INVENTORY OF SELECTED RAPTOR, COLONIAL, AND SENSITIVE BIRD SPECIES IN THE ATHABASCA OIL SANDS AREA OF ALBERTA

by

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for

ALBERTA OIL SANDS
ENVIRONMENTAL RESEARCH PROGRAM

Project LS 22.3.2

April 1980

The Hon. J.W. (Jack) Cookson
Minister of the Environment
222 Legislative Building
Edmonton, Alberta

and

The Hon. John Roberts
Minister of the Environment
Environment Canada
Ottawa, Ontario

Sirs:

Enclosed is the report "Inventory of Selected Colonial and Sensitive Bird Species in the Athabasca Oil Sands Area of Alberta".

This report was prepared for the Alberta Oil Sands Environmental Research Program, through its Land System, under the Canada-Alberta Agreement of February 1975 (amended September 1977).

Respectfully,

W. Solodzuk, P.Eng.
Chairman, Steering Committee, AOSERP
Deputy Minister, Alberta Environment

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INVENTORY OF SELECTED COLONIAL AND SENSITIVE BIRD SPECIES IN THE ATHABASCA OIL SANDS AREA OF ALBERTA

DESCRIPTIVE SUMMARY

BACKGROUND

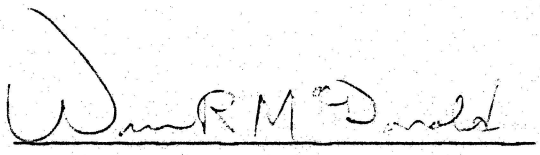
The primary objective of ornithological research in the AOSERP study area was to determine the impact that the development of the oil sands would have on the avifauna resource of the area. The initial step involved the identification of which rare, sensitive, and endangered species were present in the AOSERP study area and to determine their density, distribution and habitat requirements. Very early in the planning stages of the avifauna program, it was realized that the principal impact of the development of the oil sands on avifauna would not be attributed to contamination or destruction of existing habitat but to disturbance. Disturbance of wilderness areas could be related directly to oil sands developmental processes and/or to recreational demands placed on wilderness areas by the inevitable influx of workers and their families to the area. In order to accurately assess, predict and mitigate the impact of disturbance on rare, sensitive, and endangered bird species, baseline behavioural characteristics and responses, such as phenology of breeding events, breeding behaviour, etc., must be identified. This project was designed originally to fulfill this objective.

ASSESSMENT

This report has been reviewed by scientists from the Canadian Wildlife Service, Alberta Environment, the University of Alberta, and private environmental consulting companies. During the tenure of this project (1975 to 1978), the results have mirrored the alteration of emphasis of the objectives. This project evolved into a service role function for other projects by providing the following data:

1. Establishing, on a seasonal basis, the distribution of selected rare, sensitive, and endangered species for specific on-going projects; and
2. Developing techniques and methodologies to be utilized in areas of identified need in future projects.

Therefore, due to the service role to other projects which limits the value of this report to the general public, it has been recommended that this report be published for limited distribution.



W.R. MacDonald, Ph.D
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ABSTRACT

A three-year inventory of selected rare, endangered and sensitive bird species in the Athabasca Oil Sands area of north-eastern Alberta was completed in the late summer of 1977. Aerial and ground surveys of the Alberta Oil Sands Environmental Research Program (AOSERP) study area and selected adjacent areas were conducted. Three major habitat types were investigated: the boreal mixed-wood forest of the Birch Mountains area; the jack pine sand-plains south of Lake Athabasca; and the Canadian Shield north of Lake Athabasca.

Three major groups of birds were surveyed: raptors, colonial birds, and specified sensitive species. Locations of nest sites and colonies were noted and described. No attempt was made to determine the absolute abundance of each species in the AOSERP study area, as the aerial surveillance techniques employed do not justify such an estimation.

The exception to this were two species whose total population in the AOSERP study area was restricted to very small areas and therefore could be readily determined: White Pelicans and Peregrine Falcons. Each of these species was investigated in considerable detail and the data reported in separate publications.

Recommendations were made for:

1. Further, more intensive surveys of part of the AOSERP study area in order to determine phenology and numbers of initial breeders more accurately; and
2. Additional surveys of the Canadian Shield area which was incompletely surveyed during this study.

Observations of foraging behaviour of a breeding pair of Bald Eagles were conducted in the Birch Mountains, 90 km northwest of Fort McMurray, Alberta, from mid-summer to early fall, 1977.

Bald Eagles foraged almost exclusively on fish, although gull wings and a merganser skull were found below nest trees.

Nest trees were generally located less than 50 m from water. Active nests were more frequently located on islands and

peninsulas. The nest trees were usually tall and broad and included jack pine, spruce, and less frequently trembling aspen. Live trees were preferred over dead trees.

In the Birch Mountains, Bald Eagles were relatively sensitive to boat traffic and approaches by humans on foot.

Further work is strongly recommended:

1. To further outline critical breeding and foraging habitat criteria; and
2. To assess the potential impact of disturbance on breeding and foraging Bald Eagles.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the assistance and encouragement extended them by D. Hadler and C. Boyle of the AOSERP field staff.

Valuable technical assistance was provided by U. Banasch, H. Armbruster, and K. Zurfluh.

S. Popowich and B. Chubb drafted the figures presented in this report.

This research project LS 22.3.2 was funded by the Alberta Oil Sands Environmental Research Program, a joint Alberta-Canada research program established to fund, direct, and co-ordinate environmental research in the Athabasca Oil Sands area of north-eastern Alberta.

1. GENERAL INTRODUCTION

It was recognized very early in the research planning stages of the general avifauna program that the primary effect created by oil sands development upon various species of avifauna would be attributed to disturbance rather than contamination or loss of critical habitat. This disturbance may be directly associated with the developmental process, such as created by equipment involved in the construction of cutlines, seismic operation, or an increase in air traffic in support of ground activities. However, it was deemed more probable that the primary source of disturbance would be attributed to the ever-expanding recreational utilization of wilderness areas as the urban centres expanded in conjunction with increased development of the oil sands resource.

It therefore became evident that, in addition to delineating species abundance and distribution, detailed behavioural data would be required in order to determine the impact that disturbance would have on sensitive species.

Specific projects were initiated to provide baseline data on generally declining species which may be locally or regionally endangered, due, in part, to sensitivity to human interference. In this context the definition of rare, sensitive and endangered species includes:

1. Raptoral species - Peregrine Falcon (*Falco peregrinus anatum*), Golden Eagle (*Aquila chrysaetos*), Bald Eagle (*Haliaeetus leucocephalus*), Osprey (*Pandion hallaetus*);
2. Colonial species - White Pelican (*Pelecanus erythrorhynchos*), tern species, gull species (*Larus* sp.); and
3. Other sensitive species - Common Loon (*Gavia immer*) and Sandhill Crane (*Grus canadensis*).

The original program was designed not only to provide an inventory and distribution of avifauna species in the oil sands area but also to determine critical habitat requirements and detailed behavioural characteristics relating both to breeding and foraging.

Due to the regional and national significance assigned to the White Pelican and Peregrine Falcon, separate investigations were conducted on each of these species. Final reports, under separate covers, are currently in preparation for the Peregrine Falcon (Johnston-Beaver in prep.) and White Pelican (Beaver et al. in prep.).

This report summarizes inventories of selected raptor, colonial, and sensitive avifauna species found in the oil sands area. The data were collected from aerial and ground surveys conducted during 1975, 1976, and 1977. The data presented in this report are a compilation of three annual interim reports prepared by the Canadian Wildlife Service and submitted to AOSERP (Bishoff and Fyfe 1976; Beaver 1977; Ealey 1978).

In addition to the inventory program, the habitat requirements and breeding and foraging behaviour of Bald Eagles will also be presented in this report. The data presented will be summarized from an interim report submitted to AOSERP (Ealey 1978).

Reporting the explicit locations of raptor nest sites in technical reports intended for publication is contrary to Canadian Wildlife Service and Alberta Fish and Wildlife Division policies (Appendix 5.1). Therefore precise nest site locations have been omitted from this report. However, these data are available subject to prior authorization from the Regional Director, Western and Northern Region, Canadian Wildlife Service and the Director of Wildlife, Fish and Wildlife Division, Alberta Department of Recreation, Parks and Wildlife.

2. INVENTORY SURVEYS

2.1 INTRODUCTION TO INVENTORY SURVEYS

Prior to 1975, data pertaining to the abundance and distribution of the raptor and colonial avian species in the oil sands area were collected primarily from incidental observations. It was recognized that several species of these birds show a definite preference for inaccessible wilderness areas. However, because of the data gaps, there existed reasonable grounds for concern when attempting to assess the potential impact arising from increased recreational utilization of these wilderness areas. Substantial portions of the sandplains south of Lake Athabasca, the Precambrian Shield north of Lake Athabasca, and the trophy lakes of Birch Mountains, northwest of Fort McMurray, are excellent areas for sport fishing, hunting, and other wilderness related recreational activities. Until recently, these areas have received minimal utilization; however, the projected expansion of the urban centres associated with the development of oil sands extraction plants will undoubtedly alter this situation and an increased level of disturbance will be experienced by all species of avifauna.

This section of this report concludes a series of aerial and ground surveys conducted during the period 1975 to 1977. These surveys were designed to provide complete and adequate baseline data regarding distribution and critical habitat characteristics for the designated rare and sensitive species in the oil sands area. These data were a prerequisite to preparing management recommendations required to mitigate the effects of the potential disturbance. However, the incomplete nature of the surveys reduced the effectiveness with which critical areas could be covered. Recommendations were therefore conservative in order to avoid problems resulting from deficiencies in the data base.

The specific objectives of the inventory program, 1975 to 1977, as presented in the letter of agreement dated 19 May 1977, are outlined below.

1. To determine the breeding population of Bald Eagles, Osprey, and colonial avian species in the AOSERP study area southeast of the Richardson River;
2. To obtain data on productivity, general breeding biology and phenology;
3. To locate specific foraging areas of these species; and
4. To map (1:50 000) all breeding territories, colonies, and observation of foraging birds.

However, due to late starts, insufficient funding and manpower, some of these objectives have been only partially fulfilled while others have not even been addressed.

2.2 DESCRIPTION OF STUDY AREA

The AOSERP study area covers approximately 28 000 km^2 extending from 56°15' to 59°00'N Latitude and 110°47' to 112°55'W Longitude, excluding Wood Buffalo National Park (Figure 1). It incorporates most of the 23 000 km^2 of the area known as the Athabasca Oil Sands (Carrigy and Kramers 1974).

Land elevations in the area vary from 275 to 450 m asl. Rising above a platform of lacustrine and alluvial deposits are the Birch Mountains (elev. 825 m asl) to the northwest, Stony Mountain (750 m asl) to the south, and Muskeg Mountain (640 m asl) to the east. The Thickwood and Fort Hills (530 and 340 m asl) are located 20 km west and 70 km north of Fort McMurray, respectively. The Athabasca River flowing from the southwest and turning north at Fort McMurray, where it is joined by the Clearwater River from the east, has carved through the platform to an elevation of approximately 235 m asl. Between Grand Rapids, 90 km southwest of Fort McMurray, and Lake Athabasca, 220 km to the north, the Athabasca River drops 165 m within the AOSERP study area. The Athabasca is fed by a number of tributaries including the Beaver, MacKay, Dover, and Ells rivers from the west and the Steepbank, Muskeg, and Firebag rivers from the east.

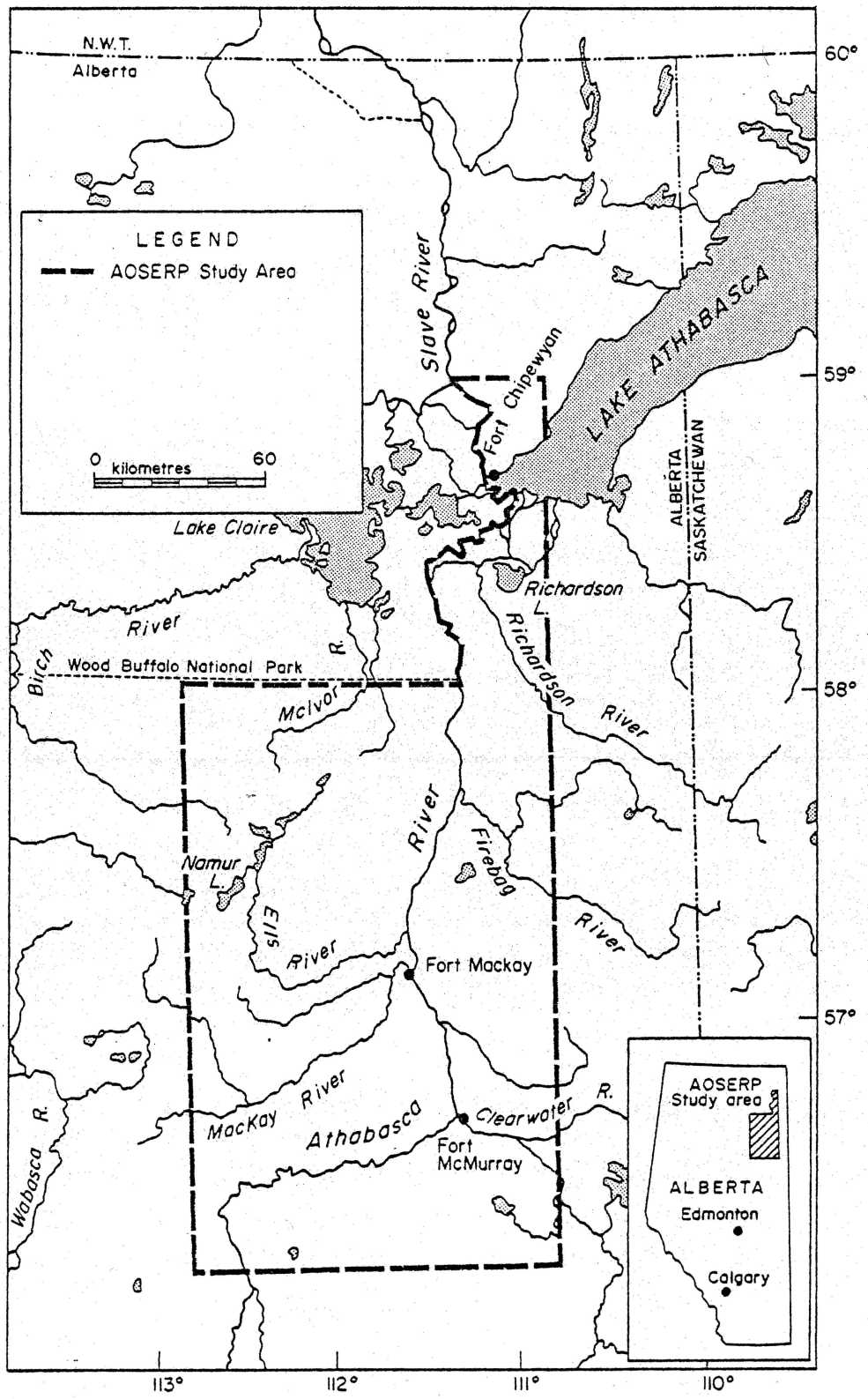

Figure 1. Map delineating the boundaries of the AOSERP study area.

A dense distribution of lakes (relative to other portions of the oil sands) occurs in the Birch Mountains (Namur and Gardiner being the largest at 44 km^2 and 54 km^2, respectively) and in the sandhills extending northeast from the Athabasca River 125 km north of Fort McMurray. Elsewhere, large lakes are widely distributed, the major ones including Ronald, McClelland, Algar, and Gregoire.

Additionally, in the oil sands area, there is a scattered distribution of numerous small lakes of variable nature, from small muskeg-type beaver ponds to lakes with sand beaches surrounded by mixed upland forest.

The vegetation of the area has been described by LaRoi (1967). It includes portions of the regions known as the boreal-subarctic alluvial lowlands, boreal-subarctic jack pine sandplains and the boreal mixed-wood (Rowe 1959).

The area included in the inventory surveys covered a broad range of habitat types: a subarctic, open, coniferous woodland, resting on Canadian shield, which occurs north of Lake Athabasca; boreal-subarctic, jack pine sandplains comprise the majority of the survey area south of Lake Athabasca; and a boreal, mixed-wood forest occurs to the west of the Athabasca River. The entire 1975 to 1977 survey area included numerous lakes; their physiographic and trophic nature differed among the three major habitat types.

2.3 METHODOLOGY

Initial aerial surveys of the AOSERP study area, west of the fourth meridian, were flown from 8 to 27 July 1975 (Figure 2). Areas immediately adjacent, east to the Saskatchewan-Alberta border, north to the Northwest Territories-Alberta border, and west to Chipewyan Lake in Alberta were also covered (Figure 2). Following initial coverage of the area two 114 km^2 quadrats located north and south of Lake Athabasca were intensively resurveyed by helicopter. The results were intended to provide an index of accuracy of the initial fixed wing survey of the same area and thereby a more accurate estimate of total population for the entire AOSERP study area.

