launches and state parks with impoundments.

3.1.4. Provide information to the public about viewing opportunities in the state and encourage the public to watch ospreys and contribute to monitoring this flagship species and other species that live in the same habitat.

Developing pages for the agency website about osprey-watching, which should include instructions on how to watch nests without disturbing them, will accomplish this strategy. The agency's social media and other outlets will be employed to engage and educate the public. Some observation opportunities exist on public lands including state game lands, state parks, and public fishing areas where education can take place. Emphasis will be placed on locations where nests and perched and feeding birds can be easily observed and parking is free and accessible.

Objective 3.2. <u>Develop osprey specific classroom educational materials to teach about water quality, watershed health, environmental contaminants, and conservation.</u>

The osprey program and subsequent population growth could be developed for classroom instruction. Information derived from the restoration programs could be used in a variety of classes including biology, geography, chemistry, mathematics and civics classes.

Strategies

3.2.1. Meet state-mandated educational goals and standard practices for appropriate grade levels.

In today's structured classrooms, educational materials have to fit into existing lesson plans and curricula in order to be used by teachers. Bureau of Information and Education staff have the skills and experience to determine the most effective way to use information about the osprey program and subsequent successful population expansion in classrooms. Information derived from the restoration, monitoring and history could be used in a variety of classes including civics, biology, geography, chemistry and

mathematics classes.

3.2.2. Provide classroom materials in an easily accessible digital format

Adding class room materials to the website will make them easily accessible to all interested instructors and clearly identifying how the materials meet state mandated educational goals/standard practices will facilitate their use. Providing materials in this format makes them easily available to a very large part of the public very economically and efficiently for the agency.

SECTION II: OSPREY BACKGROUND AND SUPPLEMENTAL INFORMATION

Life History

The osprey is the only raptor that feeds exclusively on fish and has been known as the "fish hawk" or "fishing eagle" (Poole et al. 2002). In reality, it is neither a hawk nor an eagle but the only member of its family, the *Pandionidae* (Lenner and Mindell 2005, Chesser et al. 2010). It is a distinctly marked, well-known bird. Nearly extirpated from many parts of its range by human impacts (primarily DDT/DDE accumulation), it is now regularly exploiting human made structures and waterways for nesting and foraging in many areas, including Pennsylvania. Osprey have been the focus of considerable conservation attention in Pennsylvania. Pioneering hacking efforts by Larry Rymon and Charles Schaadt of East Stroudsburg University of Pennsylvania were responsible for reintroducing the species to the state. As a result, ospreys are increasingly common on the state's waterways and serve as a symbol of a highly successful, cooperative conservation effort and improving habitat quality within the state.

Taxonomy

The osprey is a monotypic species, with a nearly cosmopolitan distribution being found on all continents except Antarctica (Poole et al. 2002). North American populations are a distinct sub-species, *Pandion haliaetus carolinensis*.

Physical Description of Species

In all plumages, the osprey is dark brown above, white below, with a white head and prominent dark eye stripe. Osprey are fairly large raptors (1,400 to 2,000 grams), making them even larger than red-tailed hawks, but much smaller than bald eagles (Poole et al. 2002). Males and females are virtually indistinguishable although females are typically 25% larger with darker and more plentiful streaking on their belly band (Poole et al. 2002). Juveniles are similarly marked, but their plumage is fringed with pale buff on the feather edges (Dunn and Alderfer 2011). In flight, the head appears small in comparison to the overall size of the bird and the distinct "W" wing shape, characterized by a crook or bend in the wing at the carpal joint, is diagnostic (Poole et al. 2002). It might be confused with the bald eagle which is even larger than the osprey, has a larger head, and flies on flat wings. Some large gulls might also be confused with ospreys since they are large, mostly white, and have crooked wings in flight.

Feeding Ecology

Ospreys feed almost exclusively on fish, which comprises 99% of prey items recorded in nearly every published account and are usually taken from the surface or in shallow water (Poole et al. 2002). A survey across North America indicated over 80 species of fish taken but often 2-3 species dominate in a particular area (Bent 1937, Vana-Miller 1987, Palmer 1988, Poole 1989). The osprey's vast range and broad piscivorous diet make preferences difficult to summarize but see Poole (1989) for details. Fish are mostly caught during the breeding season in flight rather than from perches, the latter perhaps being a more common tactic on their wintering grounds (Poole 1989, Steeger et al. 1992). Fish captured generally weigh 150–300 g (range = 50 g–1.2 kg) and measure approximately 25-35 cm in length (Cramp and Simmons 1980, Prevost 1982). Fish up to four pounds (~2 kg) are sometimes taken (Brown and Amadon 1968). Swenson (1979) reported foraging efficiency ranging from 19-69% across 13 studies. The most common prey species of fish at the initial hacking locations in the Poconos were suckers (*Castostomus* spp.), carp (*Cyprinus carpio*), catfish (*Ictalurus* spp.), and members of the sunfish family *Centrarcidae* (Rymon 1989).

Although our most strictly piscivorous raptor, ospreys are somewhat flexible in their foraging habits. Ospreys catch fish near the water surface, only being able to dive about a meter or less, thus limiting their foraging opportunities and prey selection to those species most likely to be found near the water surface (Poole et al. 2002). Ospreys use different dive approaches for different kinds of fish. Their foraging efficiency is reduced where there is thick emergent and submerged vegetation, so reservoirs and other open water bodies often provide the best opportunities for hunting (Poole et al. 2002). Ospreys have been observed, albeit rarely, foraging on dead fish (Dunstan 1974, Poole 1984) and other carrion (white-tailed deer, opossum; Dusi 1995). They have also been seen feeding on live prey other than fish, including mammals (vole, squirrel, muskrat), birds (crow, black-crowned night-heron, mallard, wood duck), reptiles (turtle, snake, alligator) and amphibians (salamander, frog) (Wiley and Lohrer 1973, Poole 1989, Poole et al. 2002). An individual has even been seen dropping conchs onto a cement-filled steel drum near the Red Sea (Leshem 1984).

