ARTIFICIAL NESTING PLATFORMS FOR OSPREYS NEAR YELLOWKNIFE, NORTHWEST TERRITORIES

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ABSTRACT

Artificial nesting platforms were used to mitigate the negative impacts of ospreys (Pandion haliaetus) nesting on the main Northern Canada Power Commission (NCPC) transmission line supplying Yellowknife, Northwest Territories with power. During wet weather, nests in contact with or near insulators on the wooden structures occassionally caused phase (conductor) to phase flashover, resulting in total system outages. As a result, line maintenance personnel regularly removed osprey nests to prevent recurring flashover, eliminating osprey production in the process. Seven occupied osprey nests were raised in a cooperative effort involving NCPC and the Department of Renewable Resources. Each of the nests was placed on a plywood and angle iron nesting platform secured to the structure, effectively raising the nest beyond potential interference with the line. All raised platforms located at previously occupied sites were occupied in subsequent breeding seasons. The project has resulted in a decrease of osprey-related power outages, while retaining preferred nesting locations for the birds and effectively minimizing destruction of osprey nests and the associated loss of entire clutches or broods.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Osprey (Pandion haliaetus) readily take to artificial nesting structures located in suitable habitat (Ames and Mersereau 1964, Reese 1970, Postupalsky 1977, Rhodes 1977, Saurola 1978, Westall 1983; for a complete review see Olendorff et al. 1980). In a majority of the cases reported, artificial structures were erected to reverse the widespread decline in osprey numbers by encouraging local expansion of nesting distribution or replacing lost natural nesting sites.

Nesting by ospreys on hydroelectric power structures is widespread in Canada, with some power disruptions associated with these activities (Stocek 1981). However, actual installation of artificial nesting platforms on transmission systems has been limited (Olendorff et al. 1981). This paper examines the use of artificial nesting platforms to mitigate the negative impacts to both the birds and the power company of ospreys nesting on the main transmission line supplying Yellowknife, Northwest Territories (NWT).

Ospreys are found in the NWT north to approximately the tree-line (Godfrey 1966). Although local exceptions are known, population densities are generally low, with documentation of nests in the Yellowknife area limited to few locations (Allen and Ealey 1979, Bromley and Trauger n.d., NWT Renewable Resources files, pers. obs.).

In 1946 the Northern Canada Power Commission (NCPC) built a 115 kV transmission line from the Snare River system to Yellowknife, approximately 145 km long (Fig. 1). The line, comprised of about 715 wooden, two- or three-pole structures supporting the high voltage wires, crosses an uninhabited area covered with numerous lakes and rivers. The local relief