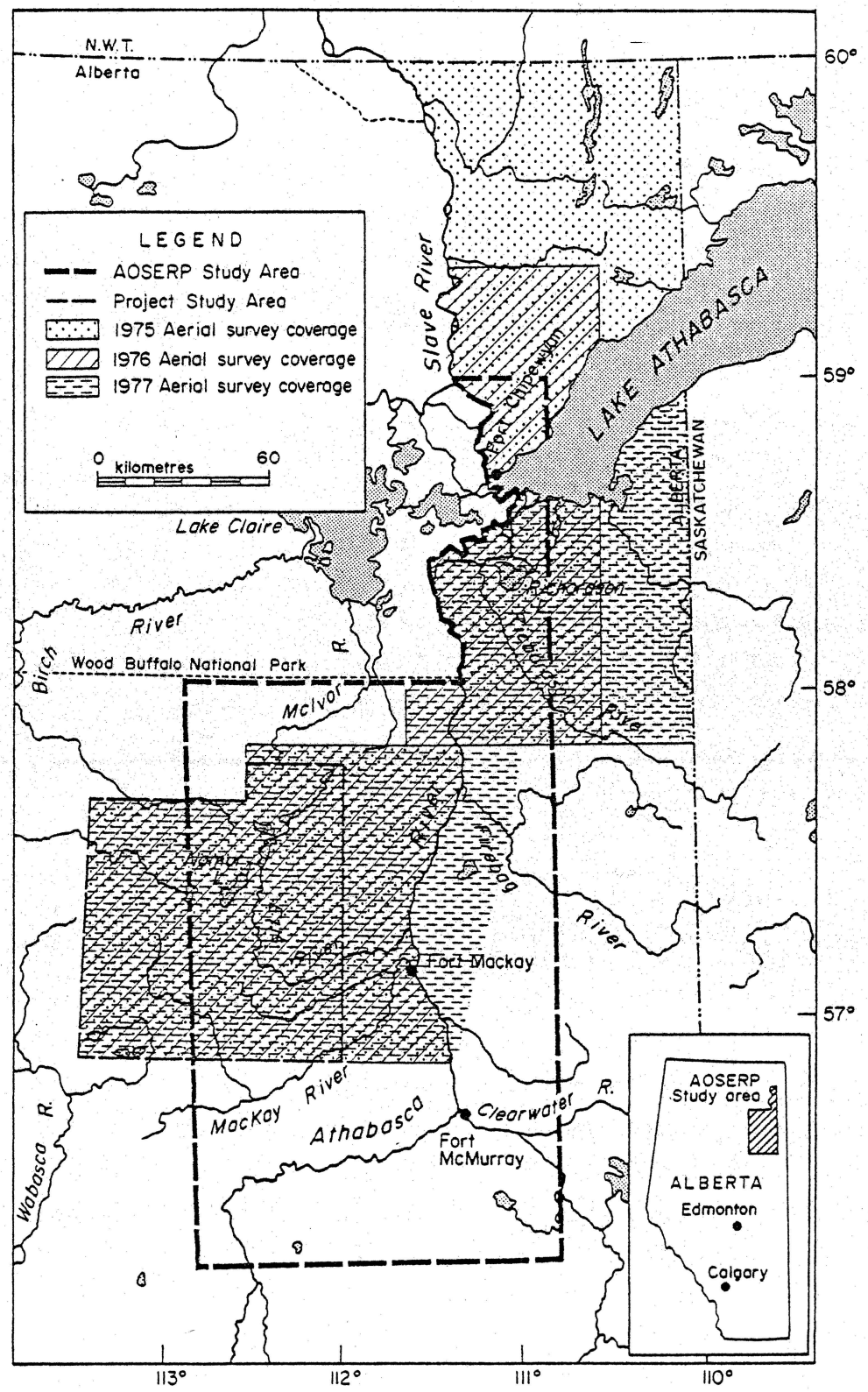

Figure 2. Map indicating the areas surveyed for selected species of avifauna during 1975, 1976 and 1977.

Aerial surveys conducted during 1976 included approximately the same area (Figure 2); however, intensive surveys of waterbodies within the study area were included in 1976. Aerial surveys during 1976 were flown on 27 and 30 May, 1 to 29 June, 23 August, and 15 September (Figure 2).

In 1977, a much reduced area was surveyed on the following dates; 26 April, 6 May, 8 June, 11 July, 13 and 16 August, and 10 September (Figure 2).

Four types of aircraft were utilized during the surveys; the fixed wing aircraft was either a Cessna 180 or 185 on floats, while the helicopter was either a Hughes 500c or a Bell 206.

The methodology utilized during the surveys, regardless of aircraft type, involved following linear transects 2 miles apart, at an altitude of 100 to 200 m above ground level, at 100 to 200 km/h. Observations were made by one passenger assisted by the pilot. Coverage of larger lakes was accomplished flying grid patterns, while smaller waterbodies were surveyed by shoreline circuits. Flights commenced at first light and usually continued all day, weather permitting. Weather conditions, visibility, and time of day were noted for each survey.

Due to manpower and funding constraints, ground verification was restricted to occupied sites and was accomplished in conjunction with a banding program during July of each year. Nests containing young were visited on foot. The young were banded, prey remains in and around the nest were collected and identified, and the nest site location was described during the visitations.

2.4 RESULTS AND DISCUSSIONS

In order to adequately assess a potential breeding population, it is essential that surveys be conducted in early spring. Pair breeding success generally is obtained by comparing the number of pairs which initiated breeding. The late start of surveys in 1975, 1976, and 1977 has prevented the determination of breeding success. Therefore, the data presented in this section will include only inventory data collected from 1975 to 1977 of active breeding

populations of the above-defined avian species. The data make no attempt to suggest that the total population of each species was documented, nor calculated, nor do they attempt to evaluate reproductive success, population increases, or declines. The existing data will be presented and discussed on an individual species basis.

2.4.1 Raptors

2.4.1.1 Peregrine Falcon (*Falco peregrinus anatum*). The Peregrine Falcon population in Alberta is presently restricted to the northeastern corner of the province, a large portion nesting within the AOSERP study area. The small but stable population of Peregrine Falcons which breed in the Fort Chipewyan-Lake Athabasca region have been extensively studied and manipulated since the early 1970's. Johnston-Beaver (in prep.) has prepared an excellent review of the status of this species.

Table 1 summarizes the status of the Peregrine population in the AOSERP study area from 1975 to 1977. Due to the detail of treatment of this species by Johnston-Beaver (in prep.), the reader requiring further data on this species is referred to the above report.

2.4.1.2 Bald Eagle (*Haliaeetus leucocephalus*). There exists a substantial population of breeding Bald Eagles in the northeastern corner of Alberta. This species remained the most abundant raptor, of the species investigated, in the AOSERP study area of the three years that the surveys were conducted (Table 2). The relative density of the nest sites was the highest in the shield country, followed by the sandplains south of Lake Athabasca (Figure 3). In comparison, the Namur Lake area had a relatively low density of breeding Bald Eagles (Figure 4).

The three years of surveys identified the locations of 57 breeding territories which were determined as having been productive at least once during the three years which the surveys

Table 1. The number of Peregrine Falcon (*Falco peregrinus anatum*) nest sites, annual production and total observations in northeastern Alberta from 1975 to 1977[a].

Nest Sites	1975	1976	1977
Occupied[b]	3	6	7
Unoccupied[c]	10	4	7
Productive[d]	1	5	4
Unproductive[e]	2	1	2
Total	13	14	14
Production			
Native young[f]: male	—	3	2
female	—	4	4
unknown	3	7	2
Reintroduced young	6	16	9
Effective production[g]	6	19	13
Observations			
Lone adults	—	5	4
Lone immature	—	—	1
Productive pair	2	5	4
Non-productive pair	1	1	2
Total number of birds	6	17	17

[a] - Compiled by Johnston-Beaver (in prep.)
[b] - Unoccupied territory.
[c] - Occupied by one or more adults.
[d] - Occupied by one pair and productive.
[e] - Occupied by one pair but unproductive; i.e. no young fledged from nest.
[f] - Before mortality.
[g] - Actual number of young fledged from nest site.

Table 2. The number of Bald Eagle (*Haliaeetus leucocephalus*) nest sites, productivity and total observations in northeastern Alberta from 1975 - 1977.

Nest Sites Observed	1975		1976[a]		1977[a]	
	New	Old	New	Old	New	Old
Productive	23	3	14	4	8	7
Potent. product.	17	—	4	4	7	9
Unoccupied	32	—	12	28	4	22
Total Nests	72	3	30	36	19	38
	75		66		57	

Total observed nest sites in area - 124

Productivity	1975	1976	1977
Total young produced	37	23	23

Observations		1975	1976	1977
Lone individuals	adults	80	28	52
	immatures	37	35	4
Breeding pairs		27	18	—
Non-breeding pairs		13	8	—
Total No. of Individuals		197	105	56

[a] Decline in numbers not due to population declines but a reduction in the area surveyed.

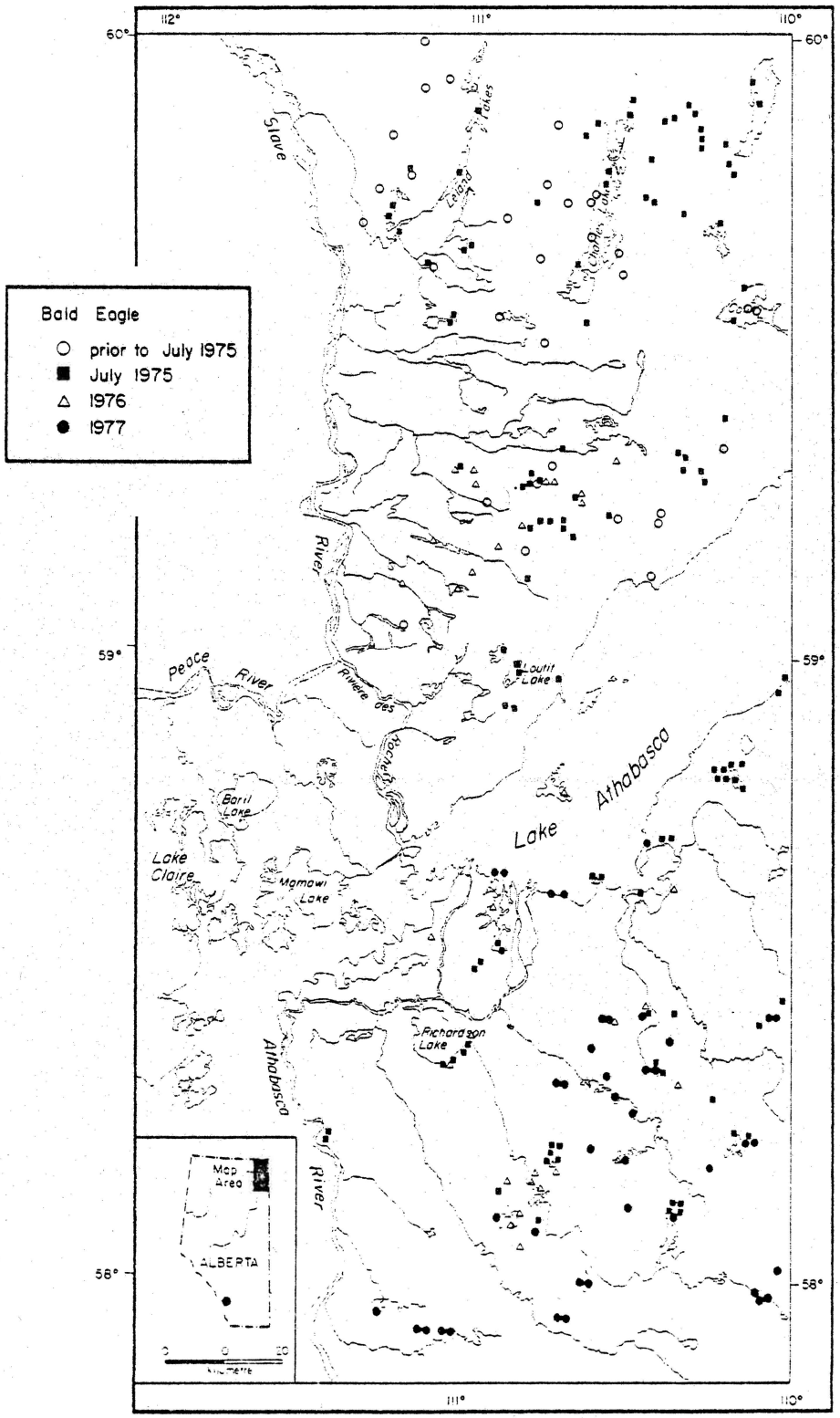

Figure 3. Distribution of Bald Eagles in the northeastern portion of the study area from 1974 to 1977.

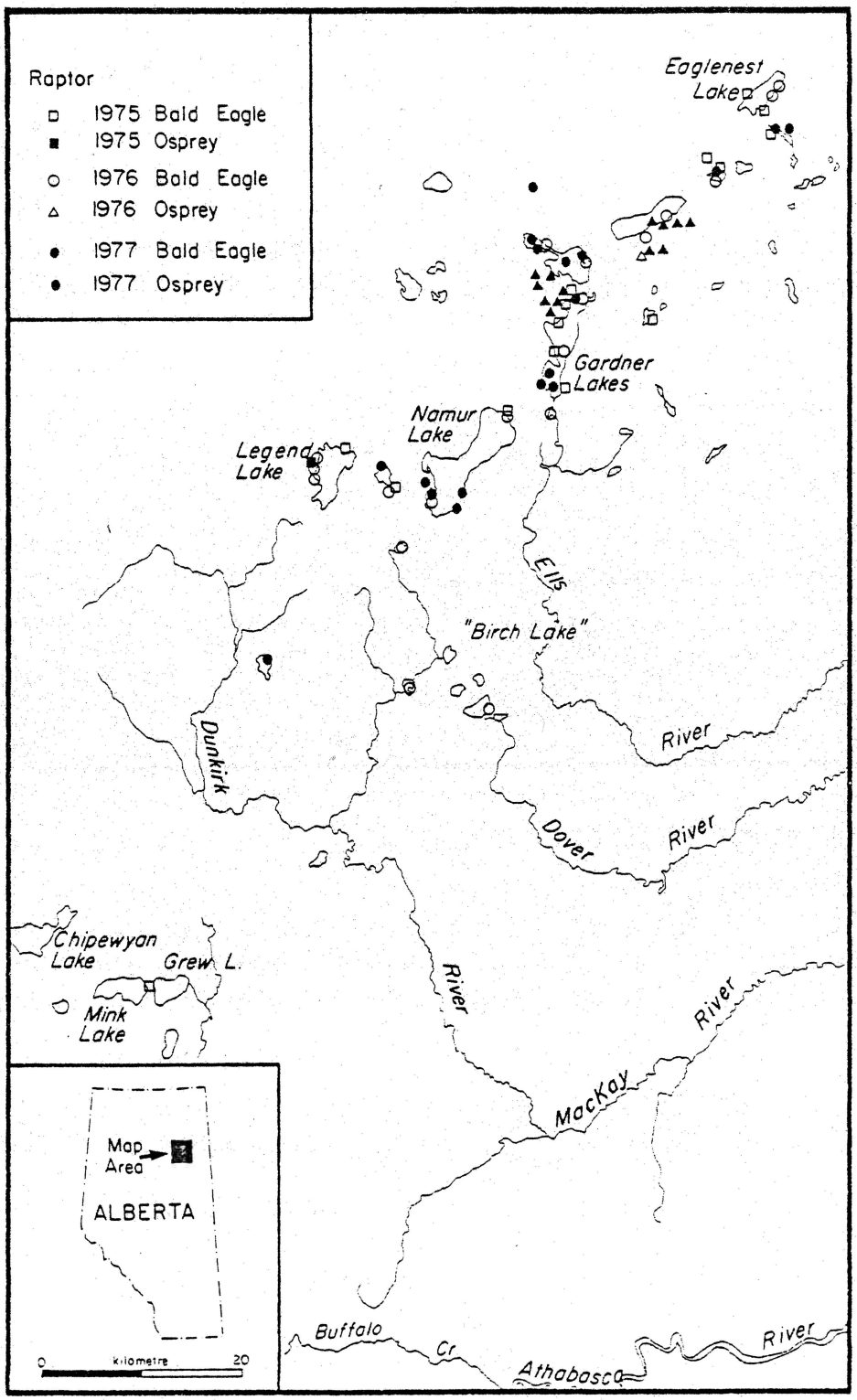

Figure 4. Distribution of Bald Eagles and Osprey in the northwestern portion of the study area from 1975 to 1977.

were conducted. An additional 34 breeding territories were located but remained non-productive; i.e., one or a pair of birds were observed in attendance but no young were produced. Some of these non-productive sites were observed only once and may well have been productive during one or both of the other survey years. Twenty-six nests which may have been Bald Eagle nests (potential nests) were also observed during the course of the study.

