ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

Potential Productivity of Black Bear Habitat of the AOSERP Study Area

TF 1.3

April 1978

Sponsored jointly by

Alberta ENVIRONMENT

Environment Canada

Environnement Canada

15th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta, Canada
T5K 2J6

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

RESEARCH REPORTS

These research reports describe the results of investigations funded under the Alberta Oil Sands Environmental Research Program, which was established by agreement between the Governments of Alberta and Canada in February 1975 (amended September 1977). This 10-year program is designed to direct and co-ordinate research projects concerned with the environmental effects of development in the Athabasca Oil Sands in Alberta.

A list of research reports published to date is included at the end of this report.

Enquiries pertaining to the Canada-Alberta Agreement or other reports in the series should be directed to:

Alberta Oil Sands Environmental Research Program
15th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6
(403) 427-3943

Potential Productivity of Black Bear Habitat of
the AOSERP Study Area
Project TF 1.3

This report may be cited as:

Young, B.F. 1978. Potential productivity of black bear habitat of the AOSERP study area. Prep. for the Alberta Oil Sands Environmental Research Program by the University of Calgary. AOSERP Project TF 1.3. 22 pp.

The Hon. D.J. Russell
Minister of the Environment
222 Legislative Building
Edmonton, Alberta

and

The Hon. L. Marchand
Minister of State for the Environment
Parliament Buildings
Ottawa, Ontario

Sirs:

Enclosed is the report "Potential Productivity of Black Bear Habitat of the AOSERP Study Area."

This report was prepared for the Alberta Oil Sands Environmental Research Program, through its Terrestrial Fauna Technical Research Committee (now part of the 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

J.P. Bruce
Member, Steering Committee, AOSERP
Environmental Management Service
Fisheries and Environment Canada

POTENTIAL PRODUCTIVITY OF BLACK BEAR HABITAT OF THE AOSERP STUDY AREA

DESCRIPTIVE SUMMARY

ABSTRACT

Potential black bear *(Ursus americanus)* production was determined for the Alberta Oil Sands Environmental Research Program (AOSERP) study area using information obtained by radio-telemetry on forest cover use by bears during the two years of study at Cold Lake, Alberta. Expected densities for each of five forest cover classes were calculated using the Cold Lake data. The areas of individual townships comprised by each of the cover classes were determined and multiplied by the expected bear density of each class to provide a population estimate for each township.

The crude average bear density for the AOSERP study area, including water areas, was 0.18 per km^2 assuming total avoidance of muskeg areas and 0.25 per km^2 assuming use of muskeg. The potential entire population estimate was calculated as 5188 and 7431 bears using the two methods. The most productive bear habitat was located along the eastern and southern edges of the Birch Mountains and in the Gregoire Lake area. The poorest potential was in the Thickwood Hills and in the northeastern corner of the study area.

Although final population estimates may be biased, township population estimates should provide at least a valid index for identifying important areas of black bear habitat.

BACKGROUND AND PERSPECTIVE

The purpose of this study on the "Potential Productivity of Black Bear Habitat of the AOSERP Study Area" was to provide preliminary information for the "Habitat Mapping" project which will be carried out for the area and to provide some data for this mapping. The "Potential Productivity of Black Bear Habitat of the AOSERP Study Area" includes additional information on the technique of this information transference in the Recommendations section.

Color-coded maps of the individual townships were prepared and are on file at the AOSERP Program Management Office in Oxbridge Place, Edmonton, Alberta. These maps have not been reproduced in the report, but this information will be included in the ongoing habitat mapping program. Data from which these maps are compiled are given in an appendix.

Determination of black bear responses to habitat alterations, environmental disturbances and open pit refuse disposal is being considered for the AOSERP study area to provide futher information for habitat mapping.