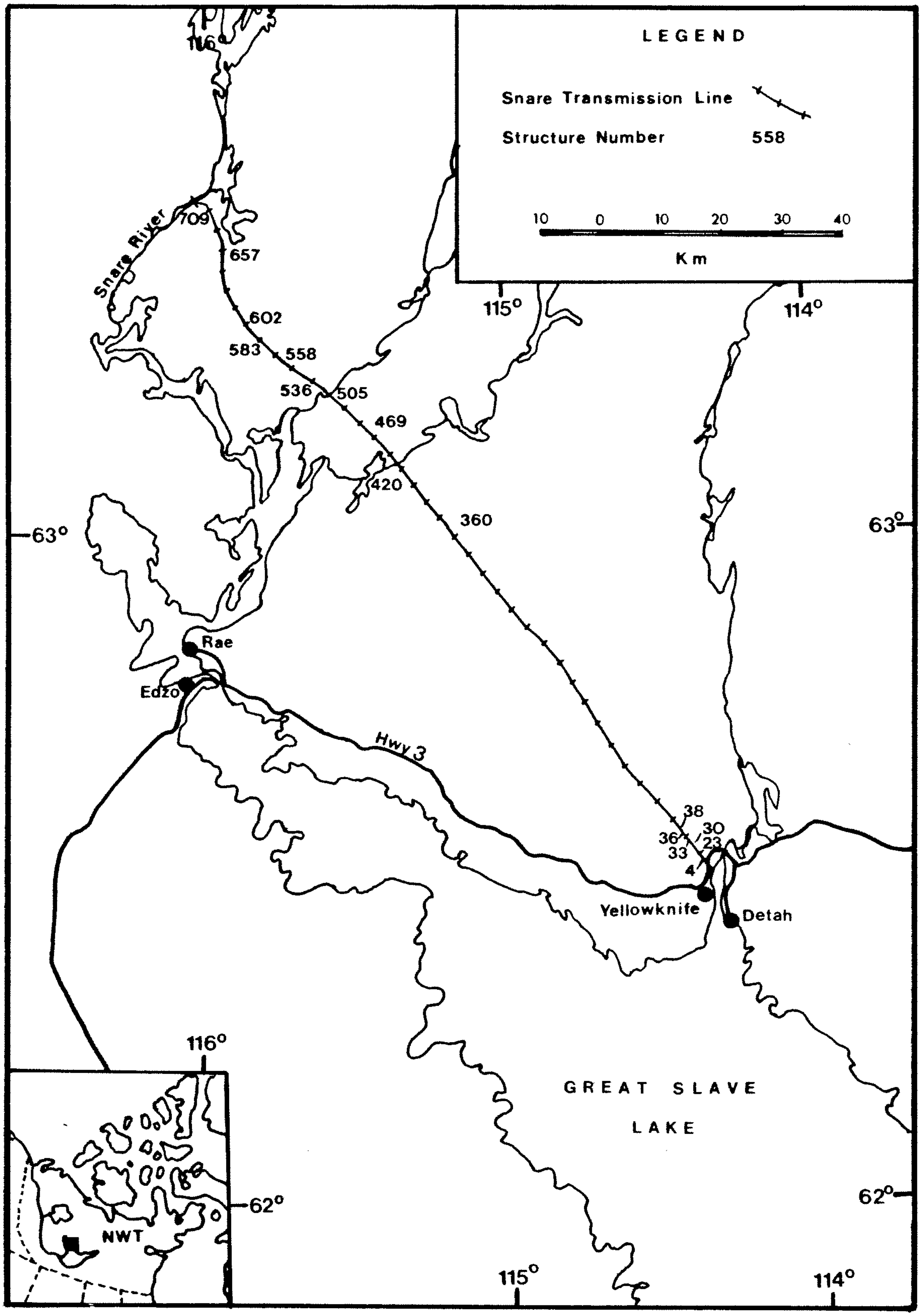

Figure 1. The location of the NCPC Snare transmission line and structure numbers mentioned in the text.

varies from approximately 190 m asl near Yellowknife to 270 m in the northern third of the line.

The area lies in the northwestern transition section of the boreal forest region (Rowe 1972), with the trees, mainly spruce (Picea spp.) and jack pine (Pinus banksiana), often sporadically dispersed among the Precambrian Shield granitic outcrops. Trees in the area rarely attain heights greater than 10-12 m. The transmission structures, however, are 13-18 m in height, and often were built on elevated land or on lake edges. The combination of these suitable locations and the flat nesting surface offered by the crossarms and insulators that support the high voltage wires, form excellent nesting sites for ospreys.

Unfortunately, numerous and costly problems associated with ospreys nesting on the line have occurred. On structures where the insulators are horizontal to the crossarms, the osprey nests often overlapped onto or came near the insulators. During periods of heavy rainfall, generally June to September, wet sticks near or touching the insulators occassionally caused phase (conductor) to phase flashover, resulting in a total system outage. Water collecting in the nest may also have caused flashover by tracking, even if the sticks were more than 1 m from the insulators. In addition to lost revenues during power outages, high costs were incurred in locating the offending nest(s). As the Snare line is the sole source of hydroelectricity for Yellowknife, other than a backup or supplemental 34.5 kV diesel generating station near the town, such costly outages have been unacceptable to the power company and the residential and industrial community served.