The number of sites and immatures which were observed, either flying or perched, varied considerably throughout the three survey years. One hundred and ninety-seven individuals were observed in 1975 while only 56 were observed in 1977. These results are not indicative of a decline in the population of Bald Eagles but rather mirror a reduction in the area surveyed in 1976 and 1977 and the incorporation of the two intensively surveyed areas in 1975, which was not duplicated in 1976 and 1977.

Productive nest sites numbered 26 in 1975, 18 in 1976, and 15 in 1977, while productive and potentially productive nests numbered 43 in 1975, 26 in 1976, and 31 in 1977. The total number of nest sites observed during the three years that surveys were conducted was 124. How accurately this number reflects the actual number of nest sites is not known; however, the investigators estimate that the total number of nest sites observed encompasses approximately 80% of the total number present in the area.

Breeding Bald Eagles are largely limited to the northern part of Alberta (Salt and Salt 1976). Two nesting records exist for lakes at the most northern extremity of the Rocky Mountains in Alberta [Canadian Wildlife Service (CWS) unpublished data] and in the more southern National Parks (Salt and Salt 1976). Approximately a dozen nests, not all active, have been recorded from Lake Bistcho in northwestern Alberta (LGL Ltd. 1972), and two additional breeding territories have been determined in Wood Buffalo National Park (L. Johnston-Beaver, CWS, pers. comm.). Therefore, it would appear that well over half of Alberta's population of breeding Bald Eagles may dwell in the AOSERP study area and immediately adjacent areas. It was for this reason that

a portion of one summer (1977) was devoted to determining critical habitat characteristics and breeding and foraging behaviour of Bald Eagles in AOSERP study area (see Section 3).

2.4.1.3 Golden Eagles (*Aquila chrysaetos*). Field observations of this species over the three years that the surveys were conducted indicated a very limited population. One factor contributing to its rarity is the lack of significant quantities of suitable breeding habitat in the AOSERP area. Golden Eagles nest primarily on cliffs and only occasionally in trees (Salt and Salt 1976). A second factor possibly contributing to the low population is the lack of suitable available foraging habitat, open areas which possess active populations of small mammals (Salt and Salt 1976).

Data presented in Table 3 illustrate the scarcity of Golden Eagles in the AOSERP study area. The total number of nest sites (productive, potentially productive, and unoccupied) observed during the three years of aerial survey was only 17, while four individuals were maximum observed in any one year (Figure 5).

In contrast with the situation exhibited by Bald Eagles, there is less likelihood that Golden Eagles will be disturbed because of their low numbers and inconspicuous nest sites. Furthermore, the population investigated does not appear to comprise a substantial portion of the Alberta population of Golden Eagles. However, populations of Golden Eagles, like other predatory bird species, have been on a general decline for many years and any disruption of their breeding activities should be avoided (Brown and Amadon 1968).

2.4.1.4 Osprey (*Pandion haliaetus*). Osprey are exclusively piscivorous and as such rarely select nesting sites that are far from water (Salt and Salt 1976). The Osprey breeds throughout the Rocky Mountains, foothills, and scattered northern lakes. There is a small breeding population in the AOSERP study area which is centred around the Namur Lake area and the northeastern corner of the province, around Lake Athabasca (Figures 4 and 5).

Table 3. The number of Golden Eagle (*Aquila chrysaetos*) nest sites, annual production and total observations in northeastern Alberta from 1975 to 1977.

	1975	1976	1977
Nest Sites			
Productive	—	1	4
Unproductive	—	1	7
Unoccupied	—	10	6
Total Nest Sites	—	12	17
Production			
Male	—	—	—
Female	—	—	—
Unknown	1	2	—
Total Production	1	2	—
Observation			
Adults	—	—	3
Immature	—	—	1
Breeding Pair	1	1	—
Non-breeding Pair	—	1	—
Total Number of Birds Observed	2	4	4

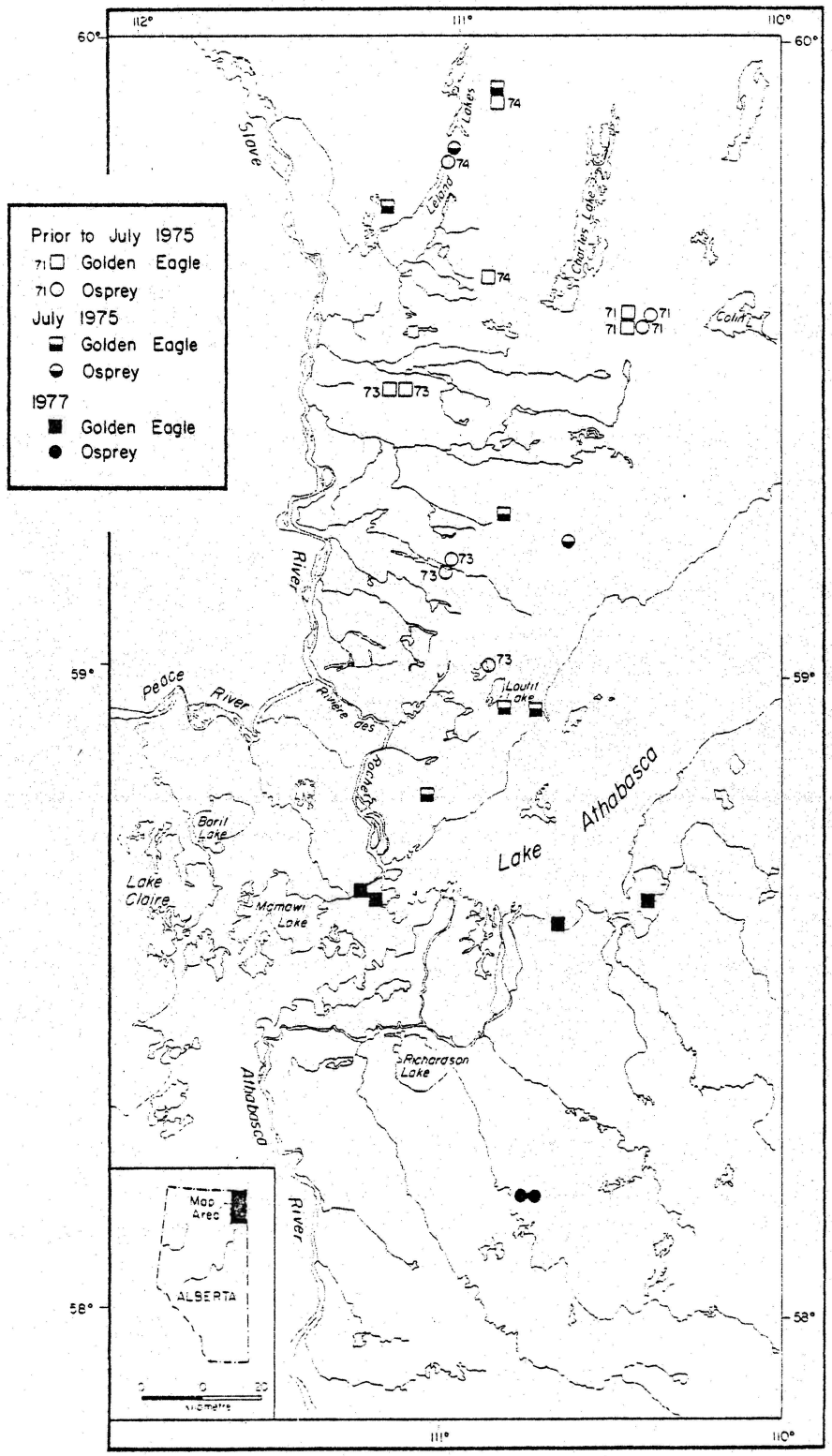

Figure 5. Distribution of Golden Eagles and Osprey in the northeastern portion of the study area from 1975 to 1977.

A total of 12 nest sites were located during the period 1975 to 1977, of which seven were productive in 1975, five in 1976, and four in 1977 (Table 4).

Maximum production was recorded in 1975 with 12 young; this dropped to eight in 1977. Production figures were unavailable for 1976 because the timing of the survey coincided with incubation and adult birds were reluctant to flush thereby preventing an examination of nest contents.

The apparent decline in the population levels is not felt to be significant because of the decreasing survey effort in 1976 and 1977.

2.4.2 Colonial Birds

2.4.2.1 White Pelican (*Pelecanus erythrorhynchos*). There has existed a traditional White Pelican rookery on an island located in the northeastern corner of Namur Lake. In 1975, the White Pelicans appeared to desert this traditional site, apparently in response to disturbance which occurred during incubation (Beaver and Ballantyne 1977).

White Pelicans did not nest at the Namur Lake site in 1976; instead, a new rookery, comprising 140 breeding pairs, was established on a small island in an unnamed lake in the Snipe Creek drainage basin, approximately 13 km south of Namur Lake (Figure 6). This rookery produced 68 young, of which 67 successfully migrated from the area (Beaver and Ballantyne 1977).

In 1977, the White Pelican rookery was again located on the unnamed lake in the Snipe Creek drainage basin. White Pelicans breeding at this rookery declined in numbers from 140 breeding pairs in 1976 to 70 breeding pairs in 1977; an average of 0.79 young were produced per initiated nest for a total production of 55 young in 1977. This production was more successful than the 0.49 young per nest produced in 1976, although the total production for the rookery was higher in 1976 with 68 young. The young had migrated from the area by the end of September.

Table 4. Osprey (*Pandion haliaetus*) annual production and total observations in northeastern Alberta from 1975 to 1977.

	1975	1976	1977
Nest Sites			
Productive	7	6	4
Non-productive	—	—	1
Unoccupied	1	1	—
Total Nest Sites	8	7	5
Production			
Male	4	—	—
Female	3	—	—
Unknown	5	—	8
Total Production	12	—[a]	8
Observations			
Adults	2	2	11
Immature	—	—	—
Breeding Pairs	7	5	—
Non-Breeding Pairs	1	—	—
Total Birds	18	12	11

[a] In 1976, surveys were conducted during incubation. Adults would not flush therefore no production figures are available.

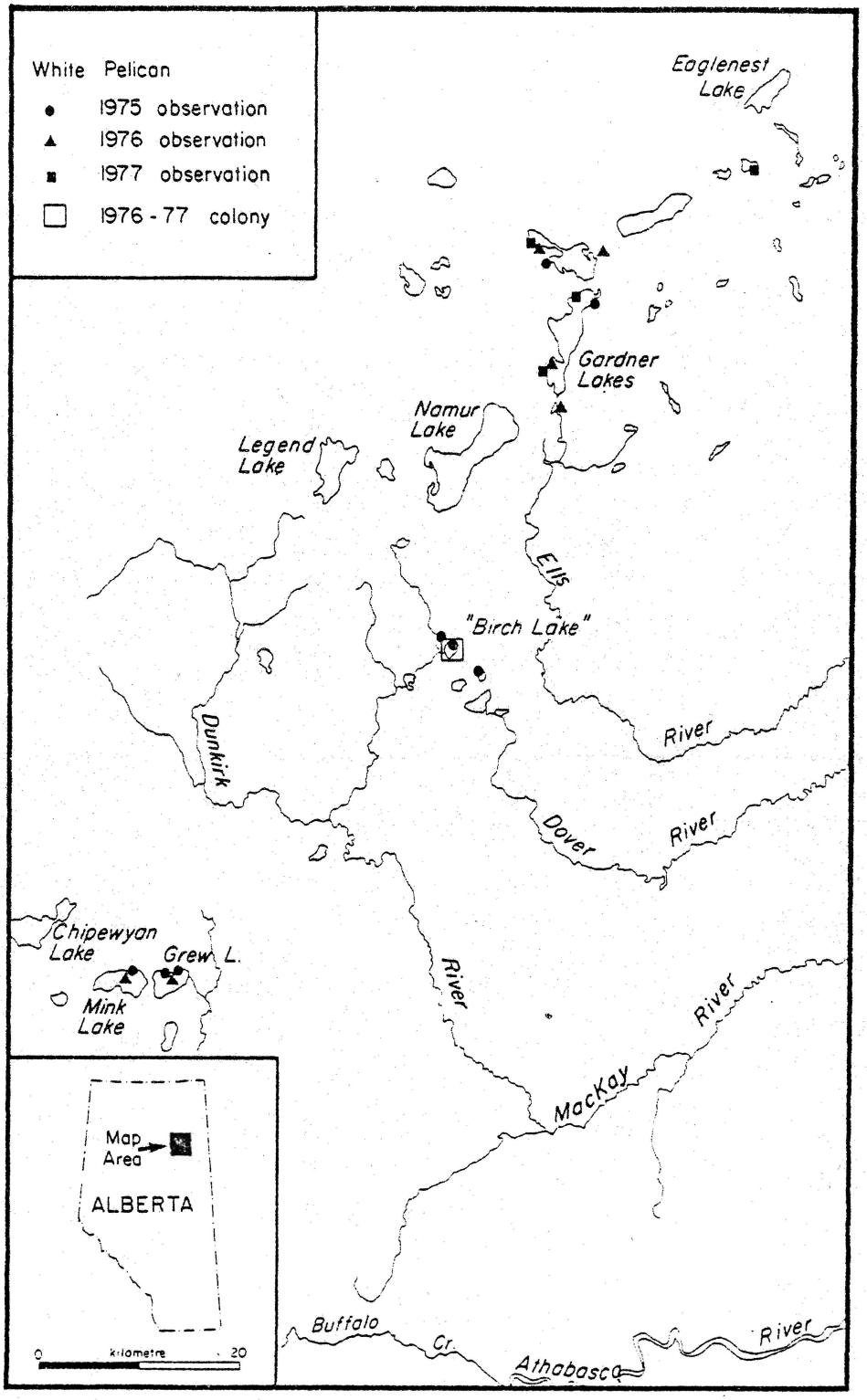

Figure 6. Distribution of White Pelicans in the northwestern portion of the study area from 1975 to 1977.

White Pelicans appeared to prefer an isolated, low profile island in a permanent water body as a rookery location. They do not appear to require vegetative cover and, in all probability, the selection of a rookery location may be predicted on its remoteness as much as any other physical requirement.

The selection of foraging areas included most of the larger, permanent lakes within a 60 km radius of the rookery (Figure 6). Throughout the three years that the surveys were conducted, White Pelicans were observed to forage on the following lakes: Mink, Grew, Ells, Upper and Lower Gardiner, Big Island, Eaglenest, Namur, and Richardson (Figure 6). There appeared to be a change in foraging distribution in 1977; in August a large concentration of White Pelicans began foraging on Eaglenest Lake to the complete exclusion of Mink and Grew Lakes (Ealey 1978). The selection of foraging areas by White Pelicans may not be habitat dependent, but may depend on the fluctuations and movements of the fish population of any particular waterbody.

For a further and much more detailed treatment of White Pelicans, the reader is referred to Beaver et al. (in prep.).

2.4.2.2 Common Tern (*Sterna hirundo*). The 1975 surveys located colonies of 30 breeding pairs on Burstall Lake, 15 breeding pairs on Cornwall Lake, and 20 breeding pairs on St. Agnes Lake (Figure 7).

In 1976 and 1977 none of the Common Tern colonies in the northern shield area was surveyed and no new colonies were observed elsewhere in the AOSERP area. In 1977, there were a few observations of individuals or small groups of these terns on Big Island Lake.

Critical breeding or foraging habitat has not been delineated for the AOSERP study area.

2.4.2.3 Black Tern (*Chlidonias niger*). In 1975, Black Tern colonies were located on Richardson Lake. There were two colonies of 30 and 50 birds, respectively.