Breeding Biology and Phenology

Like other fish-eating birds, only nest sites are defended; feeding sites are left unprotected (Poole et al. 2002). Ospreys typically arrive on breeding areas in Mid-Atlantic States from mid- to late-

March into early April. First-time breeders may arrive as late as mid-May and can continue to look for nest sites even later in the season (Poole 1984). The males usually select a nest site before the females arrive. Ospreys readily accept artificial nest sites including duck blinds, channel markers, power poles and towers, cell towers, and platforms specifically designed to attract them. Nest height at natural sites range from ground level to tree sites 15-18 m tall (Wetmore and Gillespie 1976). Generally, 90% of nest sites are located with 1 km of water but ospreys have been known to select sites 10-20 km from water depending upon site quality and foraging opportunities (Greene et al. 1983, Hagan and Walters 1990, Ewins 1997). Osprey nests can be clustered and dense clusters of nests can be considered colonies (Hagan 1984, Poole 1989, Hagan and Walter 1990). In this way, ospreys have a fundamentally different nest dispersion pattern than the fish-eating bald eagle (*Haliaetus leucocephalus*), which tends to have more distinct nesting and foraging territories and wide spacing between nests throughout its range including Pennsylvania (Buehler 2000, Gross and Brauning 2011). Bald eagles also favor natural support structures for nesting in Pennsylvania rather than artificial structures. Some osprey clusters are associated with dams where there is a locally high availability of prey, perch points, and potential nest-support structures so co-existence of these species is more likely at these locations.

Egg laying is initiated 10-30 days after arrival on territory, normally during April, and 1-3 days after the nest lining is added (Poole 1984, 1989). Clutches are replaced when lost early during incubation (1-3 weeks). Incubation is by both parents but females do the majority of it (70% of daylight hours vs. 30% for males in California; Levenson 1979). Incubation takes an average of 39 days.

In southern New England, fledging occurs in 50-55 days (Poole 1989). Young can be sexed by weight at 30 days or older, females are typically 25% larger than males. Fledged young are dependent on adults and stay near their nests for at least 20 days with adults supplementing fish caught by fledglings (Stinson 1977, Poole 1984). Fishing behavior appears to be innate (Schaadt and Rymon 1982). Ospreys begin dispersing from breeding territories in August (Bednarz et al. 1990). Migration is complete with peak migration in Pennsylvania occurring during mid- and late-September (Goodrich and Smith 2008).

Population Status

The Americas

Osprey are found from Labrador west to boreal Alaskan lakes, south on both coasts to Mexico and Florida (Prevost 1983) and inland across the entire continent where distribution is clustered around suitable lakes, reservoirs and rivers. The total estimated worldwide population has varied from 25-30 thousand pairs to 460,000 individuals (Poole 1989, Birdlife International 2013), but most recently estimated at 500,000 (Partners in Flight Science Committee 2013). In 2001, only 4 states (Oklahoma, North Dakota, Nebraska and Kansas) had no known breeding individuals. The Chesapeake Bay is an important population center of osprey along the east coast of North America with 3,500 breeding pairs estimated in 1995–96 (Poole et al. 2002). This population may be even higher today.

Increasing numbers of osprey winter at scattered locations across the continent from southern Canada southward to the Gulf Coast (Poole 1989). Most northern individuals travel to the tropics from Mexico and the Caribbean southward to the equator in South America. Two U.S. Fish and Wildlife bands from wintering or migrating individuals from Peru and Aruba (banded 23 June 1994, reported from Oranjestad, Aruba on 13 March 2005), originally placed on Pennsylvania birds banded by Larry Rymon, have been returned to East Stroudsburg University (T. Master, pers. comm.). These bands demonstrate a tangible link for osprey between Pennsylvania, the Caribbean and South America. Protection is lacking for ospreys in several countries where they migrate or over-winter (Poole 1989) with many of the mortalities resulting from shooting in Central or South America as indicated from U.S. banding data (Poole and Agler 1987).

Pennsylvania Historical Patterns

The osprey was never a common or widespread nesting species in Pennsylvania. Prior to the 1980 effort, summer birds were reported from 15 of the state's 67 counties including Beaver, Berks, Bradford, Bucks, Chester, Clarion, Dauphin, Delaware, Lehigh, Lancaster, Northampton, Perry, Susquehanna, Wyoming, and York counties (Warren 1890, Stone 1894, Poole 1964, Wood 1979). Given the propensity of this species (presumably sub-adults) to disperse during the summer into areas where nesting has never been documented, this list of counties is not considered the nesting range. Early authors confirmed nesting activity only in Beaver, Bucks, Clarion and Delaware counties (McWilliams and Brauning 2000). Most of these counties were confirmed by single nesting events further emphasizing the rarity of the species as a breeding bird in the state. The last confirmed historic nesting occurred in 1935 (Poole 1964). A pair did

attempt to nest on a utility pole in 1980 near Girard, Erie County (Stull et al. 1985). Clearly, Pennsylvania's historic osprey population was small, scattered, and intermittent. In 1982, the Pennsylvania Biological Survey officially designated the osprey an extirpated species (Gill 1985). Shooting, egg-collecting, habitat degradation, poisoning, and nest-disturbance are among the factors that may have contributed to decline in osprey numbers (Poole et al. 2002).