To deal with these interruptions the power company often removed suspected problem nests in midsummer, resulting in the loss of entire osprey broods. Due to the uncertainty in determining the actual problem nest, all nests encountered were generally removed. In late 1981, NCPC approached Renewable Resources to investigate the possibilities of rectifying the situation on a permanent basis. After a review of the available options it was decided to elevate the existing nests, thereby reducing the potential for nest-related outages by increasing the distance between the nests and the conductors. This option also allowed the preferred nesting locations to be maintained. Specific objectives of the project were:

1. to eliminate power outages on the Snare line caused by osprey nests;
2. to eliminate or minimize the annual destruction of osprey nests and the ensuing mortality of eggs or nestlings;
3. to assess the use and breeding success of ospreys on artificial nesting platforms; and
4. to devise a practical method for moving osprey nests (a problem due to their large size and weight).

MATERIALS AND METHODS

Due to the remoteness of the line, with associated high access costs and difficult logistics, it was decided to use the structures themselves for support of the artificial platforms, rather than mount platforms on new poles placed adjacent to the sites (Rhodenizer and Austin-Smith 1980).

Designs for the artificial nesting platforms were developed in conjunction with NCPC engineers to comply with electrical restrictions. Angle iron frames were constructed to attach the platforms to one of the poles on the structures (Fig. 2). The nesting platforms were 1 m in diameter, made with 19 mm creosote-treated plywood. Twelve 10 cm long pieces of 1.2 cm dowelling were placed in the plywood to anchor the nest and reduce loss of sticks in high winds. During placement, the angle iron frames were fastened to the pole with two galvenized bolts, and the platforms were bolted onto the frame. A minimum distance of 25 cm from the platform to the top of the crossarm was required (W. Miskolzie pers. comm.).

Beginning in 1982, two or three surveys of the line were flown each year to document construction of nests, site occupancy and, where possible, productivity. Surveys were generally flown in small fixed-wing aircraft during NCPC crew changes between Yellowknife and the Snare system. One survey was flown in a Bell 206B helicopter.

It is preferable to raise the osprey nests between September and April each year, when the birds are not present in the north. However, as the Snare line is the main source of electricity for Yellowknife and nearby communities, a shutdown during this period was not feasible. Actual work on the line was restricted to one 8-hour period per year during the annual shutdown in July or August when routine maintenance on the line and