In 1976, 144 single birds of this species were observed, primarily in the Peace-Athabasca Delta. Single Black Terns were

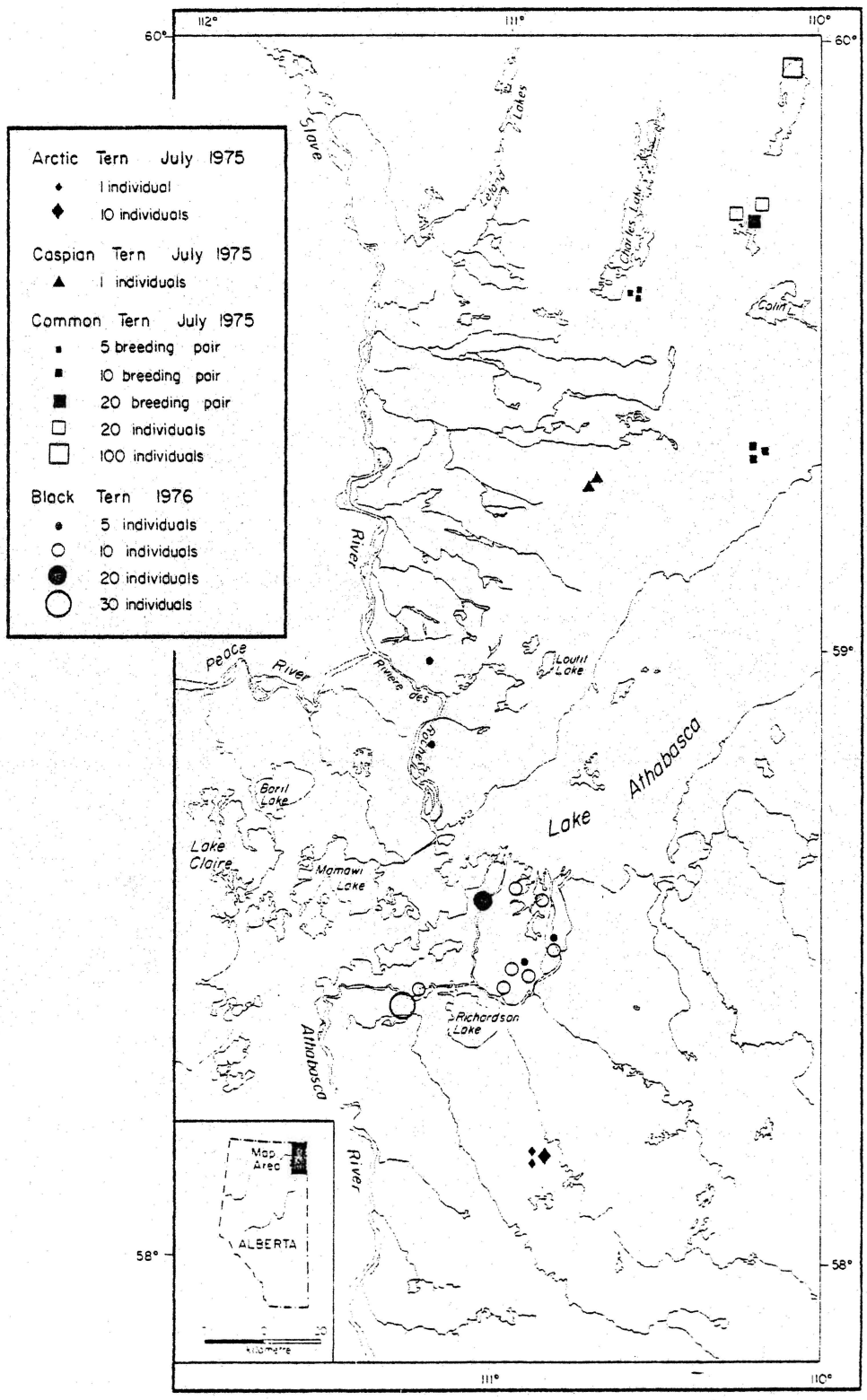

Figure 7. Distribution of Arctic Terns, Caspian Terns, Common Terns and Black Terns in the northeastern portion of the study area from 1975 to 1977.

also observed near scattered marshy lakes throughout the study area. No definite colonies were found (Table 5, Figures 7 and 8), because the size and coloration of Black Terns render colony identification from the air very difficult.

No Black Terns were observed during the 1977 survey. Black Terns are not always colonial nesters which may explain the lack of observed colonies.

Black Terns prefer marshes or sloughs as nesting habitat (Salt and Salt 1976) which would indicate that the most suitable environment would occur within the Peace-Athabasca Delta.

2.4.2.4 Arctic Tern (*Sterna paradisaea*). In the three years that surveys were conducted, few Arctic Tern sightings were documented (Table 5). This concentration was located south of Lake Athabasca and the area was not included in the subsequent surveys (Figure 7). These birds are rare breeders in Alberta and no habitat relationships were investigated in the AOSERP study area.

2.4.2.5 Caspian Tern (*Sterna caspia*). Only two birds of this species were observed during the 1975 to 1977 surveys (Figure 7).

2.4.2.6 Bonaparte's Gull (*Larus philadelphia*). Surveys incorporating larids were conducted only in 1976 and 1977.

In 1976, 90 breeding pairs were observed and two large colonies were identified (Table 5, Figures 8 and 9). This species forms very loose colonies and, therefore, sightings of small aggregations of breeding pairs were common. Two hundred and sixty-eight single birds or birds in flocks were also observed. The two larger colonies were located north of Lake Athabasca and in the Birch Mountains area (Figures 8 and 9).

The 1977 surveys detected a total of 74 individuals, of which 60 were believed to be associated with two colonies in Birch Mountains (Table 5, Figures 8 and 9). The fewer numbers of Bonaparte's Gulls observed in 1977, compared with 1976, were not believed to be indicative of a population reduction but rather due to a decrease in the area surveyed.

Table 5. The numbers of selected species of colonial birds observed in northeastern Alberta from 1975 to 1977.

Species	1975	1976	1977
White Pelican (*Pelecanus erythrorhynchos*)			
Colonies	—	1	1
Breeding pairs	—	140	70
Individuals	203	78	185
Young produced	12	55	68
Common Tern (*Sterna hirundo*)			
Colonies	3	—	—
Breeding Pairs	65	—	—
Individuals	42	—	—
Young produced	44	—	—
Black Tern (*Chlidonias niger*)			
Colonies	2	—	—
Breeding pairs	—	—	—
Individuals	160	144	—
Arctic Tern (*Sterna paradisaea*)			
Colonies	—	—	—
Individuals	12	—	—
Young produced	2	—	—
Caspian Tern (*Sterna caspia*)			
Individuals	2	—	—
Bonaparte's Gull (*Larus philadelphia*)			
Colonies	—	2	2
Breeding pairs	—	90	74
Individuals	—	268	—
Franklin's Gull (*Larus pipixcan*)			
Colonies	—	2	2
Breeding pairs	—	140	—
Individuals	—	150	440
California Gull (*Larus californicus*)			
Colonies	—	1	2
Breeding pairs	—	15	220

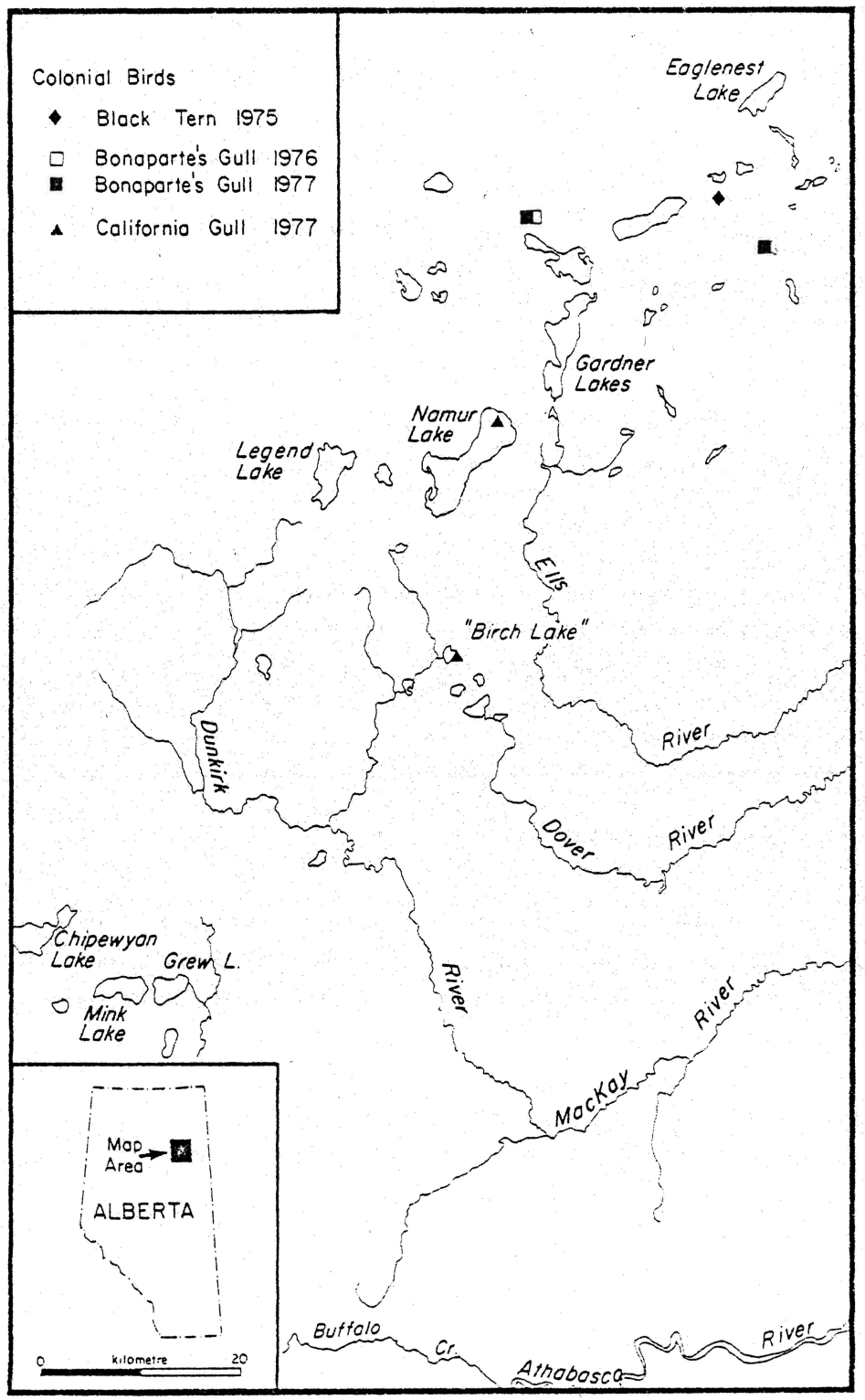

Figure 8. Distribution of Black Terns, Bonaparte's Gulls and California Gulls in the northwestern portion of the study area from 1975 to 1977.

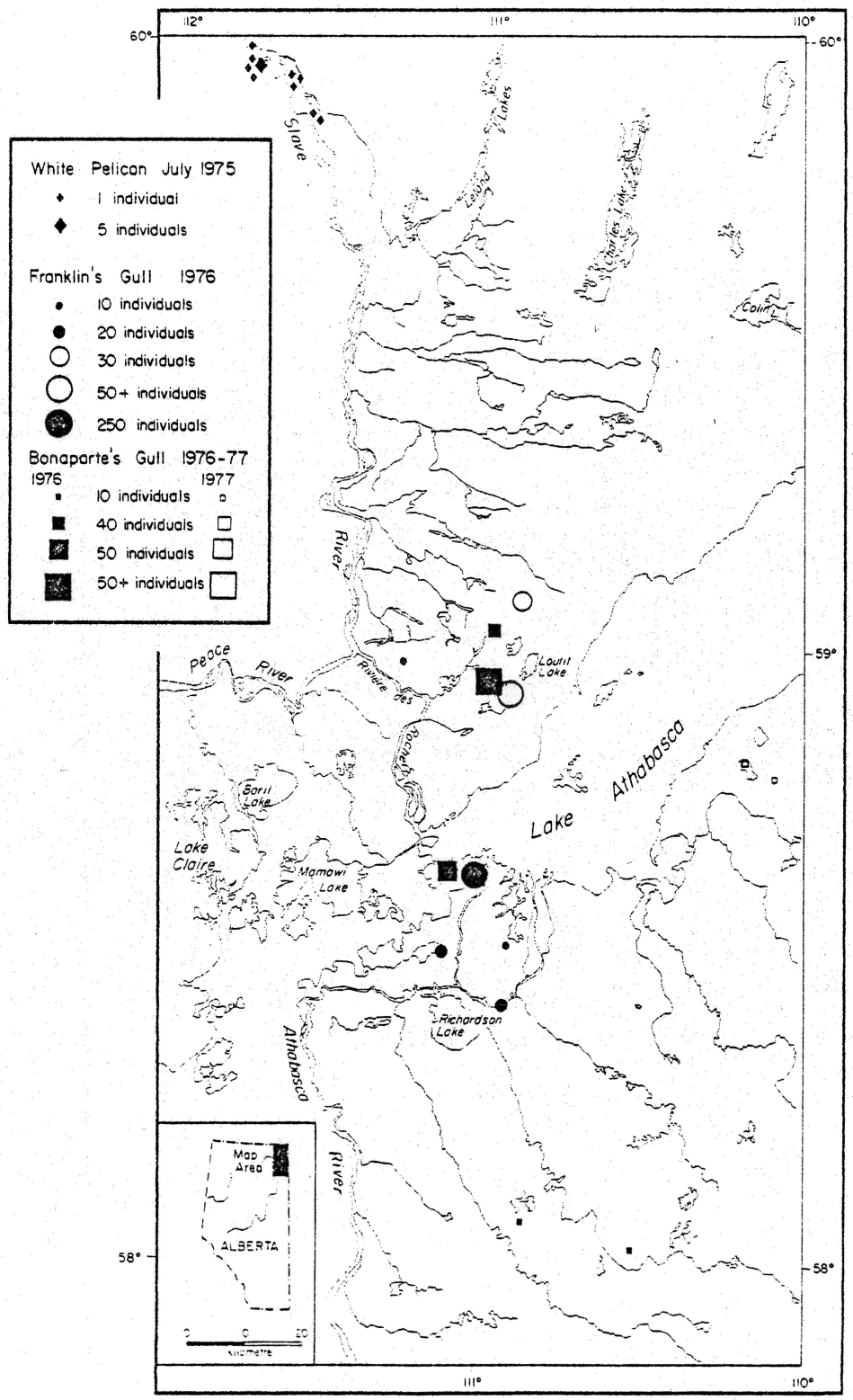

Figure 9. Distribution of White Pelicans, Franklin's Gulls and Bonaparte's Gulls in the northeastern portion of the study area from 1975 to 1977.

Bonaparte's Gulls prefer, as breeding habitat, shallow, muskeg lakes surrounded by black spruce (Salt and Salt 1976).

2.4.2.7 Franklin's Gull (*Larus pipixcan*). In 1976, sightings of this species were confined almost exclusively to the Peace-Athabasca Delta. Two large colonies accounted for 140 of the breeding pairs observed while 150 single birds were observed over lakes adjacent to the delta (Table 5, Figure 9).

No sightings of Franklin's Gulls were made during the aerial surveys in 1977. Well over 100 birds were infrequently observed while in transit over the Gardiner Lakes and were occasionally observed loafing in the Lower Gardiner Lakes during July and August 1977.

Primary nest habitat includes sedge tussocks in marshy lakes (Salt and Salt 1976).

2.4.2.8 California Gull (*Larus californicus*). In 1976, one nesting colony of California Gulls containing 15 breeding pairs was recorded during the summer but not during the aerial survey. The birds were breeding associates of the White Pelicans and were observed casually during the course of the breeding behaviour study of White Pelicans (Beaver and Ballantye 1977).

Two colonies of California Gulls were located in the Birch Mountains area during the 1977 survey (Figure 8). One colony of 20 pairs was observed on the same island as the White Pelican rookery. Another colony of 200 pairs was located on the former pelican rookery island in Namur Lake (Table 5, Figure 8).

California Gulls form a tighter colonial association than the two previous species of gull and utilize small, bare, sparsely vegetated islands (Godfrey 1966).

2.4.2.9 Other Larid Species. Ring-billed Gulls (*Larus delawarensis*) were rarely seen during any of the aerial and ground surveys.

In 1976, one suspected colony of Ring-billed Gulls raised young on the Namur Lake White Pelican rookery; however, no estimate

of breeding numbers was made as the colony was visited late in the year after young had dispersed over the surrounding area.

A reluctance to directly visit gull colonies during the critical incubation period necessitated identification of birds from the air, a task which was found to be extremely difficult given the similarity between gull species. Identifications, therefore, are tentative and must be subjected to ground check verification in the future at non-critical periods in the breeding season.

2.4.3 Sensitive Species

2.4.3.1 Common Loon (*Gavia immer*). The Common Loon was an abundant species in the oil sands area, with most lakes containing at least one pair of Common Loons while some larger lakes often contained two or more pairs.

In 1975, five breeding pairs with broods were observed while 35 additional pairs and 33 single birds were also noted (Table 6, Figures 10 and 11).

In 1976, 75 adult pairs were noted but due to the timing of survey, no broods were seen. Also 96 single Common Loons were observed.

Surveys conducted in 1977 were again early and therefore no broods were observed. However, 52 pairs, 24 single birds and a lone adult on a nest were observed during aerial surveys.

Throughout the surveys, Common Loons were observed on most lakes and a substantial population regularly breeds in the survey area.