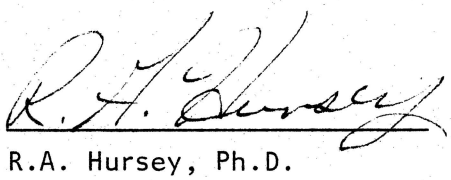
ASSESSMENT

The report entitled "Potential Productivity of Black Bear Habitat of the AOSERP Study Area", which was prepared by Mr. B.F. Young, has been reviewed by the Alberta Oil Sands Environmental Research Program, the former Terrestrial Fauna Technical Research Committee, and the Oil Sands Environmental Study Group. In view of the value of the document, the Alberta Oil Sands Environmental Research Program recommends that the report be made public through placement in designated Canadian libraries.

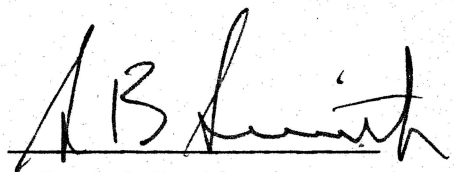
The report is fairly comprehensive and includes calculated forest cover classes and expected black bear populations by township in the AOSERP study area. As a preliminary report "Potential Productivity of the Black Bear Habitat of the AOSERP Study Area" represents a working document which will serve as a basis for research on black bear populations in the AOSERP study area. Readers should note that the estimates are not based on any field work conducted

within the AOSERP study area, but on an extrapolation of data from a manipulated population at Cold Lake, Alberta. Use of results and conclusions should be made with appropriate reservations.

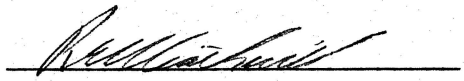
The content of this report does not necessarily reflect the views of Alberta Environment, Environment Canada or the Alberta Oil Sands Environmental Research Program. The mention of trade names for commercial products does not constitute an endorsement or recommendation for use.



R.A. Hursey, Ph.D.
Research Manager -
Land System



S.B. Smith, Ph.D.
Program Director, AOSERP



R.G. Weatherill
Project Manager

POTENTIAL PRODUCTIVITY OF BLACK BEAR HABITAT OF THE AOSERP STUDY AREA

by

Barry F. Young, M.Sc.
University of Calgary
CALGARY, ALBERTA

for

ALBERTA OIL SANDS ENVIRONMENTAL RESEARCH PROGRAM

PROJECT TF 1.3

April 1978

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The crude average bear density for the AOSERP study area, including water areas, was 0.18 per km^2 assuming total avoidance of muskeg areas and 0.25 per km^2 assuming use of muskeg. The potential entire population estimate was calculated as 5188 and 7431 bears using the two methods. The most productive bear habitat was located along the eastern and southern edges of the Birch Mountains and in the Gregoire Lake Area. The poorest potential was in the Thickwood Hills and in the northeastern corner of the study area.

Although final population estimates may be biased, township population estimates should provide at least a valid index for identifying important areas of black bear habitat.

1. INTRODUCTION

This study was conducted to determine the potential of the AOSERP study area (Figure 1) to support black bears. No previous research has identified areas of important bear habitat within the study area. Such information is of interest as loss of habitat proceeds with further oil sands development. This report classifies individual townships by potential bear production and predicts probable black bear densities within the AOSERP study area.

Estimates of black bear densities within the specific forest cover types were based on research conducted at Cold Lake, Alberta. The Cold Lake black bear study began in 1968 and has continued to the present. Approximately 45 bears have been radio-collared and telemetry data from 1974 and 1975 provided insight into habitat use. Since the major forest cover types at Cold Lake and in the AOSERP study area are similar, it was assumed that cover selection by bears, and therefore expected bear densities within cover types, would be comparable between the two areas.