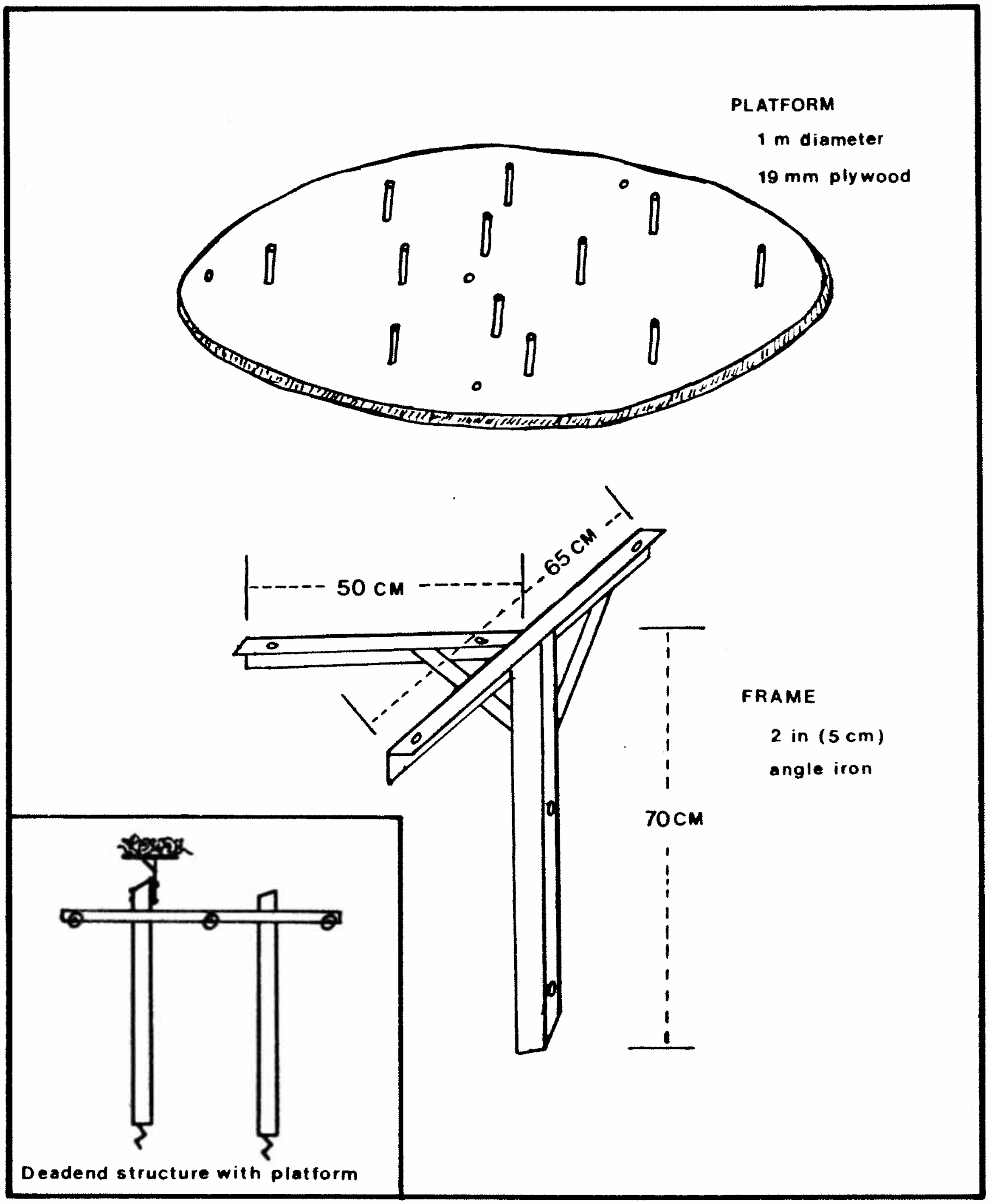

Figure 2. The angle iron frame and wooden platform used in the osprey project.

substations was carried out. It was, therefore, not possible to adhere to the recommendations of Fyfe and Olendorff (1976) to minimize disturbance to the nesting birds. As a partial consolation, the authors believed that osprey are the most tolerant of all raptor species during the early stages of nesting, normally an extremely critical period for raptors, and will generally tolerate relocation of their eggs or nestlings without deserting them.

Placement of nesting platforms occurred on 7 August 1982, 16 July 1983 and 14 July 1984. With the exception of structure 36, all platforms were placed on structures that harboured nests. The 1982 raising of one productive nest located approximately 12 km north of Yellowknife was used as a pilot project. As experience was gained, a typical placement operation proceeded as follows:

A Sikorsky S-55T helicopter was used to transport crews and materials to the sites. Electrical grounds were placed on either side of the structure that was to be worked on to provide protection against accidental power bumps or lightning strikes. The structures were climbed using spurs and climbing gear. Any nestlings or eggs present were lowered to the ground for safe keeping. To maximize clearance, the metal frame was usually bolted to the pole on the structure that protruded furthest above the crossarms. The nests were about 1.0-1.5 m in diameter and weighed up to an estimated 50 kg in some instances. Occassionally it was necessary to dismantle and subsequently rebuild a nest. In 1984, where possible, the nest was slid onto a plywood sheet for ease of movement and to facilitate relocation onto the pegged platform. When the security of a nest on a platform was in doubt, portions of the nest were wired to the platform. The young and/or eggs were then replaced into the nest.