Godfrey (1966), Ream (1976) and Salt and Salt (1976) have stated that this species is very sensitive to disturbance and, as a result of rapidly encroaching development and recreational utilization of wilderness lakes, the Common Loon is losing its breeding habitat. Consequently, its breeding range may become restricted to inaccessible lakes. It is therefore suggested that, with the projected human population increase in the AOSERP area, coupled with

Table 6. The numbers of Common Loon (*Gavia immer*) and Sandhill Crane (*Grus canadensis*) observed in northeastern Alberta from 1975 to 1977.

Species	1975	1976	1977
Common Loon			
Single birds	33	96	129
Non-Breeding Pairs	35	75	—
Breeding Pairs	5	—	—
Number of Broods	5	—	—
Sandhill Crane			
Single Birds	10	1	—
Non-Breeding Birds	2	1	—
Breeding Birds	—	—	—
Number of Broods	—	—	—

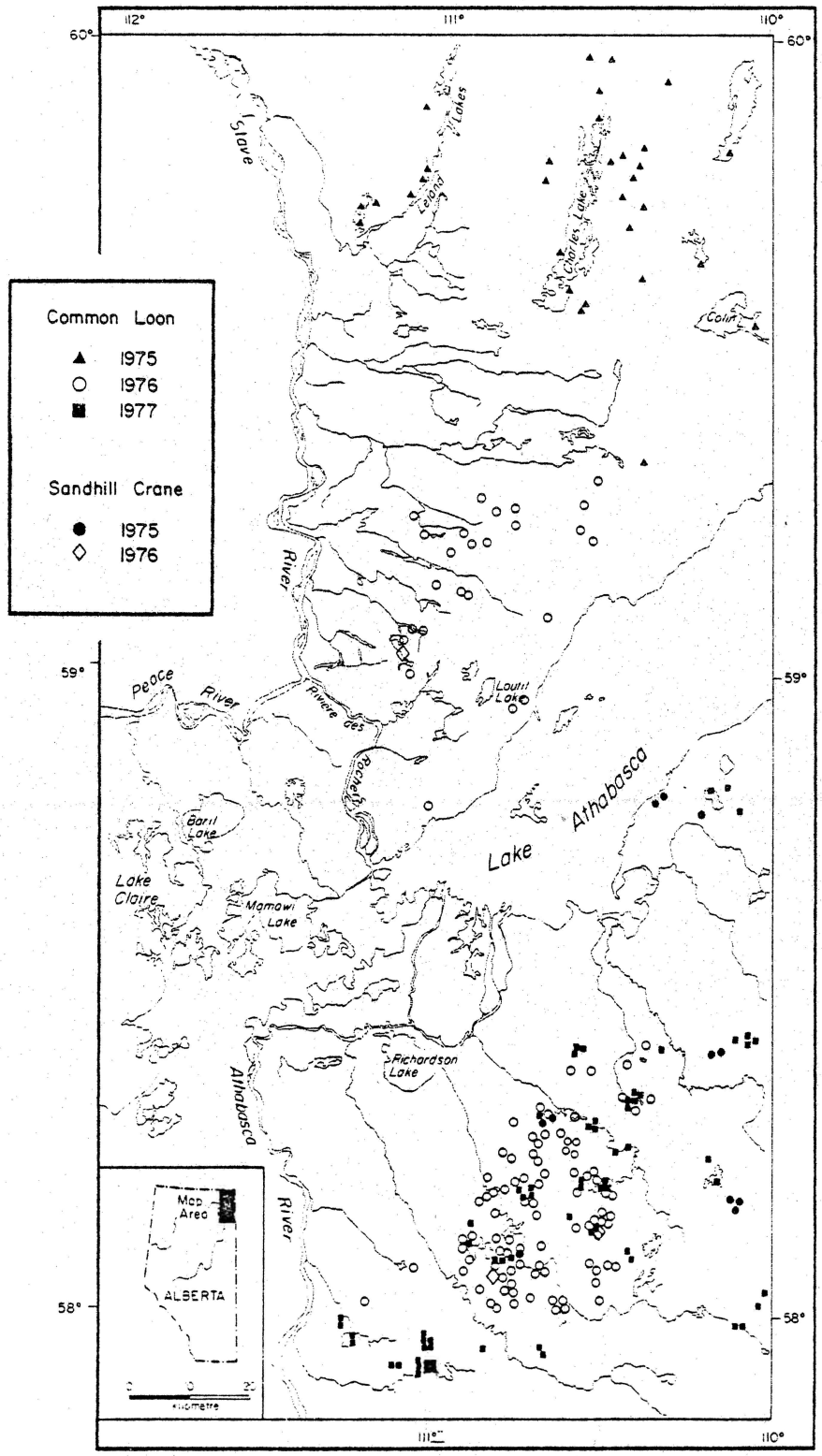

Figure 10. Distribution of Common Loon and Sandhill Crane in northeastern portion of the study area from 1975 to 1977.

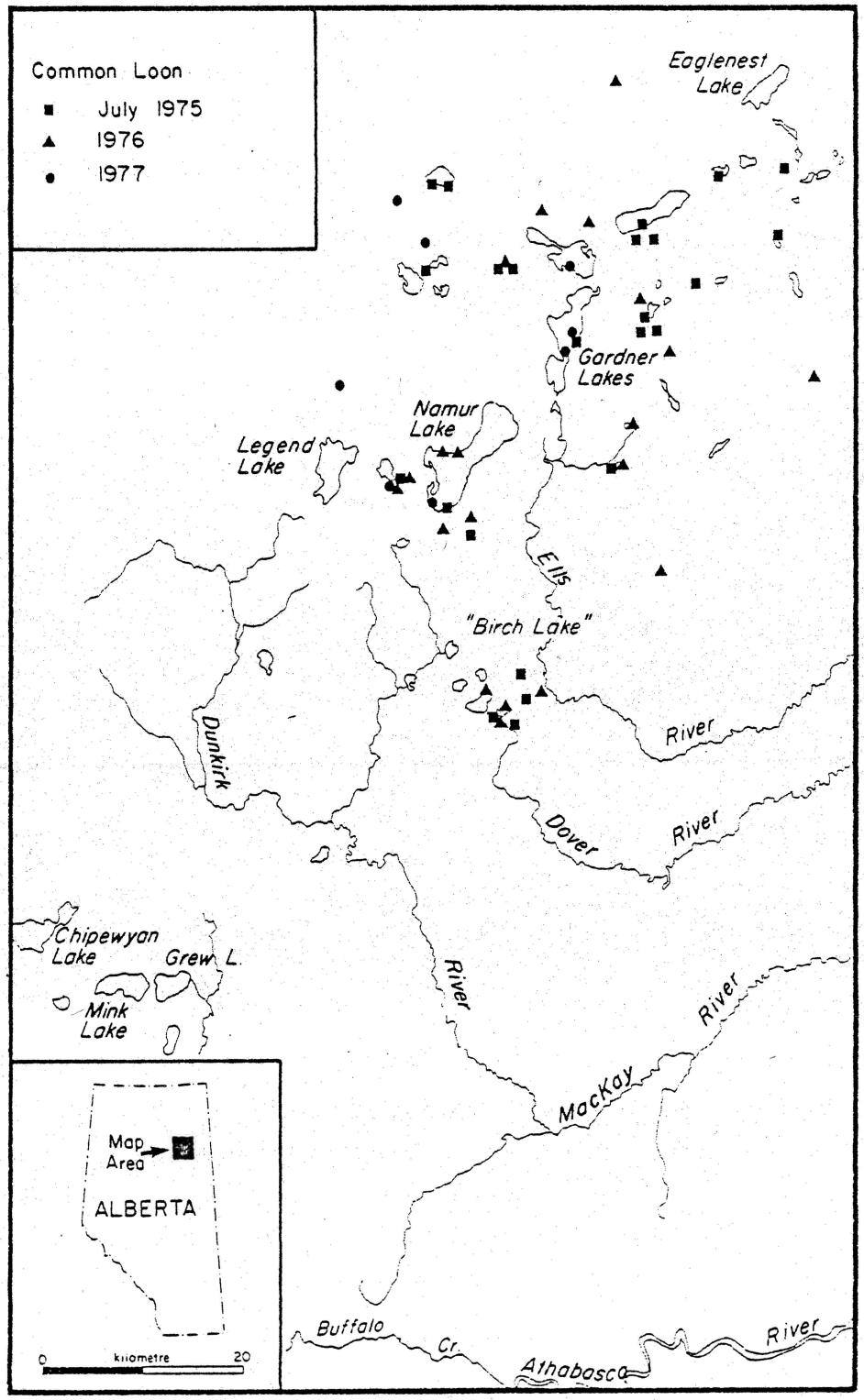

Figure 11. Distribution of Common Loon in the northwestern portion of the study area from 1975 to 1977.

the subsequent projected demand for recreational utilization of more remote areas, in future years we may expect a substantial decline of the once abundant Common Loon.

2.4.3.2 Sandhill Crane (*Grus canadensis*). This species is considered to be an uncommon breeder in the oil sands area, as only two pairs and ten individual sightings were reported in 1975 (Table 6). These were observed south of Lake Athabasca and were believed to be non-breeding birds. In 1976, only one pair, on the Maybelle River, and one single adult were observed (Figure 10). However, Hennan and Munson (1978) have reported that 55 individuals were observed incidentally during aerial waterfowl surveys in 1976 of selected oil sands wetlands.

Francis and Lumbis (1978) reported 1 breeding pair/km^2 on their mixed muskeg plot and 2 breeding pair/km^2 on tamarack fens. These studies involved extensive use of ground survey techniques. These authors suggest that specific habitats within the oil sands, tamarack fens and bogs for breeding and open habitats for foraging, support a considerable population of Sandhill Cranes.

These results indicate the inadequacy of aerial surveys for Sandhill Cranes, as they were utilized during the raptor surveys. The results further suggest that Sandhill Cranes are relatively abundant in the oil sands study area and occupy habitats (tamarack fens and bogs) which are projected for future destruction and will not be reclaimed. Therefore, the combination of habitat destruction and disturbance may have a negative effect on the Sandhill Crane population in the oil sands area. However, our current data base does not permit a quantitative estimate of the impact of oil sands development on the Sandhill Crane population nor does it permit informed mitigative measures to be suggested.

2.5 CONCLUSIONS

The primary objective of this study was to determine the breeding status and abundance of a number of several avian species within the AOSERP study area. The purpose for acquiring inventory data was two-fold:

1. To identify critical areas for rare, endangered and sensitive bird species which are potentially susceptible to disturbance from increased recreational activity; and
2. To document the baseline status for breeding populations of key avian species, so that periodic surveys could monitor population trends in response to disturbance.

For two major areas, Namur Lake and the jack pine sandplains south of Lake Athabasca, adequate data are available on successfully breeding raptors to provide reliable comparisons in future years. However, it is likely that the most informative indicator of environmental disturbance of the raptor population is reproductive success which is calculated by comparing the number of birds which initiate breeding to the number of young which are produced and eventually fledge. For the majority of the raptorial species investigated, reproductive success cannot be calculated due to insufficient data for the number of birds which initiate breeding. Thorough aerial and ground surveys during early spring (March-April) are required to determine the number of birds in this category.

The status of the four raptor species included in this report varies considerably, both in Alberta and throughout their ranges. Peregrine Falcons are seriously endangered in North America. The importance of the Alberta Peregrine population northwest of Lake Athabasca, coupled with its susceptibility to disturbance from human activity, has been documented as a result of breeding and foraging studies conducted in the area (Johnston-Beaver in prep.).

Ospreys and Golden Eagles were also uncommon in the survey area. It is unlikely that either species represents a substantial proportion of the population which breeds in Alberta. Nonetheless, declines of both species have occurred in widespread areas in the past and any further reduction of breeding numbers should be prevented. A concentration of Ospreys in the Namur Lake area would likely suffer severe disturbance from an increased

sport fishery but the remainder of the population and that of the Golden Eagle are unlikely to suffer increased disturbance from human activity.

A significant proportion of the Alberta population of breeding Bald Eagles was observed in the study area. Many of the lakes which possess ideal habitat for Bald Eagles also appear to be excellent for sport fishing. These two factors may indicate a significant potential conflict. Unlike many areas where human activity has increased slowly and the resulting disturbance of breeding Bald Eagles has been minimal (Mathison 1968; Buckle et al. 1970), the Athabasca Oil Sands area has received comparatively minor disturbance from outdoor recreational use. However, both the current rate of urbanization and that projected for the subsequent five years will increase the recreational demands on wilderness areas. Therefore, the Bald Eagle population in the AOSERP area is expected to experience a dramatic increase in disturbance. With our current data base it is impractical to predict the effect that this disturbance will have on this population of Bald Eagles. Aspects of breeding and foraging Bald Eagles will be dealt with in Section 3. However, because our current data base is insufficient, it is strongly recommended that further investigations be conducted into the behaviour of breeding and foraging eagles.

Colonial birds were observed in varying numbers between 1975 and 1977, depending on the intensity of the aerial survey. Three colonies of larids were located in the Namur Lake area and these were maintained at a relatively constant level from 1975 to 1977. Two colonies were formed by California Gulls and a third by Bonaparte's Gulls. The remaining observations of larids indicated a considerable fluctuation in colony location. Further data are required on the occurrence of these colonial species before the potential impact of disturbance can be assessed.

In 1976 White Pelicans established a new rookery on an island in a small lake located 13 km to the south of Namur Lake. Investigations into the breeding and foraging characteristics of

these birds is dealt with in considerable detail in Beaver et al. (in prep.). Potential impacts and management recommendations are discussed in considerable detail in the cited reports.

The Common Loon is abundant in the survey area. Because of the widespread distribution of loons and their consistent selection of remote lakes, the impact of disturbance may be minimal; however, this statement must be qualified by data from the literature indicating that the impact of development, and the resulting loss of suitable habitat, could force the loon progressively farther north in search of remote wilderness lakes.

The Sandhill Crane appears to be more numerous in the oil sands study area than indicated by the aerial surveys conducted from 1975 to 1977. Because the precise population density of Sandhill Cranes in the area cannot be determined from current data, the significance of the population on a regional or national basis cannot be evaluated. The impact of disturbance on these birds is difficult to assess as a pair of Sandhill Cranes successfully bred on the edge of the cleared area of Syncrude's lease in 1974 (Sharp et al. 1975) while the area was subjected to a considerable level of disturbance from heavy earthmoving equipment. Therefore, other than destruction of habitat, it is impossible to completely assess the total impact on Sandhill Cranes of oil sands development because there are just not sufficient data to make such an evaluation.

There are numerious aspects of rare, endangered and sensitive bird species breeding biology which remained unanswered. It would be valuable to determine the breeding phenology in detail for at least a small portion of the survey area. This would require frequent surveys spanning the entire breeding season. The Canadian Shield area has been surveyed only once and should receive more thorough investigation, particularily in view of its apparent importance to several species. The Bald Eagle population represents a substantial portion of the provincial breeding segment and also faces the most serious potential impact from the expected increase in recreational activity. Further investigations conducted

on Peregrine Falcons and White Pelicans would greatly improve the development of reasonable management recommendations.

The combination of the limitations inherent with aerial surveillance and the limited manhours and funding, which could be expended on this project over the three years, has kept successful completion of all the original 1975 objectives to a minimum; however, the surveys have indicated which of the species, present in the oil sands area and important on a regional or national basis, may suffer the most significant impact from oil sands development. The survey data have also served as a preliminary base from which to launch more intensive investigations into White Pelicans, Peregrine Falcons, and Bald Eagles. The data have also indicated areas which require further investigation in order to provide adequate management recommendations concurrent with the accelerated oil sands development.

3. ECOLOGY AND BEHAVIOUR OF BREEDING AND FORAGING BALD EAGLES

3.1 INTRODUCTION

Just over a decade ago, concern for the declining breeding populations of Bald Eagles in the contiguous United States was reaching a peak. Since that time, numerous studies have been conducted which were concerned with determining continental population numbers and distribution (Gerrard and Whitfield 1967; Gittens 1968; Whitfield et al. 1974; Hagar 1976; Grier 1977). Feeding habits, as determined by remains found at nests and winter roosts, have been extensively examined (Chrest 1965; Retfalvi 1965; Gittens 1968; Buckle et al. 1970; Sherrod et al. 1976). The effects of direct and indirect (e.g., pesticides) human disturbance have been examined to determine impact on local population numbers (Hancock 1966; Gittens 1968; Mathison 1968; Grier 1969; Belisle et al. 1972; Wiemeyer et al. 1972).

Yet, until recently (Bishoff and Fyfe 1976; Beaver 1977; Ealey 1978) there was very little known about the density and distribution of the substantial population of breeding Bald Eagles in northeastern Alberta. Knowledge of Bald Eagles foraging behaviour and patterns, in general, remains relatively incomplete despite numerous lists of prey species. Critical habitat features for breeding and foraging Bald Eagles vary among populations (Hensel and Troyer 1964; Retfalvi 1965; Whitfield et al. 1974; Gerrard et al. 1975). Therefore, local habitat features must be examined before one can understand the factors affecting the density and distribution of a particular population of Bald Eagles.