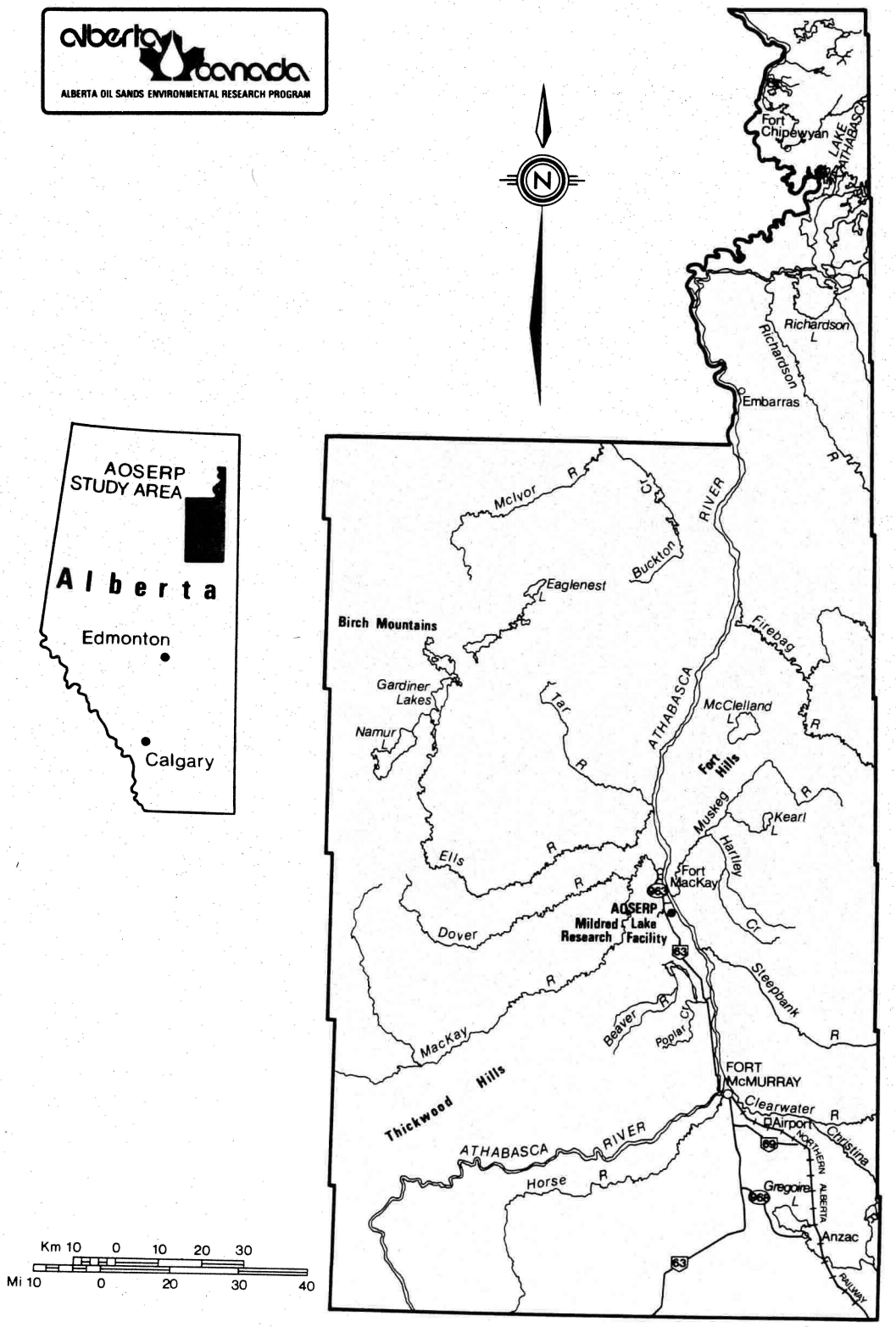

Figure 1. Location of the AOSERP study area.

2. METHODS

Individual radio-locations of 25 male black bears at Cold Lake in 1974 and 1975 were recorded as to one of five main cover types (Young 1976). These included deciduous, deciduous/coniferous mixture, coniferous, muskeg, and garbage dump area. Bears selected aspen and garbage dump areas and appeared to avoid muskeg.