Terminology used in this paper follows that of Postupalsky (1974), briefly: a structure (site) was judged to be occupied if one or two adults were observed during at least a portion of the breeding season and breeding was assumed, and a productive (successful) nest was one where at least one young was in an advanced stage of development. Due to the timing of surveys and actual work done on the line, the latter criterion was expanded to include sites where the young were only 1-2 weeks of age.

RESULTS AND DISCUSSION

History of Use

Prior to 1982, intermittent records kept by NCPC documented those structures where either nests were present or nests were removed (Table 1). However, we cannot be confident that the entire nesting picture was recorded for these years.

In 1981, all nests but the one at structure 38 were removed in mid- to late summer; thus, except for site 38, all nests located during surveys the following year were built during the 1982 breeding season. No nests have been removed since 1981. In addition, no new nests confirmed to be occupied by osprey have been built since the 1982 breeding season. Two unoccupied, incomplete nests of uncertain origin were built in 1984 (structures 420 and 469).

The nesting records indicate two main points. First, despite the existance of over 200 suitable structures and literally dozens of apparently adequate nesting sites along the length of the line (see Future Nesting), the ospreys repeatedly chose the same sites year after year. This fact is interpreted as indicating a preference for sites likely based on local characteristics, such as: surrounding habitat, access to ice-free water early in the breeding season, and the relative size of fish populations in the lakes and streams adjacent to the line. Second, despite continuous human interference, birds returned year after year to the same locations to attempt nesting, further emphasizing the tenacity of the species to previously used sites.

Table 1. Records of osprey nesting activity on structures of the NCPC Snare transmission line, 1971, 1974, 1976, 1979 and 1981-1984.[a]

Structure Number	1971	1974	1976	1979	1981	1982 10 May	1982 3 Aug	1982 7 Aug	1983 11 Apr	1983 20 Jun	1983 16 Jul	1984 8 Mar	1984 8 Jun	1984 14 Jul
4			X											
23	X	X												
30	X	X		X	X									
33					X									
36								Pl vac	vac	vac	vac	vac	vac	vac
38					X	X	X	Pl P 2yg	X	Occ	P ?yg	X	Occ	P 1yg
360				X										
420														vac[b]
469														vac[b]
505							X		X	Occ	vac	X	Occ	Pl Occ
536			X	X	X		X		X	Occ	P 1?yg	X	Occ	Pl P 2yg
558				X										
583					X		X		X	?	Pl P 3yg	X	Occ	P 2yg
602		X	X	X	X		X		X	Occ	Pl P 3yg	X	Occ	P 2yg
657	X	X	X	X	X		X		X	Occ	Pl P 1e,2yg	X	Occ	Occ
709				X	X		X		X	vac	Pl P 1e,2yg	X	Occ	Occ

[a] Data from 1971-1981 likely incomplete. X = nest present; Pl = platform erected; P = productive nest; Occ = occupied but not productive site; e = eggs; yg = young; ? = data not clear; vac = vacant.

[b] Identity of species that built nest unknown.

Artificial Nesting Platforms

Two platforms were erected in 1982, one under a productive nest on structure 38, and a second at nearby structure 36. The latter platform was set up partly due to confusion resulting from two overlapping numbering systems for structures on the line. The platform on structure 36 is likely within the territory of the pair at structure 38, and as such has not been occupied in the two subsequent nesting seasons.

Four platforms were erected in 1983, and two in 1984 (Table 1). In all cases but one, the platforms were placed on structures that were productive in that season. The exception, structure 505 in 1984, was occupied in June, but abandoned by the time of the annual shutdown in July.

On all six structures where two upright poles were present, the nest was built around the pole on the N to NE to E side of the structure (Table 2). It is unclear whether this observation has any significance. On average 2.5 hrs. were required to complete work on each nest (range 2-3 hrs.). The nests were raised an average of 60 cm (range 35-130 cm).

Productivity

To date, all five occupied sites where platforms were placed prior to 1984 were occupied in subsequent breeding seasons. Four of six nests (67%) were productive in subsequent breeding seasons (two seasons for structure 38). Thus, although more years of observation are required, raising of the nests has not appeared to affect subsequent use to date.