Osprey numbers also declined severely across all of North America during the 1960s and 1970s. The coastal region from Cape Cod, Massachusetts southward to Cape May, New Jersey experienced a decline from approximately 1,000 pairs to <200 pairs from 1900 to 1970 (Houghton and Rymon 1997). The primary culprit is believed to have been DDT. However, the Committee on Pennsylvania Birds of Special Concern noted that "the Osprey had already vanished from Pennsylvania before these pesticides were developed" (Gill 1985). Osprey continued to persist along the Mid-Atlantic coast through the 1970s, especially on Chesapeake Bay, although this region was severely impacted by DDT also (Spitzer 1989). Following lows in the mid-1970s, osprey populations began natural recoveries in these states. The ban on DDT, hacking programs, increasing use of artificial nesting structures and successful use of reservoirs as nesting sites all contributed to osprey population increases (Spitzer 1989, Poole et al. 2002). There is a similar pattern of decline, hacking, and recovery in the inland parts of New York (Nye 2008).

Despite declines, osprey seemed to have the potential for population recovery in Pennsylvania and many parts of its historical range in the United States. The tendency for ospreys to be tolerant of many non-interfering human activities such as boating allows for recovery in many locations despite the presence of humans in osprey nesting and foraging habitat (Poole et al. 2002). Ospreys habituate easily to human activities nearby and often nest on human-made structures.

Pennsylvania Population Recovery

A breeding population of ospreys was reestablished in Pennsylvania through a translocation technique known as hacking, used initially in 1975 by Professor Tom Cade and associates at Cornell University for reintroducing Peregrine Falcons (Cade and Temple 1977, Barclay and Cade 1983). The osprey hacking program was pioneered in 1980 by Dr. Larry Rymon and Charles Schaadt, then at East Stroudsburg University of Pennsylvania, and supported in part by

the Wild Resource Conservation Fund and the Pennsylvania Audubon Society. Birds obtained from Chesapeake Bay were hacked at several lakes, bogs and reservoirs in the Poconos including Penn Forest Reservoir, Wild Creek Reservoir, Long Pond, Pocono Lake, and at the General Public Utilities power plant along the Delaware River at Portland, Pennsylvania (Rymon 1989). One hundred ten birds were raised in the Poconos from 1980-1989. Ospreys were subsequently hacked in 2 other areas in Pennsylvania, following the model developed by Rymon. Sixty birds were released at Tioga-Hammond Reservoir, from 1990-1994, and 95 at Moraine State Park from 1993-1996 (McWilliams and Brauning 2000). Birds later returned to each of these areas as adults (Figs. 1 and 2).

As a direct result of successful translocation efforts, the first nesting attempt by released birds occurred in 1985 and the osprey was reclassified from extirpated to endangered. The first successful nesting was in Monroe County in 1986. Individuals released in the hacking program provided a source of birds that returned to natal (hacked) areas and by 1987 6 fledglings were raised by 8 nesting pairs established in the Poconos (Rymon 1989). Osprey also nested within several years of the original hacking effort at the Tioga-Hammond Reservoir in 1994 and Moraine State Park in 1996 (McWilliams and Brauning 2000). Thus, birds released by the hacking programs were typically found nesting in close proximity to their natal hacking towers 3-4 years following translocation. Subsequent pairs have since occupied a growing radius around translocation sites. Thus, most current clusters of nesting ospreys reflect these translocations.

Ospreys naturally expanded north along the Susquehanna River from the growing Chesapeake Bay population as translocated birds returned to the Poconos. The first nesting in the Susquehanna River basin was in 1987. Three pairs nested in Lancaster County along the lower reaches of the river in 1990. In 1990, for the first time this century, an osprey nest was reported in western Pennsylvania at Cranberry Glades Lake, in Somerset County. One of the birds in this nesting pair was released as part of a reintroduction program in West Virginia (Buckelew and Hall 1994). However, since ospreys do not readily colonize locations more than 50 km from their natal area, there has not been colonization of several bodies of water in Pennsylvania and other Northeastern states (Poole et al. 2002, Nye 2008, Brauning 2012).

The presence of non-breeding individuals complicates the ongoing assessment of nesting activity in the state. During the first Pennsylvania breeding bird atlas (1983-89), summer sightings came

from 34 counties (Rymon 1992). Most of these sites were not believed to represent breeding pairs, but were likely non-breeding 3-year olds and unmated adults taking up residence in an area without nesting. These summer observations foreshadowed a wider nesting recovery including several counties.

The nesting osprey population expanded dramatically during the 1990s from core areas centered on the hacking sites described above. A high degree of natal fidelity brought birds back to the vicinity of hack sites resulting in the population expanding concentrically farther and farther from original hack sites. In the Poconos, this expansion extended south along the Delaware River into Northampton County and north to lakes in Pike County. In response to the growing population, the Pennsylvania Game Commission upgraded the osprey from endangered to threatened in 1999 on the advice of the Ornithological Technical Committee (Brauning 1999).

Current Pennsylvania Status

By the end of the Twentieth Century, the osprey had become thoroughly established as a nesting species across Pennsylvania. The total population was estimated to be greater than 45 pairs in 2000 (Brauning 2001) nesting in 17 counties, (Bucks, Butler, Carbon, Clearfield, Fayette, Lancaster, Luzerne, McKean, Mercer, Monroe, Northampton, Philadelphia, Pike, Somerset, Tioga, Wayne, and Westmoreland) including all 6 Pennsylvania Game Commission regions. Birds colonized McKean County in 2000, probably from reintroduction efforts in New York State. In 2000, more than 60 fledglings were produced, an average of 1.8 young per nest. Agency osprey surveys tracked a steady increase in osprey pairs from 27 in 1996 to 56 in 2002 (Siefkin and Brauning 2003). Additional releases were conducted at Raystown Lake (14 birds) from 2003-2005 and at Prince Gallitzin State Park (11 birds) in 2007 but those efforts had not resulted in local nesting as of 2012. During the second Pennsylvania breeding bird atlas (2004-2008), osprey were found breeding in 27 counties and the number of atlas blocks occupied by breeding pairs increased tenfold from 9 to 90 when compared to the first atlas (1983-1989, Figs. 3 and 4). In 2010, 115 nests were documented in 21 counties and that number has continued to increase (Haffner and Gross 2011). These recently reported results contrast with the fewer number of counties (15) where osprey were reported historically. Of the nests located in 2010, 4 counties accounted for 66% of the nests which demonstrates the tendency for this species to cluster its nests. In that 2010 study, it was found that 57% of the known nests were associated with reservoirs with many others associated with dammed portions of rivers (Haffner and Gross 2011). Approximately 90% of the nests were built on artificial structures, demonstrating the

osprey's opportunistic tendencies to not only tolerate humans but take advantage of human-made structures.