Radio-locations at garbage dumps were omitted from the Cold Lake data for comparison to the AOSERP study area. The influence of dumps on bear distribution in the AOSERP study area is likely insignificant in terms of the black bear population. Of the remaining Cold Lake radio-locations, 52 percent were in deciduous, 26 percent were in deciduous/coniferous mixture, 5 percent were in coniferous, and 17 percent were in muskeg.

The 218 km^2 (84 mi^2) Cold Lake study area was composed of approximately 70 km^2 (27 mi^2) of deciduous cover, 52 km^2 (20 mi^2) of mixed cover, 18 km^2 (7 mi^2) of coniferous cover, and 78 km^2 (30 mi^2) of muskeg. Prior to an experimental population manipulation, the population at Cold Lake was estimated to average 80 bears over a four-year period. This density of approximately one bear per mi^2 (0.4 per km^2) was considered representative of boreal forest and assumed to apply to the AOSERP study area.

For the present study it was assumed that habitat preference by male bears was the same as for other sex and age cohorts. In addition, if all bears spent a proportion of total time in one forest cover type, then at any one time, that proportion of the entire population could be expected to be in that specific cover type. In other words, if bears were located in deciduous cover 52 percent of the time, the best estimate of the number of bears using deciduous cover was 52 percent of the population.

This premise was used to determine expected densities for each cover type using the calculation:

$$D = \frac{A \times 80}{B}$$

where D is the expected density for a specific cover type, A is the

percentage of the population expected to be in that cover type, 80 is the population, and B is the total area of the cover type. The expected bear densities derived from these calculations are given in Table 1.

Table 1. Expected bear densities by cover type.

Cover Type		Expected Density
Deciduous	$0.52 \times 80 / 69\ km^2$	= 0.6 bears/km^2 (1.6/mi^2)
Deciduous/coniferous	$0.26 \times 80 / 51\ km^2$	= 0.41 bears/km^2 (1.1/mi^2)
Coniferous	$0.05 \times 80 / 18\ km^2$	= 0.22 bears/km^2 (0.6/mi^2)
Muskeg	$0.17 \times 80 / 77\ km^2$	= 0.18 bears/km^2 (0.5/mi^2)

Forest cover proportions for the AOSERP study area were determined from forest cover series maps of 1:126,720 scale. Cover types were grouped into five classes corresponding to the classification system that was used at Cold Lake:

Class I Apsen *(Populus tremuloides)* and other deciduous tree species such as alder *(Alnus* spp.*)* and birch *(Betula* spp.*)*. Expected bear density = 0.6/km^2 (1.6/mi^2).

Class II Deciduous tree species mixed with conifers which may include white spruce *(Picea glauca)*, black spruce *(P. mariana)*, jack pine *(Pinus banksiana)*, balsam fir *(Abies balsamea)*, and tamarack *(Larix laricina)*. Expected bear density = 0.41/km^2 (1.1/mi^2).

Class III Conifers; PP (potential productive) stands were included here because they appeared closer to conifer stands in terms of potential bear habitat than to any of the other classes. Expected bear density = 0.22/km^2 (0.6/mi^2).

Class IV Bare and treed muskeg; cleared areas; sand dunes; rock barrens. Expected bear density = 0.18/km^2 (0.5/mi^2)

Class V Water; unclassified areas such as townsites and Indian reserves; areas of townships outside of the AOSERP area. Expected bear density = 0.

Each of the five forest cover classes was color-coded on the forest cover series maps. Individual unique stands less than 0.65 km^2 (0.25 mi^2) were included with the largest surrounding or connecting class. Individual townships were then sampled with a 144 dot grid to determine the area of each class within each township. Finally the area of each class was multiplied by the expected bear density for the class and the results were totalled to provide a single population estimate for the township.