The remoteness of the line and the danger to people of close approach prevented complete inventory of the productivity of those osprey nests not accessed during platform installation. Most line surveys were made in light

Table 2. Raised osprey nests on the NCPC Snare transmission line, 1982-1984.

Structure Number	Year	Structure[a] type	Nest Position/pole	Pole for Platform	Distance raised(cm)	Time at each(h)
38	1982	1	around NE pole	same	45	3.0
505	1984	2	around NE pole	same	130	2.4
536	1984	3	centre pole	N pole	60	2.0
583	1983	2	around NE pole	SW pole	40	2.3
602	1983	2	around N pole	same	35	2.5
657	1983	2	around NE pole	same	35	3.0
709	1983	2	around E pole	W pole	60	2.7

[a] 1 = tangent, 2 = deadend, 3 = running corner.

aircraft, not conducive to accurate examination of nest contents. Therefore, the greatest confidence in productivity data is in the seven occupied sites visited.

Over the 3 years, 16 eggs or young were present at six of the seven sites actually visited during platform placement (Table 1), a mean of 2.3 eggs or young per occupied site and 2.7 eggs/young per "successful" site. During the 1984 operation, the Sikorsky helicopter was used to examine nest contents of all sites on the line. When these sites are included in the above calculations, the 21 eggs/young from nine successful and three occupied but unproductive sites yield a mean of 1.75 eggs/young per occupied site and 2.3 eggs/young per successful site.

These figures do not represent true "productivity", due to the young age (eggs, or nestlings less than 1 week of age) of many of the offspring. Some mortality undoubtedly occurred prior to fledging to further decrease the overall productivity. Fledging success for osprey populations in the United States ranged from 0.5-1.6 fledglings per occupied nest, and 1.2-2.3 young per productive nest (Reese 1970). Reproductive success of osprey populations in eastern Canada ranged from 0.6-1.5 young per occupied nest and 1.4-2.4 young per successful nest (Stocek and Pearce 1983).

No data is available on productivity of natural osprey nesting sites in the NWT. While not a universal occurrence, some studies have found higher productivity in nests on utility poles and artificial structures than at natural sites (Van Daele and Van Daele 1982, Seymour and Bancroft 1983, Westall 1983). The reasons for this trend appear to relate to site stability and increased isolation from disturbance.

Problems in handling nestlings less than 14 days of age were encountered in 1983. Two of the 10 nestlings handled that year were killed, although one chick may have died prior to the arrival of the work crew. The cause of death could not be determined with certainty, but likely involved overheating, resulting from stress or inability to ventilate properly, or suffocation. Such repercussions are an effect of disturbance of nesting raptors during the first week of the nestling period (Fyfe and Olendorff 1976).

It is possible that the ospreys nesting on the Snare line form a major component of the species' population in the Yellowknife area. This impression is supported by the general paucity of natural sites. Extensive surveys of a region of Nova Scotia documented 65% of known sites (n=26) on utility poles (Prevost et al. 1978). Thus, the Snare transmission line may be artificially increasing osprey density above that which had occurred prior to construction of the line. If so, this would suggest that the availability of nest sites may be an important limiting factor of osprey density and distribution in the area. A similar example involving gyrfalcons (Falco rusticolus) in the NWT occurs between Inuvik and Tuktoyaktuk, where a utility line provided nest sites for three gyrfalcon pairs in an area devoid of natural nesting cliffs (Barry 1984).

Incubation is reported to begin with the first egg laid, resulting in asynchronously hatched broods (Ames and Mersereau 1964, Green 1976). Asynchronous hatching was much in evidence at many of the sites visited. During 1983, two of the four sites, 583 and 602, had broods of three nestlings with extremes in weight of 95 to 255 g and 425 to 600 g, respectively. The other two sites (657 and 709) contained two nestlings and one egg each.