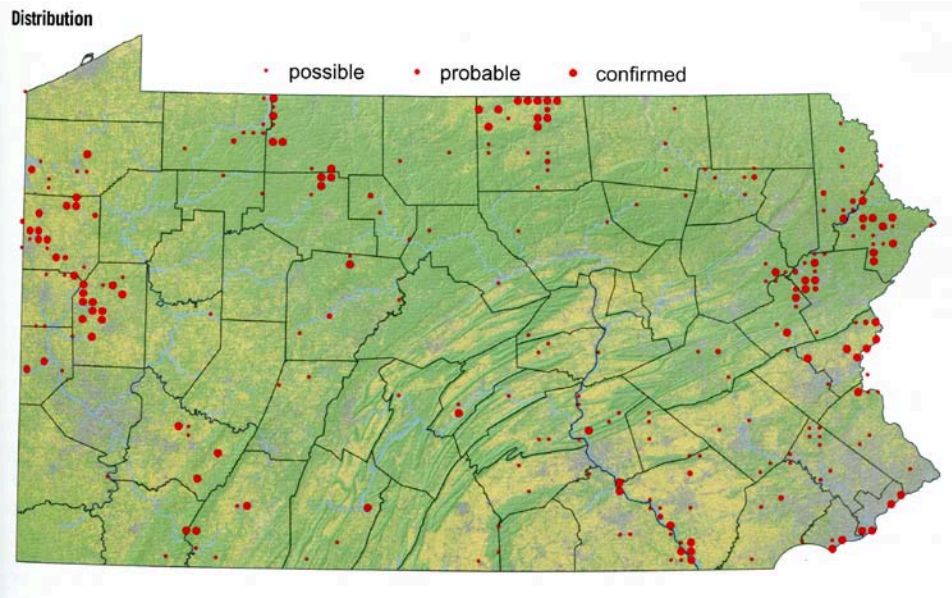

Figure 3. Osprey detections during the second Pennsylvania breeding bird atlas (2004-2008). (Courtesy, Second Atlas of Breeding Birds in Pennsylvania)

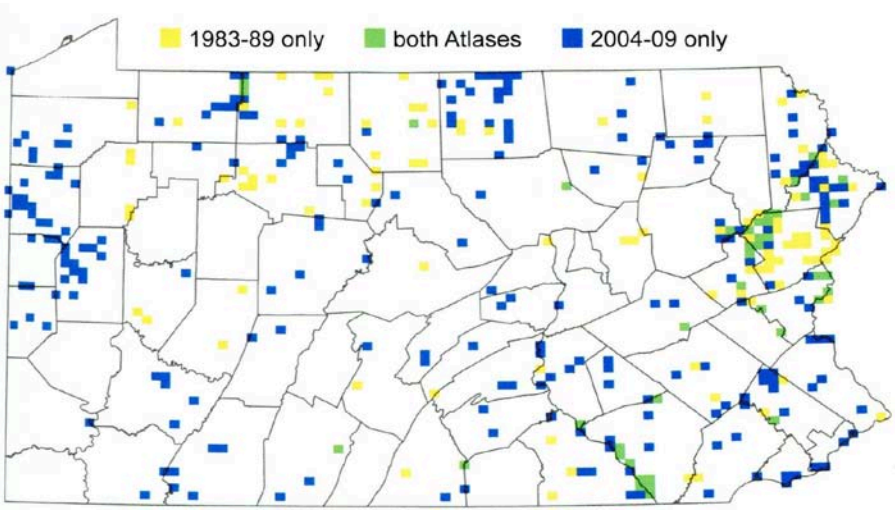

Figure 4. Distributional changes between the first (1983-1989) and second (2004-2008) Pennsylvania breeding bird atlases. (Courtesy, Second Atlas of Breeding Birds in Pennsylvania)

Although the nesting population is still highly clustered around past hacking areas and impoundments, the expansion documented during the second breeding bird atlas has considerably broadened the range of the osprey across the state and is very encouraging (Brauning 2012). The future of this species in the state is certainly entangled with the many human-made bodies of water and human-made structures where it nests and conflicts are most

likely. Since the osprey not only tolerates but thrives in areas of human activity where aquatic resources are abundant, the future looks very bright in Pennsylvania.

Threats and Limiting Factors

Historical Perspective

The traditional explanation for the decline of the osprey in the northeastern United States is pesticide contamination, specifically organochlorine interference with reproductive success (Poole 1989). Because the osprey decline began before the use of those pesticides, the precise cause of the decline in Pennsylvania is not clear (Gill 1985). The primary historic threats to the osprey were environmental contaminants and shooting followed by other general types of human disturbance; water quality degradation and habitat loss. To a great extent, the 2 primary factors, and water quality issues, have been largely ameliorated, allowing an osprey recovery.

With the loss of a breeding population in the state, natural reestablishment of nesting pairs was hampered by relatively slow dispersal and colonization rates (Poole 1989, Rymon 1989). Although individuals were observed in summer months for many years, nesting was not confirmed until 1986. Despite their long migration pattern and excellent mobility, ospreys do not tend to colonize locations more than 50 km from their natal area (Poole et al. 2002). This limits their ability and tendency to colonize new areas. Additional ongoing, emerging and potential threats include nest loss and individual deaths associated with nesting on power lines and cell towers, energy extraction (principally Marcellus Shale) development activities, climate change and competitive conflicts with an increasing bald eagle population, respectively.