Muskeg areas at Cold Lake were generally smaller than those in the AOSERP study area. They therefore may have been used more and contained greater expected densities than the larger muskeg areas further north. Township population estimates were therefore calculated in two ways. In one case maximum estimates were derived using the expected bear density of 0.18/km^2 for Class IV cover types (maximum estimate). Township densities were also calculated assuming an absence of bears in Class IV cover type to allow for possible lower use of larger muskeg areas in the AOSERP study area (minimum estimates).

3. RESULTS

A total of 315 townships, wholly or partially within the AOSERP study area were classified. Areas are given in square miles to remain consistent with available maps.

The entire AOSERP study area was found to consist of approximately 8% (896 mi^2) Class I cover (deciduous), 14% (1592 mi^2) Class II cover (deciduous/coniferous), 29% (3,336 mi^2) Class III cover (coniferous), 40% (4,485 mi^2) Class IV cover (muskeg), and 9% (1,032 mi^2) Class V cover (water and unclassified areas). The class composition of individual townships is given in Appendix 7 and the color-coded maps are on file at the AOSERP Program Management Office in Edmonton (15th Floor, Oxbridge Place, 9820 - 106 Street).

Estimates of potential populations of bears in specific townships range from 0 to 43 assuming no bears to be in muskeg and 0 to 45 assuming 0.18 bears/km^2 of muskeg. The average potential township populations for the two methods are 16.5 and 23.6 bears, respectively. The entire AOSERP study area was estimated to contain a potential population of from 5188 to 7431 black bears. These totals yield crude densities of 0.47 and 0.65/mi^2 (0.18 and 0.25/km^2) and densities omitting water and other Class V areas of 0.49 and 0.73/mi^2 (0.19 and 0.28/km^2).

Areas of greatest potential densities are located along the south and eastern edge of the Birch Mountains and around Gregoire Lake in the southeast corner of the study area (Figures 2 and 3). These areas have abundant deciduous cover and several townships have potential populations that exceed 30 bears. The poorest bear habitat is centered in the southwest Thickwood Hills area where large open muskeg prevents high densities.

The northern portion of the AOSERP study area, east of Wood Buffalo National Park, can also be expected to have low