Phenology

The age of osprey nestlings was estimated from feather development and weight (S. Postupalsky pers. comm.) for six broods during 1982 to 1984 (Table 3). The phenology of egg laying, hatching and fledging was determined by back and fore dating. The literature reports a wide range in the length of the incubation and fledging periods (Newton 1979, Cramp and Simmons 1980, Terres 1980). In this study they were assumed, somewhat arbitrarily, to be 37 and 51 days, respectively.

Ospreys arrive in the Yellowknife area about mid-May (Bromley and Trauger n.d., pers. obs.), at which time only a small proportion of the water bodies are ice-free. Courtship was observed at one site (structure 38) soon after arrival. Egg-laying occurs in late May and early June, with hatching in early to mid-July. Unfortunately, the paucity of data precludes examination of between season differences in phenology as they relate to the arrival of spring and subsequent ice melt.

Cost/Benefit

It is difficult to accurately assess the costs associated with disruption of hydroelectric transmission caused by osprey nests. From indications given by NCPC equipment, 17 outages were attributed to osprey nests from 1979 to 1983 (R. Hilton pers. comm.). The length of these outages ranged from 1 to 42 minutes (mean=14 minutes). These outages are "...costly in terms of interruptions to our (NCPC) customers and the loss of revenue". Secondary costs related to power outages, such as spoiled food and computer problems, are also encountered. In addition, prior to the inititation of

Table 3. Phenology of osprey breeding, Snare transmission line, 1982-1984.

Year	Date of Visit	Age of Oldest Nestling in Broods	Initiation of Laying	Hatch	Fledging
1982	7 Aug	28 days	3 June	10 July	30 Aug
1983	16 July	4-14 days	30 May-9 June	6-16 July	26 Aug-5 Sept
1984	14 July	7 days	31 May	7 July	27 Aug

this project, annual costs for the removal of nests were approximately $3,500 for helicopter charters, in addition to 16 hours of labour.

When the above costs, both monetary and otherwise, are weighed against the $2,000 - 3,500 invested during each of the past three years to erect platforms, the advantages of the project quickly become evident. Although it is too early to properly assess long-term benefits, and no quantitative estimates of short-term benefits are available, management at NCPC are confident that the incidence of power outages attributed to osprey nests has decreased significantly over the past two summer seasons (R. Hilton pers. comm.).

Future Nesting

The Snare transmission line is comprised of structures built from three general designs. A majority of the structures, termed tangent structures, have three strings of insulators hanging straight down from a single crossarm. As a minimal flat area is created, it is not suprising that only one nest (site 38) is presently located on tangents, and that this nest was built where an additional upright support pole had been placed. Should nesting occur on these structures, the nest would likely be built close to one of the upright poles. Since the insulators are approximately 1.75 m from the nearest pole, there is little likelihood of contact between the nesting material and an insulator, and low probability of tracking. Tangent structures comprise approximately 71% of the 715 structures on the line.

Running corner structures are built of either poles with guy-lines with no crossarms or two- or three-pole structures with double crossarms. On many, the insulators both hang directly down as well as come out horizontally from the pole approximately 30 cm below the crossarms. On the three-pole structures, the crossarms and insulators provide a support spoke every 90^{o} around the pole. As in all structures, the site becomes more acceptable when the portion of the upright pole above the crossarm is short. One nest (site 536) was built on this structure type. The potential for problems arising from this nesting situation is high, as direct contact is invariably made between the nest and an insulator. Approximately 210 (29%) of the structures are of this design and the deadend design, described below.

Deadend structures appear most favoured by nesting ospreys, with five of the seven nests currently on the line built on them. Double crossarms are used on these two or three pole structures, with three pairs of insulators coming horizontally out from the crossarms. All of the nests were built covering or surrounding one of the uprights, generally the shortest.

It is difficult to predict how many osprey nests will become established on the line in the foreseeable future. From the discussion on structure availability, it is clear that not all of the structures are conducive to nesting. It is possible that territorial spacing may limit use of the structures. The smallest inter-nest distance for occupied sites was about 5 km (sites 583 and 602).