Environmental Contaminants

The decline of several raptor species has been attributed to environmental contamination by synthetic chemicals, primarily DDT and especially its derivative, DDE. (Spitzer et al. 1978, Steidl et al. 1991). The population inhabiting the Atlantic Coast from Massachusetts to New Jersey suffered most, declining to 10% of pre–DDT levels (Spitzer 1980). Although DDT use has been banned in the United States since 1973, ospreys are still vulnerable to contamination by this and other toxins due to their migratory habits and contaminant residue that remains in the environment. Hotspots of DDE contamination still exist in the United States in areas that were heavily industrialized and those with intensive agricultural activity (Elliot et al. 1994). Constant dredging of shipping channels in Delaware Bay may account for high levels of DDE and other organochlorines found in New Jersey ospreys that were deposited originally from nearby

agricultural areas (Steidl et al. 1991). Residual pesticide levels were documented in an osprey egg recovered in Pennsylvania (Rymon, pers.com.), supporting continued concern. DDT and other dangerous chemicals are still routinely used in Latin American countries where ospreys migrate and winter. Of primary concern in this regard are juveniles that spend 18-20 months on their wintering grounds in the Caribbean, Central America, and South America before returning to North America to breed (Poole 1989).

Additional toxic chemicals reported from osprey eggs include polychlorinated biphenyls (PCBs), heptachlor, dioxin, dieldrin, chlordanes, lead and mercury (Nobel et al. 1993, Elliot et al. 2000, 2001). None of these substances have been implicated in reproductive declines. In New York, reproductive success increased as DDE levels dropped in spite of continuing high levels of PCBs and mercury in eggs (Spitzer et al. 1978).

At present, reproductive success does not appear to be affected in populations in Pennsylvania and neighboring states as sufficient young are being produced to maintain and even expand population levels. If evidence of such contamination is found, it should be investigated immediately. Eggs provide information on contaminants accumulated throughout the adult life cycle while juvenile feathers provide information on local contaminants (Hughes et al. 1997).

Shooting

Raptors in general have long been targets of reckless gunners. Because of their perceived competition for harvestable fish resources, ospreys were frequent targets but probably less so than other diurnal raptors (Poole et al. 2002). Shooting apparently was not as severe in North America as it was in Europe (Poole 1989), but may have nevertheless hastened the decline of already diminishing populations. Shooting pressure in the United States has certainly subsided since the signing of the Migratory Bird Treaty Act and subsequent public enlightenment and improving attitudes towards raptors in general. Some shooting pressure is inevitable during migration and in wintering areas of Central and South America where subsistence hunting is carried out or a strong prejudice remains against birds of prey, including fish-eating species that may be perceived as competitors for fish resources or hatchery pests. Of 451 osprey returns to the U.S. Fish and Wildlife Service Bird Banding Laboratory, 30% were shot and 93% of those were shot on the wintering grounds in the tropics (Poole and Agler 1987). Poole (1989) believes that shooting pressure on breeding grounds would have more effect than during migration or in

the wintering areas. The historically sparse population in Pennsylvania was very vulnerable to shooting of breeding birds. If 1 member of a pair is shot, it is likely that the nest site will be abandoned completely. Since pairs are typically widely scattered, the site will not likely be recolonized quickly. The young from the previous 2 years, if they survive, may return to the area but may not meet a suitable partner. As a result, the survivability of isolated nest sites is probably very low if a breeding adult is lost. Shooting remains a potential problem at fish hatcheries where the osprey and other piscivorous birds come into direct conflict with humans for fish resources (Parkhurst et al. 1987). Alternatives to shooting that reduce this potential conflict have been developed and deployed at most Pennsylvania hatcheries.

Perceived competition with anglers created an antagonistic relationship with selected segments of the fishing community, especially aquaculturists. Osprey were shot relentlessly at fish hatcheries prior to implementation of the Migratory Bird Treaty Act and may still suffer depredation on rare occasions although most aquaculture facilities now have at least some mitigation measures in place. Public fish hatcheries have installed devices that limit access of piscivorous birds to their fish stocks, and others should if they haven't already done so. These include proper fish management (e.g., place vulnerable size classes near human activity) and exclusion (caging), impediment (wire mesh, metal spines) and frightening (noise, chemical, light and water sprays) strategies. It is suggested that using more than 1 of these measures provides the best protection (Pennsylvania State University Extension Service 2014).

Water Quality

Water quality and its influence on fish availability are an important ecological consideration for osprey conservation. If ospreys are dependent on a relatively few fish species (2-3 species generally, see Feeding Ecology section above) and limited foraging areas (as may be the case in some isolated nest sites in Pennsylvania), they will be vulnerable to changes in abundance and availability of their food supply resulting from water pollution. Conversely, an increase in the number of ponds and reservoirs has created a substantially increased number of potential foraging areas. In general, water pollution issues have largely subsided, and are now primarily limited to specific point source incidents and no longer a pervasive negative influence on the osprey population in Pennsylvania. However, vigilance is required given the magnitude and the potential influence of energy and community development on 1) water quality, 2) changes in stream buffer and water quality regulations, and 3) enforcement of regulations that might affect

resources important to osprey and other species dependent on water quality.