Similarly, the results of numerous investigations of the effects of direct and indirect human disturbance have varied widely for different populations of Bald Eagles. Because most of these studies have been conducted after the disturbance has occurred, there is very little information available to indicate the potential impact of human disturbance in an area previously unused.

Inventory surveys of the AOSERP study area (Figure 2) and adjacent areas of northeastern Alberta have identified a

substantial population of breeding Bald Eagles (Bishoff and Fyfe 1976; Beaver 1977; Ealey 1978). With the expansion of the oil sands processing plants, this region of Alberta will be subjected to a considerable increase in recreational and exploration activities. The response of nesting Bald Eagles to high levels of human disturbance has been documented elsewhere (Sprunt 1963; Gittens 1968), so that there was genuine concern regarding the adverse effects that may occur in northeastern Alberta. The significant, regionally important population of Bald Eagles, coupled with the concern regarding disturbance, prompted the present investigation.

The aim of this study, extended over three years, was to provide detailed information on breeding and foraging Bald Eagles in order to complement the surveys of their distribution and numbers (Bishoff and Fyfe 1976; Beaver 1977; Ealey 1978).

The specific objectives of the project were:

1. To determine foraging characteristics and patterns of Bald Eagles within the AOSERP study area; and
2. To determine the habitat requirements of Bald Eagles with particular emphasis on critical areas and develop an annotated list of characteristics that define the habitat of this species and which will be suitable for mapping potential habitats from aerial photographs and ground surveys.

However, due to the late start and restricted time allocation (a portion of two months in 1977), very few of the objectives were attempted, much less completed. Furthermore, the behavioural data are by no means rigorous as the location of the breeding pair selected for study restricted the quantity and quality of the data which could be collected.

Due to responsibilities to concurrent projects, the investigators were forced to conduct the Bald Eagle field investigation in the Namur Lake area in 1977, where only one pair of Bald Eagles successfully bred during that year. The location of the nest precluded selection of an adequate observation location,

therefore the investigators were forced to detail Bald Eagle breeding behaviour when they were unable to directly observe the nest. Also, observations commenced after site selection and nest construction, breeding, egg laying, incubation, and hatching had occurred.

3.2 DESCRIPTION OF STUDY AREA

Intensive studies of a breeding pair of Bald Eagles were conducted on Namur Lake in northeastern Alberta. Casual observations of Bald Eagles were conducted throughout the Birch Mountains on the Upper and Lower Gardiner lakes and Big Island Lake (Figure 2).

For a detailed description of the general study area refer to Section 2.2.

3.3 METHODOLOGY

Two five-day observation periods were conducted (13 to 17 July and 6 to 10 August 1977) on the lone breeding pair of Bald Eagles on Namur Lake. A total of 44 hours of observation were accumulated during the 10 days of intensive studies. Observations of the nest area were conducted from an observation blind located on an island to the south and east of the nest. This island afforded very poor visibility of the nest itself but an acceptable view of the immediate area including perch trees which were located in close proximity to the nest. Observations from the blind were conducted utilizing a spotting scope mounted on a tripod. The data collected during each observation period were recorded on a portable tape recorder and later transcribed. Three two-hour observation periods were attempted each day: morning, afternoon, and evening; however unfavourable weather conditions occasionally disrupted this time allocation. Once each day, the entire Namur Lake shoreline was surveyed by motorboat to determine the location of perch trees and the breeding pair of Bald Eagles when they were not at the nest site.

Prey remains were recorded during visits to the nests. Other prey items were determined from observations of foraging Bald Eagles. Perch trees and nest trees were recorded and mapped

for Namur Lake, the Gardiner Lakes, and Big Island Lake (local name). Characteristics of nest trees were recorded during aerial surveys and visitations. The height and diameter, at breast height, of both perch trees and nest trees were estimated. The responses of Bald Eagles to various forms and levels of disturbance were documented. Interspecific interactions, both prey-related and others, were recorded to outline the ecological inter-relationships of Bald Eagles with the fauna in their breeding habitat.

Data on foraging behaviour and habitat requirements were also obtained during 1977 aerial and ground surveys for rare, endangered, and sensitive birds in northeastern Alberta (Ealey 1978).

3.4 RESULTS AND DISCUSSION

3.4.1 Nesting Behaviour

3.4.1.1 Phenology. The 1977 breeding period was outlined by age estimates of developing nestlings. These estimates were made during visits to the nest to band young or during observations from the air. At the time of the 5 to 11 July survey, most of the young Bald Eagles were 2 to 4 weeks from fledging, while by the mid-August survey most of these had fledged. Nestling development encompasses 9 to 12 weeks, from hatch to fledging (Gerrard et al. 1973), while incubation generally takes 34 to 35 days (Herrick 1929, 1933; Bent 1937; Hensel and Troyer 1964). By backdating, it was determined that most eggs hatched between 10 and 24 May, and that most eggs were laid between 5 and 19 April, during 1977.

In northern Saskatchewan, where Bald Eagles are not winter residents, the first arrival dates precede egg-laying by at least 3 weeks (Gerrard et al. 1975). Aerial surveys have not been conducted in northeastern Alberta during early April to document arrival dates and the dates of nest initiation. Both of these critical periods in the breeding phenology of Bald Eagles are related to subsequent reproductive success (Gerrard et al. 1975).

It is not possible to determine accurately whether there has been any variation in Bald Eagle breeding phenology from 1975 to 1977, yet the timing of breeding events is of central importance to the development of management recommendations. In the past, accurate determination of the age of nestling Bald Eagles has been difficult because good descriptive or mensural classifications were not widely published. A series of sketches and photographs of developing Bald Eagles should be compiled to provide a standard of comparison for all subsequent survey personnel.

3.4.1.2 Features of Nest Trees. A number of features of nest trees and the surrounding habitat were recorded for each nest site photographed. Bald Eagles generally chose live jack pine (*Pinus banksiana*) and spruce (*Picea* spp.) trees, although some nests were located in trembling aspen (*Populus tremuloides*) and a few were in dead or dying trees (Table 7). The estimated heights of nest trees ranged from 7.5 to 20 m, while the height of nests above the ground ranged from 6.5 to 17 m. The estimated diameter of the nest trees, at breast height, ranged from 30 to 75 cm. Although only productive nest trees were measured, the relationship of the nest to the tree top was determined for all nests photographed; of these, 18 nests were located at the top of the tree, 23 in the top quarter, 15 in the top third, and two in the top half. Clearly, Bald Eagles preferred nesting in the upper parts of the selected tree, thereby reducing the vulnerability of the young to terrestrial predators and, more importantly, providing a relatively accessible landing pad for the adults when laden with prey. In general, nest trees tended to be taller and thicker in comparison to the surrounding trees.

Nests were generally located within 200 m of a lake shore. Over 80% of the nest trees were 50 m or less from water (Figure 12). This agrees rather closely with Bald Eagle nests in northern Saskatchewan (Whitfield et al. 1974).

Most nest trees were located on islands and peninsulas, while a few were located on small points of the lake shoreline and

Table 7. Species of trees selected as nest sites by Bald Eagles (*Haliaeetus leucocephalus*) in the Birch Mountain region of northeastern Alberta during 1977.

Species	No. of Nests in Alive Trees	No. of Nests in Dead Trees
Jack pine (*Pinus banksiana*)	23	5
Spruce (*Picea* spp.)	20	2
Trembling Aspen (*Populus tremuloides*)	7	1
TOTAL	50	8

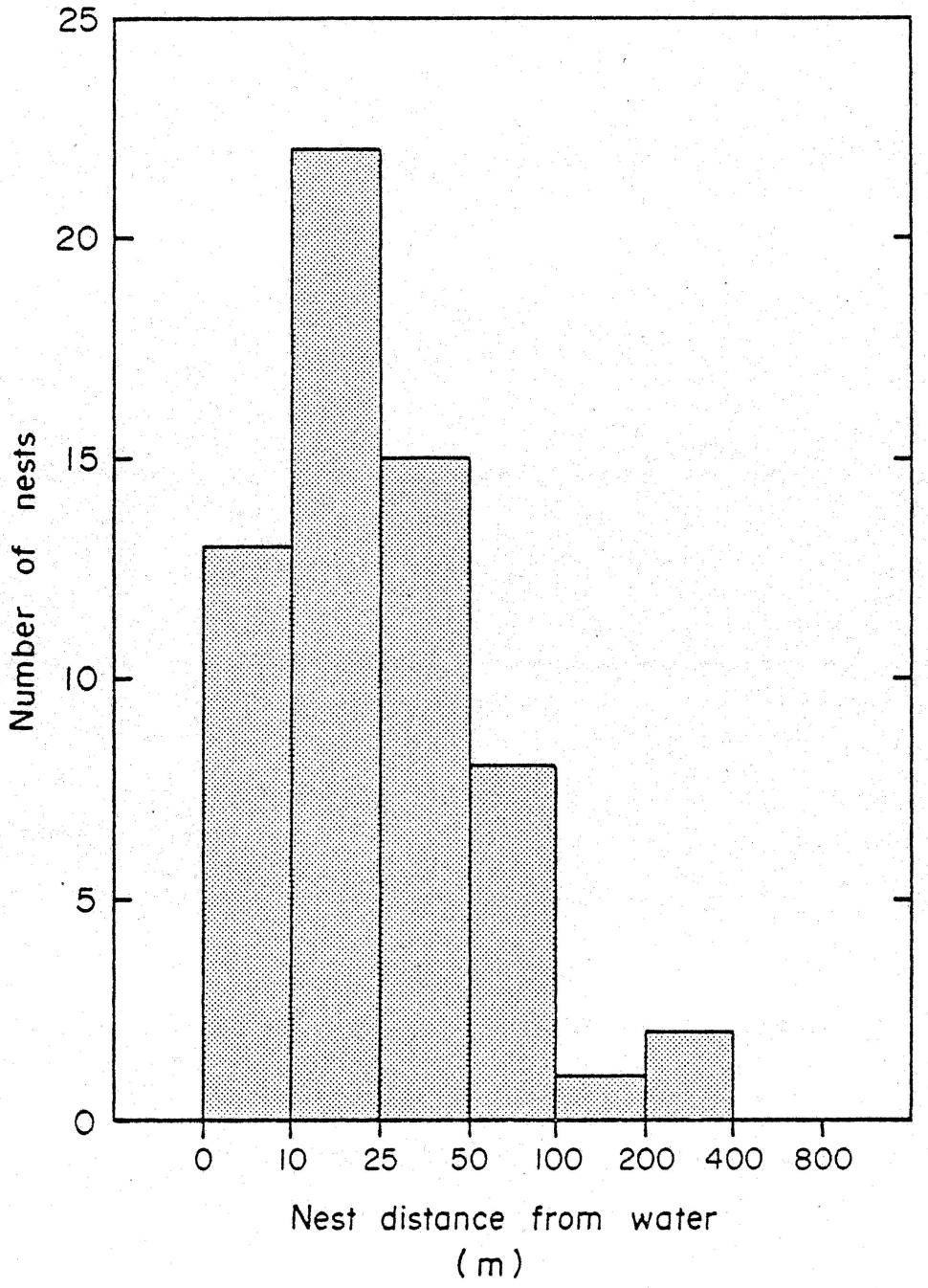

Figure 12. Distance from a body of water for all Bald Eagle nests surveyed in northeastern Alberta during 1977.

far inland (200 m or more from the water) (Figure 13). A higher proportion of active nests were located on islands and peninsulas than on mainland, while the reverse situation applied to a majority of inactive nests.

Most of the inactive nests were classified as potential nests and were identified in structure to active Bald Eagle nests. A few inactive nests were actually alternates for pairs that bred successfully at nearby nests. Two criteria were used to classify nests as alternates: those located within 2 km of a productive nest, and those observed to have been previously active. The preference for island or peninsula situations as breeding sites may reflect greater availability of perch trees located near the nest and the greater accessibility of the nest to adults approaching from any direction. This latter feature may be particularly important to prey-laden parents returning against variable wind directions.

3.4.1.3 Nesting Behaviour in the Birch Mountains. Observations were conducted at the Namur Lake nest site for two one-week periods. These observations helped outline basic activity patterns and behaviours of breeding Bald Eagles; however, because the Namur Lake nest tree was not visible from the water, it was difficult to determine when the adults were perched on or near the nest tree. Several times during long periods of observation it was apparent that, while there was no activity near the nest, at least one of the adults was perched nearby. Even when continuously visible, the adults were not often active; they would spend much time motionless on specific perch trees which were located near the nest or along the lake shore. Preening was the only major activity exhibited by the adults in addition to resting and feeding the young. Foraging behaviour and disturbance responses are discussed below.

The Namur Lake nest site was the only productive one within easy access to a base camp on Upper Gardiner Lake. Most easily observable sites on undisturbed lakes would provide better opportunities to record the baseline behavioural data required.

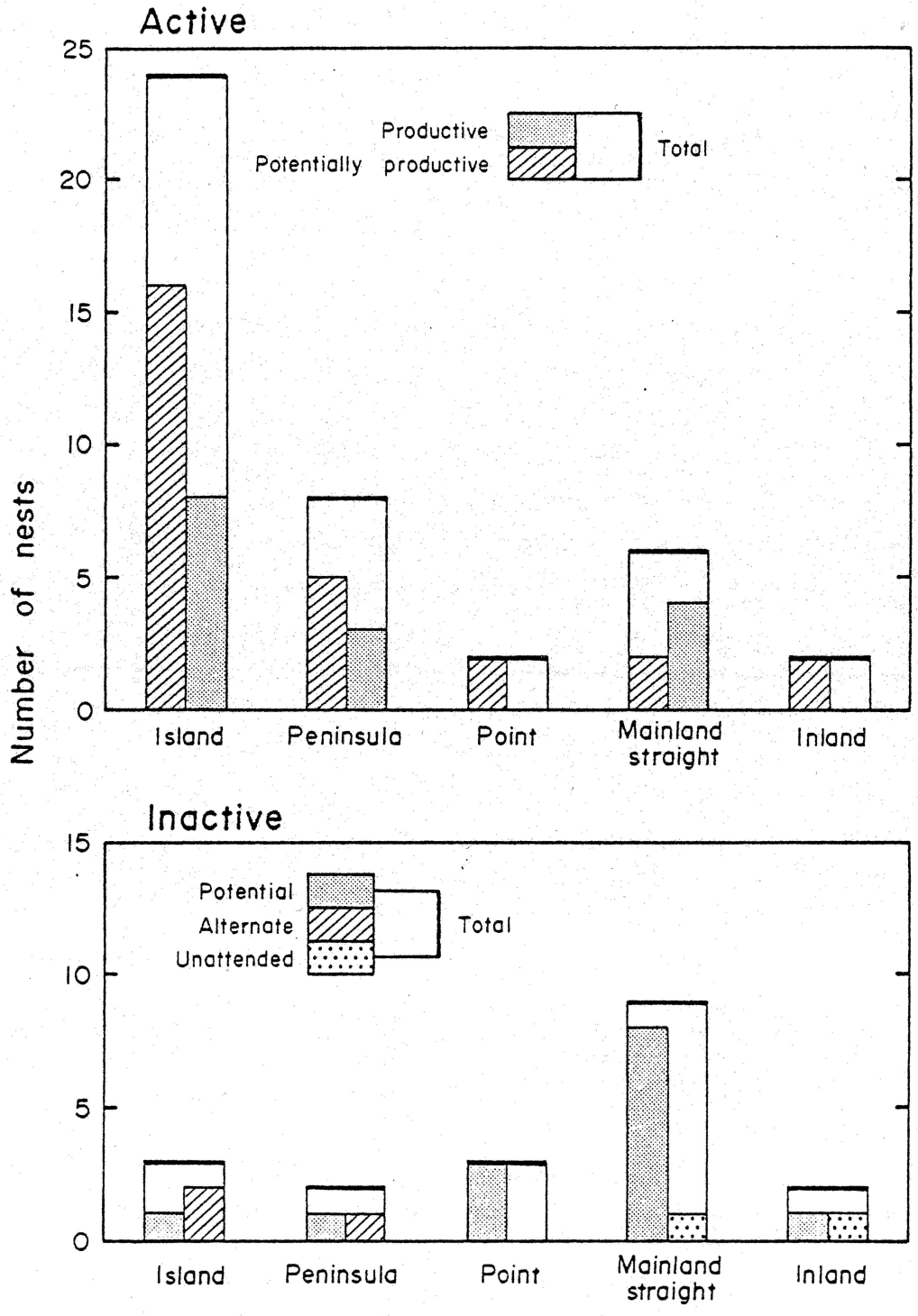

Figure 13. Geographical location, relative to nearest waterbody, for all Bald Eagle nest sites surveyed in 1977.