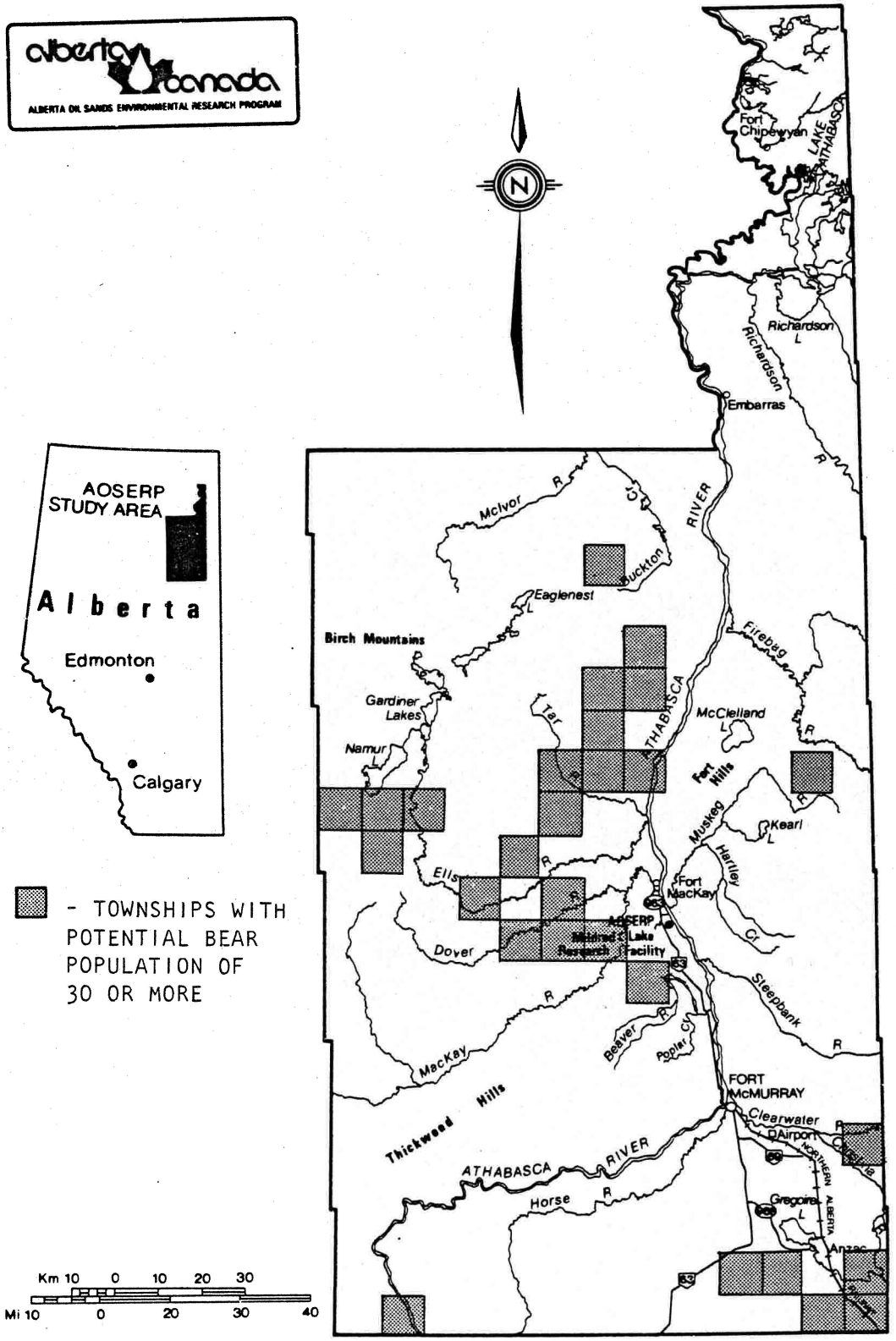

Figure 2. Location of townships with expected populations of 30 or more bears, assuming total avoidance of muskeg (minimum estimate).