Ongoing, Emergent and Potential Threats

The problem of electrocution of raptors was first noticed in the early 1970's when an investigation of poisoning and shooting of eagles in Wyoming and other western states shed light on this problem (Olendorff et al. 1981). Poole and Agler (1987) reported that <4% of banded ospreys (*n* = 451) died from electrocution, collisions with power lines and towers and entanglements with fishing equipment. In the western United States only 11 electrocutions out of 555 reported from 1986-1996 were ospreys. Reports from Florida, Michigan, Idaho and France indicate that <10% of raptor mortalities from electrocution involve ospreys (Bayle 1999, Forrester and Spaulding 2003, State of Michigan 2005). To date, there are no known electrocutions of osprey in Pennsylvania. Nevertheless, it is important to be aware of the specific problems associated with electrical infrastructure and how to mitigate those in the presence of nesting ospreys. The primary problem is the spanning and subsequent touching of 2 live contacts or a live contact and an electrical ground simultaneously by the osprey's wings (Appendix B). Ospreys are particularly vulnerable to this threat in more urban environments.

Cell towers are increasingly used as nesting platforms by ospreys because of their abundance, height and the relative safety from predation that they provide. The towers themselves, unlike power poles and electrical towers, offer no threat to nesting birds but maintenance and upgrading activities can cause disturbance. Nests are protected when active by the Migratory Bird Treaty Act and state laws.

Hydraulic fracturing, or fracking, began in 1997 in Texas by Mitchell Energy (Chesapeake Bay Program Scientific and Technical Committee 2013). Pennsylvania's gas production from fracking has skyrocketed, rising 72% in a single year from 2011 to 2012. The state now ranks third in gas production in the United States and it is estimated that only 5% of potential shale development has occurred (State Impact NPR 2013, pers. comm., Ornithological Technical Committee of the Pennsylvania Biological Survey). Thus, fracking has the potential to affect specific nesting and foraging sites by virtue of the overall pervasiveness of industrial development, noise emitted from drilling, heavy truck traffic and compressing stations, siting of exposed waste water ponds and the potential for water pollution affecting feeding sites. Approximately 70% of fracking wells are located within 300 m of stream corridors in

Pennsylvania (Chesapeake Bay Program Scientific and Technical Committee 2013). Although streams are too small to accommodate osprey foraging activities, polluted stream water, runoff, increased sediment loads, erosion from access roads and leakage from wastewater retention ponds will ultimately impact water quality in downstream ponds, lakes, and larger rivers that osprey prefer as feeding sites. The nesting range of osprey overlaps considerably with the areas targeted for Marcellus Shale development. This threat to the integrity of osprey foraging sites is growing rapidly as Marcellus Shale development continues.

Although not generally assessed, the Institute for Bird Populations ranks the osprey as moderately vulnerable to climate change using the Climate Change Vulnerability Index (CCVI) from NatureServe (Siegel 2013). Bruno et al. (2012) suggests that osprey populations will increase as a result of climate change on the Cumberland Piedmont. An ongoing review of species status assessments for revision of Pennsylvania's Wildlife Action Plan using the Nature Serve Conservation Status Assessment Protocol (Faber-Langendoen et al. 2009) lists the "scope" of potential climate change effects on osprey as "pervasive", i.e., likely to influence the entire population if impacts do occur, and continuing into the future but of minimal severity. Potential detrimental effects are likely to manifest themselves with regard to the phenology of nesting activity and the effect of warming temperatures on aquatic environments and food supply. Osprey have recently been observed wintering on the southern Chesapeake Bay, in part because 1 of their major prey items, menhaden, *Brevoortia tyrannus*, are now also over-wintering (Pelton 2012).

It is inevitable that osprey interact with bald eagle to some extent, at least locally, given broad similarities in habitat and food preferences and increasing populations of both species in the state. Conversely, the comparative timing of nesting activities and the osprey's preference for nesting near human made structures minimizes conflicts between the 2 species, especially in the vicinity of nesting sites. Ogden (1977) studied interactions between the 2 species in southern Florida, and found a decline in osprey nest numbers on keys when eagles nested. Eagles defended relatively large territories, bringing them into conflict with osprey that defend only their immediate nest site. However, nest site tenacity and pair stability of both species dictated against future interactions after initial establishment of the eagle nests. Interactions while foraging are well known between the 2 species but since neither defends feeding territories such interactions are likely to have little effect on the breeding populations of both species. There are

only a few reports of bald eagles attacking osprey chicks or adults (Liston 1968, Flemming and Bancroft 1990). The higher tolerance by ospreys of human activities allows their persistence in areas where bald eagles may not be quite so tolerant of humans despite the aquatic resources available. Other potential species conflicts include predation of osprey nests by bald eagles and great horned owls (*Bubo virginianus*) (Poole et al. 2002, Nye 2008), and the increasing population of double-crested cormorants (*Phalocorax auritus*) which is expanding in the lower Susquehanna and Delaware River basins where ospreys nest (Ross 2012). Cormorants are a potential competitor for both food and nesting resources (Nye 2008).

Other threats include fishing line and plastic containers with which ospreys become entangled (Poole et al. 2002). This is a common threat to aquatic wildlife and public education about this threat is commonly given by fish and wildlife agencies and nonprofit organizations.

Protection, Recreation, Economic Impact and Public Interest

The osprey is currently threatened in Pennsylvania. Two other northeastern states, Ohio and New Jersey, currently list osprey as threatened while West Virginia lists the species with a conservation status of S2B (NatureServe 2015). It was never listed under the federal Endangered Species Act and it is, like all native migratory birds, protected under the Migratory Bird Treaty Act.

The well-documented sensitivity of osprey to environmental contamination makes this species a valuable bio-indicator. This is due in large part to their position at the apex of the aquatic food chain (Poole et al. 2002).

Nesting and migrating ospreys provide recreational opportunities to wildlife enthusiasts and the birding public across the Commonwealth. Although hard to quantify, the history of re-establishment coupled with the bird's size, visibility and spectacular hunting technique, make osprey an obvious attraction for visitors to nesting areas. Like the bald eagle, the osprey is a charismatic species that garners public support and is easily associated with stream habitat and water quality. Since the osprey has responded very favorably to management practices, it serves well as an example of responsible bird conservation. There is potential for continued support for recovery into new areas and voluntary protections and monitoring across the state.