It is necessary to know the amount of time adult Bald Eagles spend tending to their young, perching in the nest area, maintaining plumage, and foraging; such knowledge will help indicate the potential impact of disturbance during breeding.

3.4.2 Foraging

3.4.2.1 Perch Tree Distribution. The majority of Bald Eagle foraging in the Birch Mountains commenced from perch trees situated along shorelines. Observations of the breeding Bald Eagle pair at Namur Lake revealed a very large home range, consisting of the entire lake surface of about 4370 ha, and outlined by perch trees (Figure 14). Hensel and Troyer (1964), using linear distance between nest sites and perch trees, found that 14 territories on Kodiak Island, Alaska averaged 23.1 ha. Retfalvi (1965) mapped "available area" for breeding pairs on San Juan Island and determined the average to be 3028 ha but this is likely a considerable over-estimate of home range. In northern Saskatchewan, the estimated size of home range varied from 129 to 866 ha (Buckle et al. 1970). The Namur Lake home range was considerably larger than the lake area which provided home ranges for non-breeding Bald Eagles on the Gardiner Lakes (Figure 15) and Big Island Lake (Figure 16). The home range may have been expanded to fill the available surface area of Namur Lake because of the absence of other nests. It would be valuable to know whether Bald Eagles throughout northeastern Alberta are generally confined to the nesting lake or whether they are forced to travel between lakes when the nesting lake is a certain minimum size due to food availability.

Numerous observations were made of non-breeding Bald Eagles perched on trees on Big Island Lake (local name--lake directly north of Gardiner Lake) and the Gardiner Lakes (Figures 15 and 16). There was a definite preference to perch either on or near nest trees which may reflect either the initial suitability of the nest location for foraging or the suitability of the nest

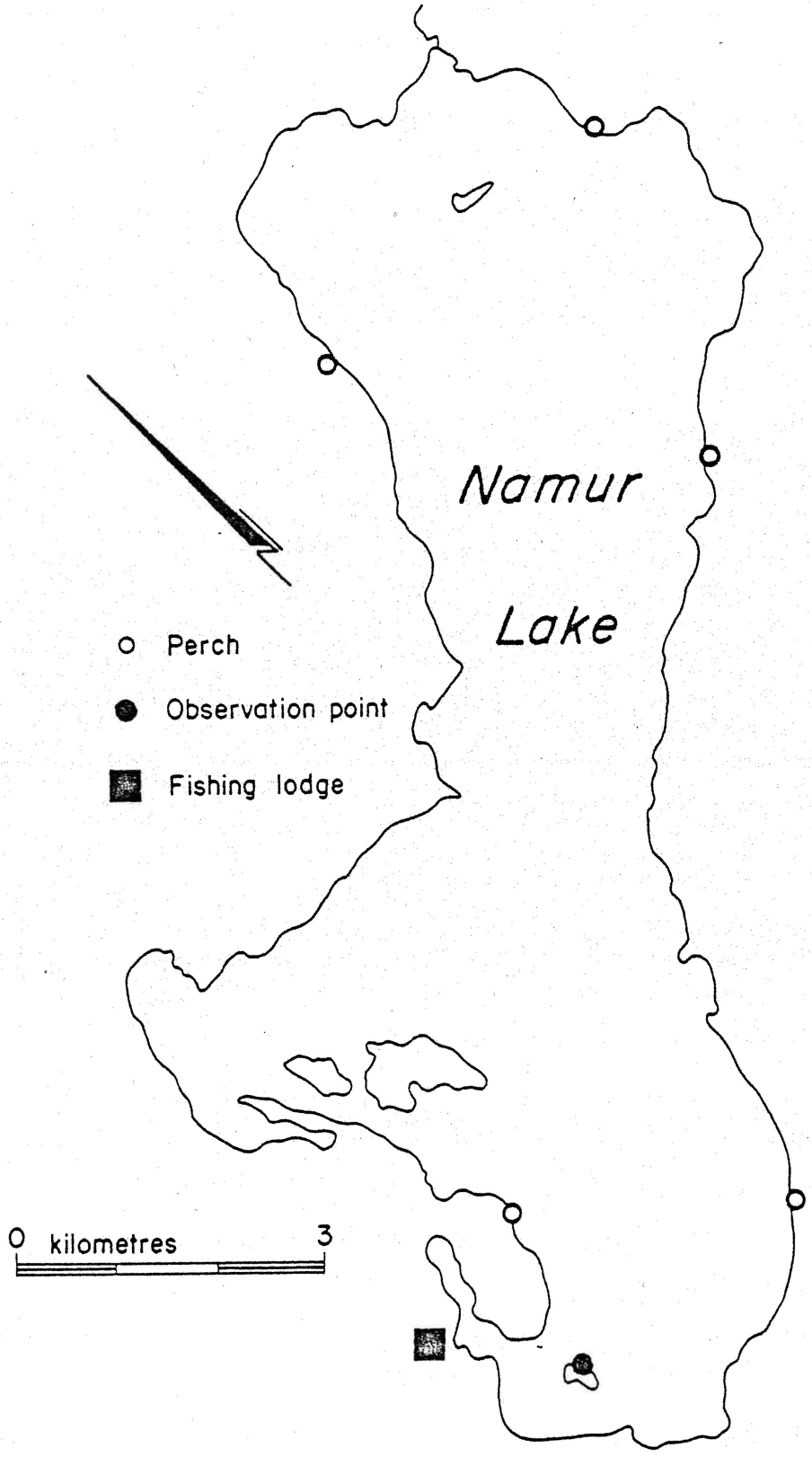

Figure 14. Perch tree distribution for breeding pairs of Bald Eagles on Namur Lake during 1977.

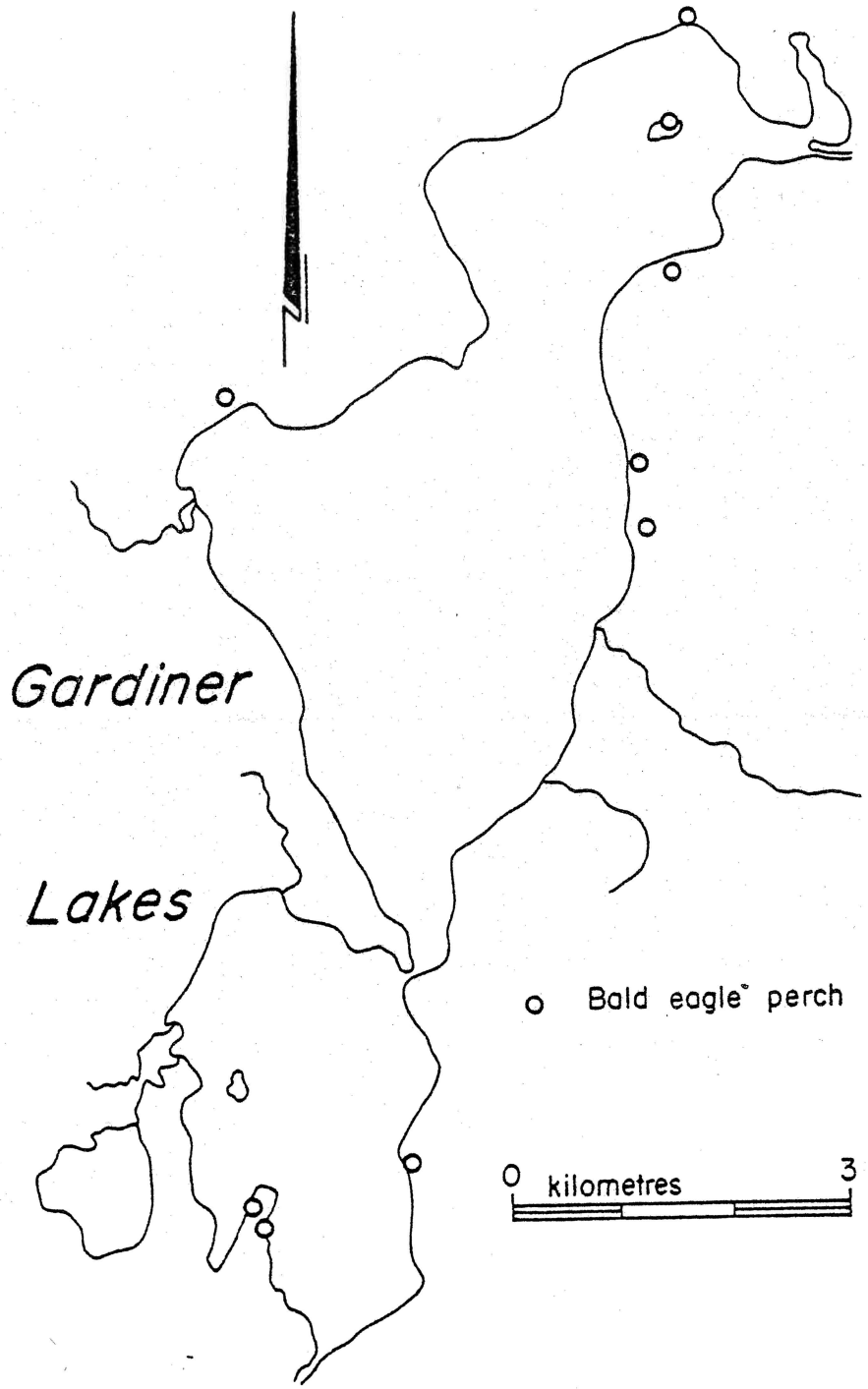

Figure 15. Perch tree distribution for non-breeding adult and immature Bald Eagles on the Gardiner Lakes during the late summer of 1977.

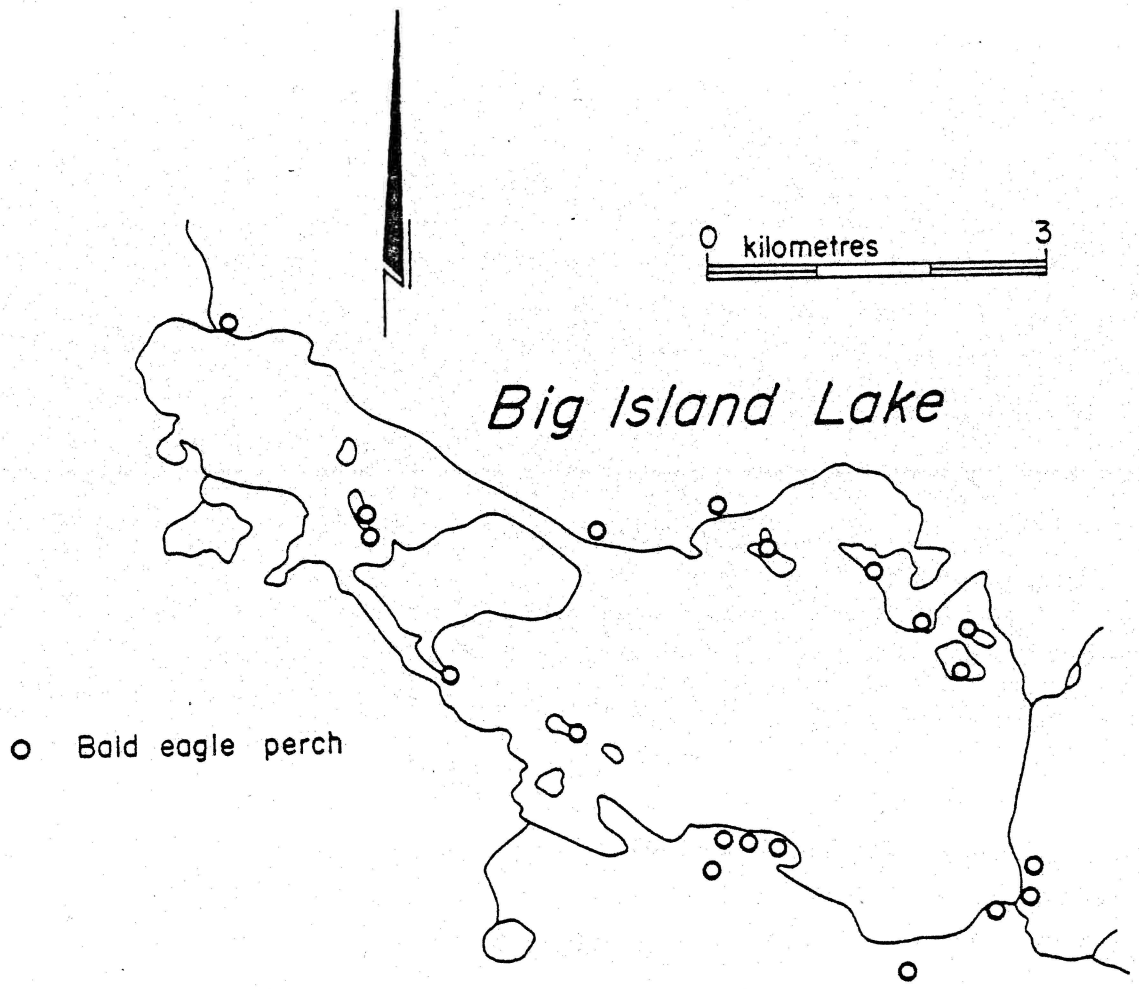

Figure 16. Perch tree distribution for non-breeding adult and immature Bald Eagles on Big Island Lake during the late summer of 1977.

as a preening or feeding perch. Several of the nests on Big Island Lake and the Gardiner Lakes had fresh nesting material deposited in the centre which indicated some nesting behaviour although apparently no eggs were laid at these sites during 1977. The other perch locations may have been suitable for both foraging for fish and watching for loafing waterfowl during their migration.

It would be useful to further examine the location and physical features of perch trees. For example, a change in use of particular perches over the summer might occur, possible reflecting a change in foraging preferences. Furthermore, a classification of perch tree characteristics could indicate the availability and suitability of trees for use as foraging perches. As a result, critical habitat could perhaps be more clearly ascertained.

3.4.2.2 Prey Items. Fish were by far the most frequent prey of Bald Eagles as only two of the 15 productive nests examined in 1977 contained prey remains other than fish (Ealey 1978). At one nest, the prey remains consisted exclusively of numerous gull wings and feathers that were widely scattered below the nest tree. Below another nest, a single merganser (*Mergus* spp.) skull was found. A Burbot (*Lota lota*), about 37 cm long, and two Lake Whitefish (*Coregonus clupeaformis*) were observed in the Bald Eagle nest on Namur Lake. In addition, a non-breeding adult Bald Eagle was observed to catch a Lake Whitefish or Cisco (*Coregonus artedii*) at Big Island Lake. Also, a juvenile Bald Eagle chased an Osprey and robbed it of its prey, either a Lake Whitefish or a Cisco.

Other studies indicate the importance of fish in the diet of breeding Bald Eagles (Krog 1953; Bortolotti et al. 1977); however, the wide range of prey items taken indicates a generally opportunisitic mode of foraging (Murie 1940, 1959; Retfalvi 1970; White et al. 1971; Sherrod et al. 1976). It would be useful to determine the importance of various prey items in the diets of Bald Eagles breeding elsewhere in the AOSERP and adjacent areas surveyed. Detailed breeding behaviour studies would accomplish this and provide data for determining what conflicts may arise

between breeding and foraging Bald Eagles and recreational use of lakes where nesting occurs.

3.4.3 Interspecific Interactions

The Namur Lake breeding pair of Bald Eagles was observed to actively harass other avian species which venture too close to the nest site.

At least three times, an immature Bald Eagle was observed perched on a rock at the west end of a long spit on Big Island Lake. This spit was a favorite loafing bar of the White Pelican (*Pelecanus erythrorhynchos*). At each arrival of the Bald Eagle, the pelicans flushed to the east side of the spit, either crowding one another or jumping into the water. Bald Eagles were also observed perching on trees near other pelican loafing bars. It seems unlikely that the Bald Eagle would be actively preying on such large birds, although pelicans have been found in Bald Eagle nests (Broley 1952); it is more likely that the eagles were watching for opportunities to scavenge or perhaps rob a fish from the pelicans near the loafing bar.

3.4.4 Effects of Disturbance

By observing closely the response of Bald Eagles to our occasional approaches during research activities and to the disruption attributed to fishermen and aircraft, it was apparent that Bald Eagles in the Birch Mountains were responding to low disturbance or activity levels.

Bald Eagles that were perched on trees along the shoreline almost invariably flushed if a boat passed within 200 m. The adults at the Namur Lake nest did not flush when a boat was driven quickly past the nest area. Boats stopping or slowly passing the nesting area caused the birds to flush off the nest or nearby perch trees. The rare exceptions occurred when the adults were on perches that provided a clear view of both the approaching boat and the nest and therefore did not flush.