Despite what appears to be adequate habitat, no osprey nests have been observed between structures 38 and 505, covering nearly two thirds (90 km) of the line. The reason for this is not clear, but may relate to the presence or absence of open water during pre-laying in late May. When the ospreys arrive a majority of the lakes and rivers are still frozen, thus a reliable source of food at this time may be a limiting factor.

Other Raptors

Since surveys by Renewable Resources biologists commenced in 1982, no species other than osprey have been observed nesting on the line. Prior to 1982 there were reports of bald eagles (*Haliaetus leucocephalus*) nesting at some of the structures, but these may have resulted from misidentification by inexperienced observers due to the gross superficial similarities between ospreys and bald eagles. Bald eagles were observed flying in the vicinity of the line during several of the surveys, and nests in close proximity to the line are known.

Golden eagles (*Aquila chrysaetos*) were observed perched on the line during the two summer surveys in 1984. Five golden eagles were seen perched on the line on the 12 June survey, and three were observed during the 14 July operation. No nesting activities on the line have been associated with these birds. In addition, no common ravens (*Corvus corax*) have been observed nesting on the line.

RECOMMENDATIONS

We are now at the stage where we could be called "up-to-date" with the osprey nests. Platforms have been placed under all osprey nests on the line that have been occupied at some time in the past three years. Recommendations for future work follow:

1. In mid- to late June each year, at which time any new osprey nests would be constructed, a biologist should survey the line during one of the NCPC crew changes to determine if new nests are present and the number of platforms, if any, that should be erected during the annual shutdown. With the protection afforded the present nests, we could expect an expanded nesting population due to increased nest success resulting from the program.

2. In an effort to reduce the impact on the osprey young occupying nests that are raised, the period from when the young hatch to about 2 weeks of age should be avoided. This translates to approximately 1-20 July, to cover yearly variations in phenology. Should work in this period be unavoidable, the nestlings should be placed in a shaded area away from disturbance. The young should be protected from rainfall. Upon replacement of the nestlings after raising the platform, the nesting area should be vacated as quickly as possible to allow the parent osprey to return to the nest.

3. If vacant nests, either partial or completed, are observed adjacent to any artificial platforms, on the same or nearby structures, they should be removed to encourage the use of the platform. Insulated hot-sticks can be used to accomplish this without disrupting hydro service. This technique was successfully used in March 1984 at structure 709, where a nest had been built on the crossarms 3-4 m from the platform. The platform was occupied in the 1984 nesting season.

4. During the July 1984 survey, structure 469 was observed to have a large but incomplete nest built on it. The identity of the builder was not determined. Efforts should be made to either dump the nest in the non-breeding season or, if nest construction persists, erect an artificial platform at this site.

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I would like to extend my appreciation to the Northern Canada Power Commission, notably R. Hilton, Area Superintendent, and A. Lammers, Distribution Supervisor, for their unfailing cooperation and logistical and financial support in enabling this project to take place. Thanks also to NCPC staff for their observations, and their enthusiasm and understanding when I turned the quiet shuttle from Snare Rapids to Yelllowknife into a low-level, turbulent and fast-banking experience. W. Miskolzie, Engineer for NCPC in Edmonton, provided excellent suggestions for the design of the platforms and supports.

Many persons assisted during the actual raising of the platforms. The help and experience of D. Cox in constructing the iron frames and wooden platforms, and assisting during the shutdowns in 1982 and 1983 was invaluable. D. Heard assisted during the 1983 operation and ably coordinated the 1984 work in my absence. R. Lower and F. Betsina, Plains Western, ensured our electrical safety and provided climbing experience. R. Bromley, M. Bromley, L. Mychasiw, K. Simpson and M. Williams assisted in the field operations. R. Bromley, W. Fenton, D. Heard, R. Hilton, K. Jingfors and A. Welch provided valuable comments that greatly improved this manuscript. To all these people, I extend my thanks.

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