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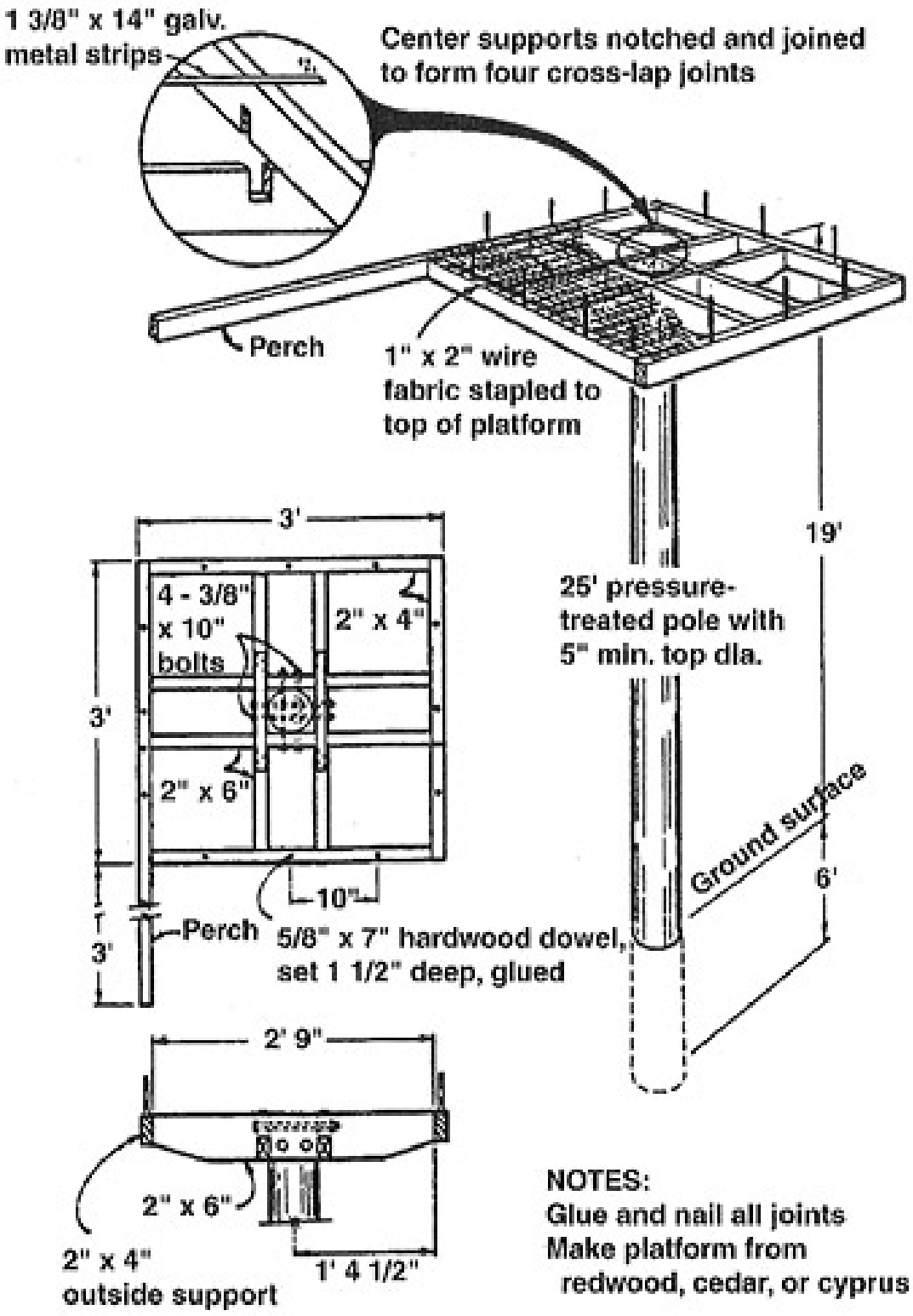
APPENDIX A. Pole mounted nest platform design.