Approach to the nest on foot was sufficient to induce the adults to flush and begin alarm vocalizations, and consequently the nest site was only approached when the adults were foraging elsewhere. In one instance, the returning adult did not detect the observer for several minutes and, even after detecting the hidden intruder, the bird did not flush. A few boat approaches caused no response during the late nestling stage, whereas, previously, the same levels of disturbance elicited flushing from the nest by adults.

In some areas, Bald Eagles appeared to have a breeding distribution that was positively correlated with low human activity (Retfalvi 1965) or a reduced breeding success directly attributed to human disturbance (Gittens 1968). In other areas, individuals appeared relatively tolerant (Mathison 1968).

Extensive controlled disturbance studies have not been carried out on undisturbed populations of Bald Eagles. Most of the data on disturbance come after the fact; therefore, often it is difficult to determine cause and effect at that stage. From anecdotal references and the extreme responses of Bald Eagles to some experimental disturbance (Gittens 1968; Bortolotti et al. 1976), it is clear that different populations have different basic responses to human activity. To examine the potential impact of disturbance on Bald Eagles in northeastern Alberta, it is important to examine the responses of breeding birds to present levels of disturbances, but also to attempt to approach the potential levels of disturbance through further controlled experimental study of breeding and foraging behaviour.

3.4.5 Critical Habitat Criteria

3.4.5.1 General Features.

1. Close proximity to water--almost exclusively lakes.
2. Absence of a high degree of human activity within the home range of a breeding pair.

3.4.5.2 Nesting Habitat.

1. Presence of islands, peninsulas and suitable straight shoreline for nest sites.
2. Availability of suitable nest trees (jack pine, spruce or trembing aspen). These trees should be alive, tall (7.5 to 20 m) and broad (30 to 75 cm, diameter at breast height). All nest trees generally provided sturdy branches near the top for support of large, heavy nests and generally were located within 200 m of a body of water.

3.4.5.3 Foraging Habitat.

1. Presence of suitable perch trees, generally taller than surrounding forest, close to shoreline and usually near shallows of bays, channels, river mouths, or island shores.
2. Presence of suitable prey species, primarily fish, and suitable water clarity in order to see fish.

3.5 SUMMARY

The breeding phenology of Bald Eagles in northeastern Alberta was based upon estimates of ages of young. Peak spring arrival likely occurred near the end of March. Peak laying occurred from about 5 to 19 April, followed by peak hatching from 10 to 24 May.

Active nest trees were observed in many locations, but were generally located on islands or peninsulas and within 200 m of water. The nest trees themselves were generally tall, broad, pine, spruce, or aspen.

Some preliminary observations of Bald Eagle breeding behaviour revealed how generally inactive the birds were. The greater proportion of time was spent perching either near the nest tree or at a foraging perch. The perch trees are valuable in outlining the home range of the breeding pair; however, there is currently only information regarding the home range of the Namur

Lake breeding pair and that area (4370 ha) is likely considerably larger than the average home range.

Prey taken by Bald Eagles consisted primarily of fish (Burbot, Lake Whitefish, Cisco), but also included gulls and a merganser. Robbing of an Osprey was observed once. Preliminary conclusions suggest that Bald Eagles exhibit an opportunist mode of foraging.

Bald Eagles chased and were chased by ravens and larids. Ospreys would not tolerate Bald Eagles near the former's nest. The eagles were occasionally associated with White Pelicans but the purpose was unclear.

Bald Eagles of northeastern Alberta appeared responsive to human disturbance. Boats and aircraft caused birds to flush from perches when they passed too closely. Approaches to the nest on foot frequently resulted in agitation of the adults for several minutes.

Therefore, considering the methodological limitations imposed upon this project, the primary function of this preliminary investigation has been to identify areas of Bald Eagle breeding and foraging behaviour which must be extensively examined before an adequate and informed set of criteria can be established to evaluate and mitigate for the direct and indirect impacts on Bald Eagles of oil sands development. The acquisition of the data must predate any useful and significant management stategies which may be developed for this wildlife resource.

3.6 RECOMMENDATIONS

1. Detailed research into the foraging and breeding activities of Bald Eagles in northeastern Alberta should be promoted. Because of the identification of a substantial population of Bald Eagles in this area, and the susceptibility of these birds to disturbance by outdoor sportsmen, it is necessary to establish baseline data on habitat use before management recommendations can be formulated.

2. The timing of breeding events is essential in outlining times with regard to disturbance; therefore, breeding phenology must continue to be monitored, in order to determine the distribution patterns over a period of several years. A file of photographs and sketches of known-age young should be compiled to standardize age estimates.
3. Bald Eagles select nest trees with a range of features. Refinement of the classification and analysis of such features would identify the critical characteristics. The nest trees in the Canadian Shield, north of Lake Athabasca, should be examined to determine if the critical features vary from the nest trees elsewhere in northeastern Alberta.
4. The degree to which breeding Bald Eagles are disturbed by recreational activities should be examined. To date most studies have been on disturbed populations of Bald Eagles. By examining an undisturbed population, the conducting of controlled disturbance experiments and observing the results, it would be possible to assess the effects of potential disturbance more critically. It may be that low levels of disturbance may be sufficiently disruptive to cause reduced breeding success through inadequte care of young. A controlled disturbance study should be able to indicate the critical levels of disturbance to be avoided, the most stressful periods of the breeding season, the nature of any buffer zone that is required, and other steps that are needed to mitigate the effects of human activity on breeding Bald Eagles.

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5. APPENDIX

5.1 REPORTING LOCATIONS OF RAPTOR NEST SITES

Environment Canada Environnement Canada

MEMORANDUM NOTE DE SERVICE

DATE October 18, 1978

FROM: DE:
Head, Migratory Birds Ecological Assessment
Canadian Wildlife Service
Western and Northern Region
Edmonton, Alberta

Our file Notre référence
WLU 401-4
AOSERP

Your file Votre référence

TO: À:
FILE

SUBJECT: SUJET:
REPORTING EXPLICIT LOCATIONS OF BALD EAGLE AND FALCON NEST SITES AS PER AOSERP/CWS AGREEMENTS.

Discussed to above with D. Neave, Alberta Fish and Wildlife this morning who agrees with our stand as per the above, as follows:

- study area may be included as a map in reports;
- specific nest sites shall not be identified;
- specific nest sites may be identified as a number or by similar identifier in the report by shall not be shown on a map or by any means whereby a site could be readily identified;
- for the purposes of a report nest sites may be generalized by shading that covers several km^2 with nest site(s) located randomly within the shading;
- shading or any means of indicating nest sites does not have to be used;
- nest sites are confidential and shall not be identified in manuscripts, papers, notes, reports and so forth intended for general public distribution.

The foregoing was confirmed this date with Mr. Stu Grant, AOSERP management.

S.E. Stephansson

c.c.: D.C. Surrendi
B. Munson
R. Fyfe

6. AOSERP RESEARCH REPORTS

1.		AOSERP First Annual Report, 1975
2.	AF 4.1.1	Walleye and Goldeye Fisheries Investigations in the Peace-Athabasca Delta--1975
3.	HE 1.1.1	Structure of a Traditional Baseline Data System
4.	VE 2.2	A Preliminary Vegetation Survey of the Alberta Oil Sands Environmental Research Program Study Area
5.	HY 3.1	The Evaluation of Wastewaters from an Oil Sand Extraction Plant
6.		Housing for the North--The Stackwall System
7.	AF 3.1.1	A Synopsis of the Physical and Biological Limnology and Fisheries Programs within the Alberta Oil Sands Area
8.	AF 1.2.1	The Impact of Saline Waters upon Freshwater Biota (A Literature Review and Bibliography)
9.	ME 3.3	Preliminary Investigations into the Magnitude of Fog Occurrence and Associated Problems in the Oil Sands Area
10.	HE 2.1	Development of a Research Design Related to Archaeological Studies in the Athabasca Oil Sands Area
11.	AF 2.2.1	Life Cycles of Some Common Aquatic Insects of the Athabasca River, Alberta
12.	ME 1.7	Very High Resolution Meteorological Satellite Study of Oil Sands Weather: "A Feasibility Study"
13.	ME 2.3.1	Plume Dispersion Measurements from an Oil Sands Extraction Plant, March 1976
14.		
15.	ME 3.4	A Climatology of Low Level Air Trajectories in the Alberta Oil Sands Area
16.	ME 1.6	The Feasibility of a Weather Radar near Fort McMurray, Alberta
17.	AF 2.1.1	A Survey of Baseline Levels of Contaminants in Aquatic Biota of the AOSERP Study Area
18.	HY 1.1	Interim Compilation of Stream Gauging Data to December 1976 for the Alberta Oil Sands Environmental Research Program
19.	ME 4.1	Calculations of Annual Averaged Sulphur Dioxide Concentrations at Ground Level in the AOSERP Study Area
20.	HY 3.1.1	Characterization of Organic Constituents in Waters and Wastewaters of the Athabasca Oil Sands Mining Area
21.		AOSERP Second Annual Report, 1976-77
22.		Alberta Oil Sands Environmental Research Program Interim Report to 1978 covering the period April 1975 to November 1978
23.	AF 1.1.2	Acute Lethality of Mine Depressurization Water on Trout Perch and Rainbow Trout
24.	ME 1.5.2	Air System Winter Field Study in the AOSERP Study Area, February 1977.
25.	ME 3.5.1	Review of Pollutant Transformation Processes Relevant to the Alberta Oil Sands Area

26.	AF 4.5.1	Interim Report on an Intensive Study of the Fish Fauna of the Muskeg River Watershed of Northeastern Alberta
27.	ME 1.5.1	Meteorology and Air Quality Winter Field Study in the AOSERP Study Area, March 1976
28.	VE 2.1	Interim Report on a Soils Inventory in the Athabasca Oil Sands Area
29.	ME 2.2	An Inventory System for Atmospheric Emissions in the AOSERP Study Area
30.	ME 2.1	Ambient Air Quality in the AOSERP Study Area, 1977
31.	VE 2.3	Ecological Habitat Mapping of the AOSERP Study Area: Phase I
32.		AOSERP Third Annual Report, 1977-78
33.	TF 1.2	Relationships Between Habitats, Forages, and Carrying Capacity of Moose Range in northern Alberta. Part I: Moose Preferences for Habitat Strata and Forages.
34.	HY 2.4	Heavy Metals in Bottom Sediments of the Mainstem Athabasca River System in the AOSERP Study Area
35.	AF 4.9.1	The Effects of Sedimentation on the Aquatic Biota
36.	AF 4.8.1	Fall Fisheries Investigations in the Athabasca and Clearwater Rivers Upstream of Fort McMurray: Volume I
37.	HE 2.2.2	Community Studies: Fort McMurray, Anzac, Fort MacKay
38.	VE 7.1.1	Techniques for the Control of Small Mammals: A Review
39.	ME 1.0	The Climatology of the Alberta Oil Sands Environmental Research Program Study Area
40.	WS 3.3	Mixing Characteristics of the Athabasca River below Fort McMurray - Winter Conditions
41.	AF 3.5.1	Acute and Chronic Toxicity of Vanadium to Fish
42.	TF 1.1.4	Analysis of Fur Production Records for Registered Traplines in the AOSERP Study Area, 1970-75
43.	TF 6.1	A Socioeconomic Evaluation of the Recreational Fish and Wildlife Resources in Alberta, with Particular Reference to the AOSERP Study Area. Volume I: Summary and Conclusions
44.	VE 3.1	Interim Report on Symptomology and Threshold Levels of Air Pollutant Injury to Vegetation, 1975 to 1978
45.	VE 3.3	Interim Report on Physiology and Mechanisms of Air-Borne Pollutant Injury to Vegetation, 1975 to 1978
46.	VE 3.4	Interim Report on Ecological Benchmarking and Biomonitoring for Detection of Air-Borne Pollutant Effects on Vegetation and Soils, 1975 to 1978.
47.	TF 1.1.1	A Visibility Bias Model for Aerial Surveys for Moose on the AOSERP Study Area
48.	HG 1.1	Interim Report on a Hydrogeological Investigation of the Muskeg River Basin, Alberta
49.	WS 1.3.3	The Ecology of Macrobenthic Invertebrate Communities in Hartley Creek, Northeastern Alberta
50.	ME 3.6	Literature Review on Pollution Deposition Processes
51.	HY 1.3	Interim Compilation of 1976 Suspended Sediment Date in the AOSERP Study Area
52.	ME 2.3.2	Plume Dispersion Measurements from an Oil Sands Extraction Plan, June 1977

53.	HY 3.1.2	Baseline States of Organic Constituents in the Athabasca River System Upstream of Fort McMurray
54.	WS 2.3	A Preliminary Study of Chemical and Microbial Characteristics of the Athabasca River in the Athabasca Oil Sands Area of Northeastern Alberta
55.	HY 2.6	Microbial Populations in the Athabasca River
56.	AF 3.2.1	The Acute Toxicity of Saline Groundwater and of Vanadium to Fish and Aquatic Invertebrates
57.	LS 2.3.1	Ecological Habitat Mapping of the AOSERP Study Area (Supplement): Phase I
58.	AF 2.0.2	Interim Report on Ecological Studies on the Lower Trophic Levels of Muskeg Rivers Within the Alberta Oil Sands Environmental Research Program Study Area
59.	TF 3.1	Semi-Aquatic Mammals: Annotated Bibliography
60.	WS 1.1.1	Synthesis of Surface Water Hydrology
61.	AF 4.5.2	An Intensive Study of the Fish Fauna of the Steepbank River Watershed of Northeastern Alberta
62.	TF 5.1	Amphibians and Reptiles in the AOSERP Study Area
63.	ME 3.8.3	Analysis of AOSERP Plume Sigma Data
64.	LS 21.6.1	A Review and Assessment of the Baseline Data Relevant to the Impacts of Oil Sands Development on Large Mammals in the AOSERP Study Area
65.	LS 21.6.2	A Review and Assessment of the Baseline Data Relevant to the Impacts of Oil Sands Development on Black Bears in the AOSERP Study Area
66.	AS 4.3.2	An Assessment of the Models LIRAQ and ADPIC for Application to the Athabasca Oil Sands Area
67.	WS 1.3.2	Aquatic Biological Investigations of the Muskeg River Watershed
68.	AS 1.5.3 AS 3.5.2	Air System Summer Field Study in the AOSERP Study Area, June 1977
69.	HS 40.1	Native Employment Patterns in Alberta's Athabasca Oil Sands Region
70.	LS 28.1.2	An Interim Report on the Insectivorous Animals in the AOSERP Study Area
71.	HY 2.2	Lake Acidification Potential in the Alberta Oil Sands Environmental Research Program Study Area
72.	LS 7.1.2	The Ecology of Five Major Species of Small Mammals in the AOSERP Study Area: A Review
73.	LS 23.2	Distribution, Abundance and Habitat Associations of Beavers, Muskrats, Mink and River Otters in the AOSERP Study Area, Northeastern Alberta
74.	AS 4.5	Air Quality Modelling and User Needs
75.	WS 1.3.4	Interim Report on a Comparative Study of Benthic Algal Primary Productivity in the AOSERP Study Area
76.	AF 4.5.1	An Intensive Study of the Fish Fauna of the Muskeg River Watershed of Northeastern Alberta
77.	HS 20.1	Overview of Local Economic Development in the Athabasca Oil Sands Region Since 1961.
78.	LS 22.1.1	Habitat Relationships and Management of Terrestrial Birds in Northeastern Alberta

79. AF 3.6.1 The Multiple Toxicity of Vanadium, Nickel, and Phenol to Fish.
80. HS 10.2 & HS 10.1 History of the Athabasca Oil Sands Region, 1980 to 1960's. Volumes I and II.
81. LS 22.1.2 Species Distribution and Habitat Relationships of Waterfowl in Northeastern Alberta.
82. LS 22.2 Breeding Distribution and Behaviour of the White Pelican in the Athabasca Oil Sands Area.
83. LS 22.2 The Distribution, Foraging Behaviour, and Allied Activities of the White Pelican in the Athabasca Oil Sands Area.
84. WS 1.6.1 Investigations of the Spring Spawning Fish Populations in the Athabasca and Clearwater Rivers Upstream from Fort McMurray; Volume I.
85. HY 2.5 An intensive Surface Water Quality Study of the Muskeg River Watershed. Volume I: Water Chemistry.
86. AS 3.7 An Observational Study of Fog in the AOSERP Study Area.
87. WS 2.2 Hydrogeological Investigation of Muskeg River Basin, Alberta
88. AF 2.0.1 Ecological Studies of the Aquatic Invertebrates of the Alberta Oil Sands Environmental Research Program Study Area of Northeastern Alberta
89. AF 4.3.2 Fishery Resources of the Athabasca River Downstream of Fort McMurray, Alberta. Volume I
90. AS 3.2 A Wintertime Investigation of the Deposition of Pollutants around an Isolated Power Plant in Northern Alberta

These reports are not available upon request. For further information about availability and location of depositories, please contact:

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