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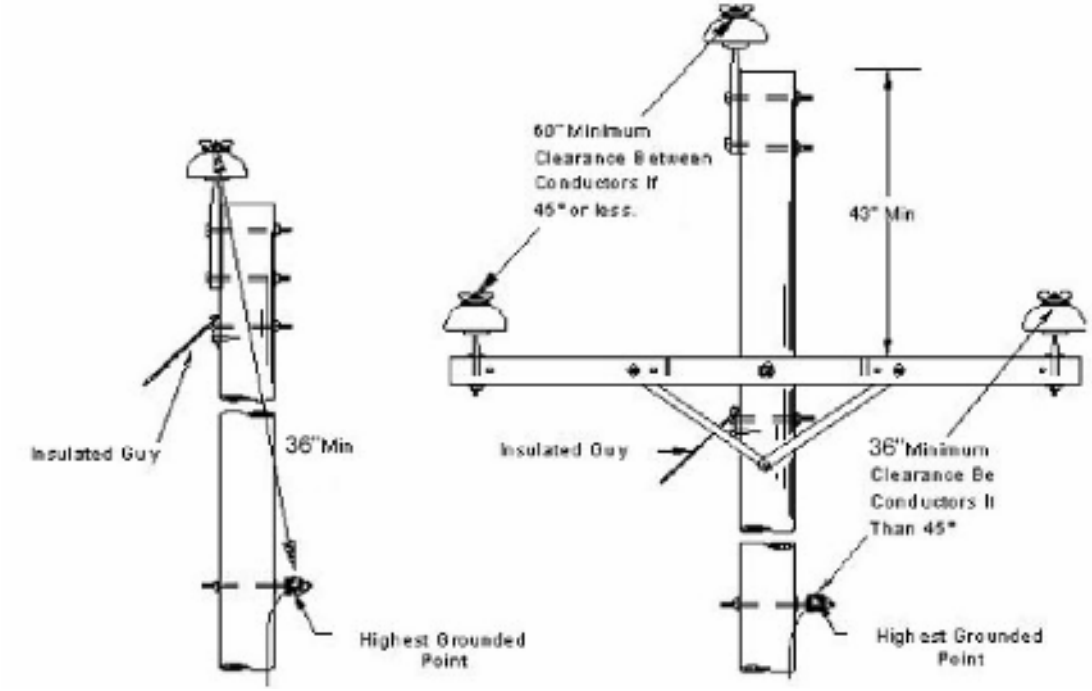
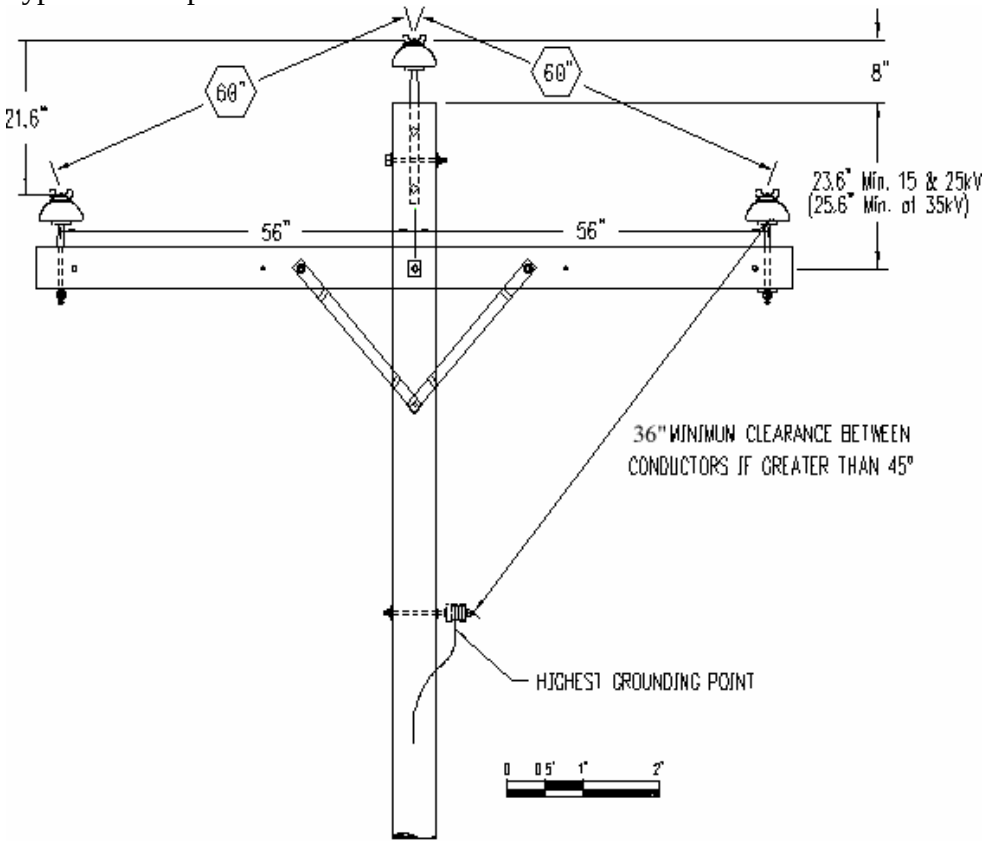
APPENDIX B. Utility pole designs to prevent electrocution

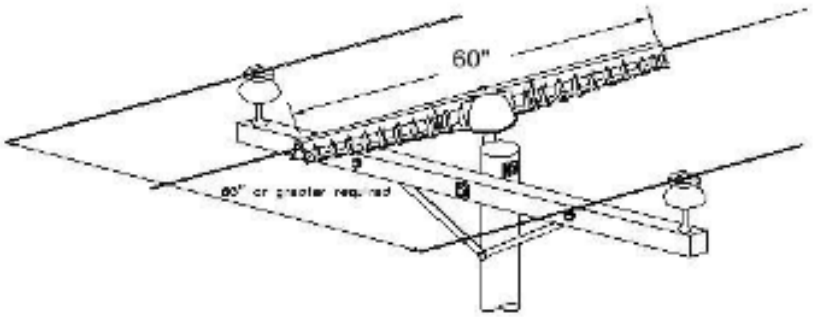
60” spans between contacts on power poles to prevent electrocution.

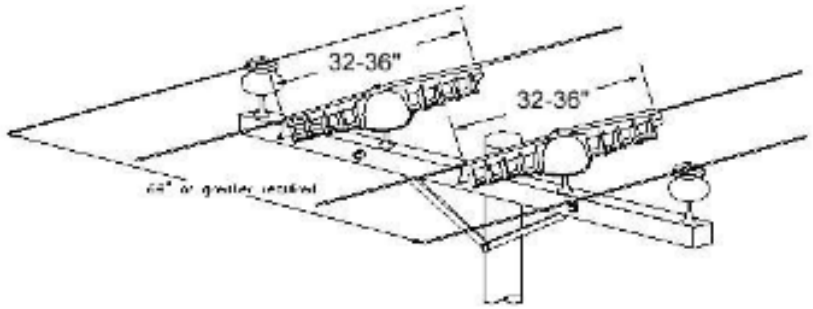


Typical three–phase avian-safe structure with 10–foot crossarm



Power pole cross arm covers that prevent electrocutions if less than 60” apart.





Edison Electric Institute’s Avian Power Line Interaction Committee (APLIC) and U.S. Fish and Wildlife Service (USFWS). 2005. Avian Protection Plan (APP).