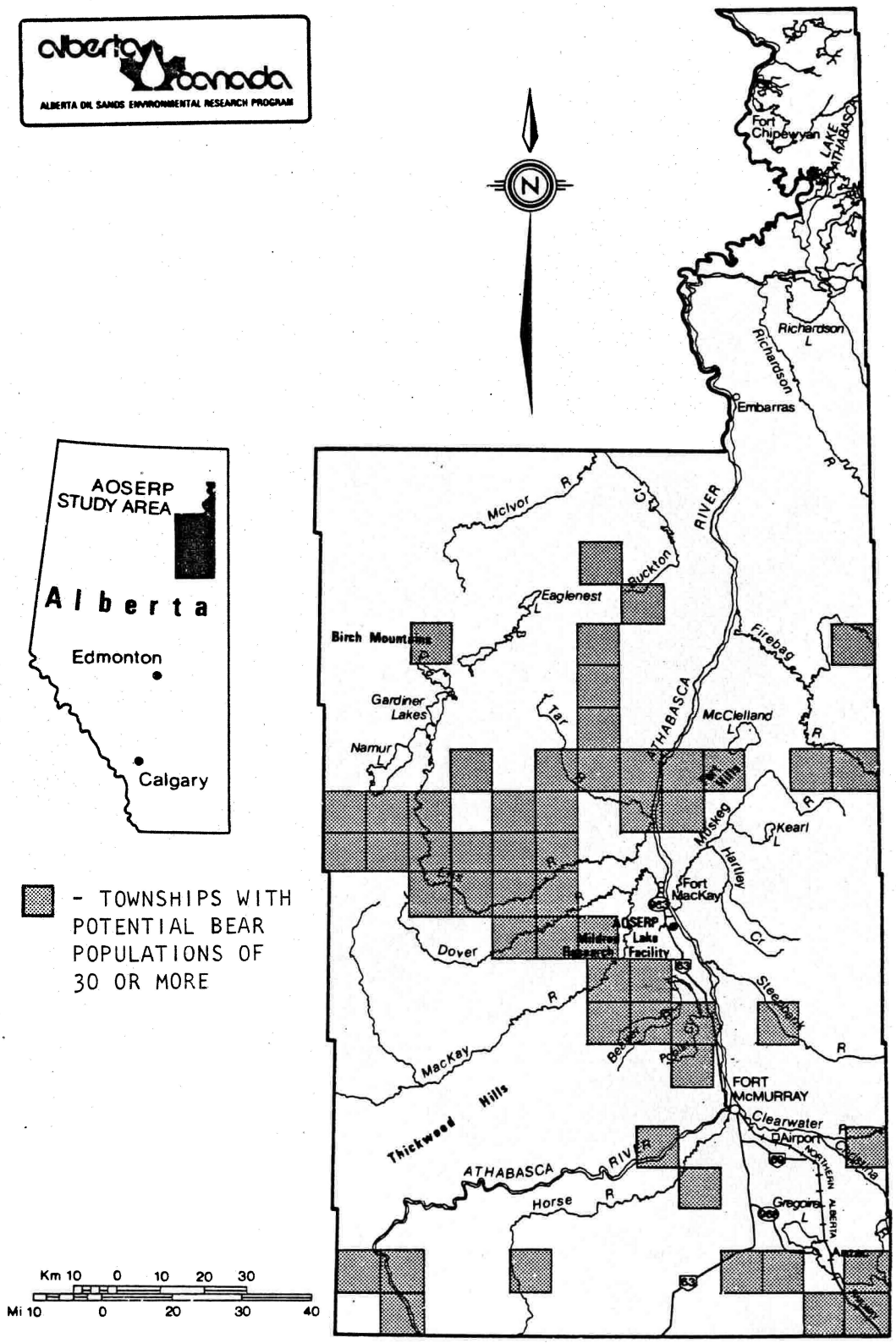

Figure 3. Location of townships with expected populations of 30 or more bears, assuming densities of $0.18/km^2$ in muskeg areas (maximum estimate).

bear densities because of muskeg, rock barrens, and marshes. However, deciduous cover along the Athabasca River and some delta channels, coupled with the barrier effect of these waterways, may result in locally high densities.

4. DISCUSSION

The assumption that forest cover use by black bears is similar between the AOSERP study area and the Cold Lake study area is based on the similarity of the vegetation of the two locations. The preference of bears for aspen and mixed woods at Cold Lake likely results from the presence of vetchling *(Lathyrus ochroleucus)* and sarsaparilla *(Aralia nudicaulus)*. These two plants are closely associated with aspen and are the two most utilized food items during spring and summer at Cold Lake. These species are also associated with aspen in the AOSERP study area and would make aspen cover equally attractive to bears there.

The avoidance of muskeg and large openings by bears in northeastern Alberta appears to be a function of both low food availability and an innate preference for forest that allows escape by climbing. None of the major food items of bears at Cold Lake were found to grow extensively in muskeg. Hererro (1972) discussed the evolutionary and behavioral factors involved in the preference for forest cover exhibited by black bears.

The population estimates for specific townships given in Appendix 7 may be biased due to the assumptions employed in their calculation. However, the numbers should at least provide an index of potential production of black bears in different areas. Although actual population estimates may remain in doubt, individual townships may be compared to others to identify which may be more important in terms of black bear habitat quality.

5. RECOMMENDATIONS

The validity of the AOSERP study area estimates should be tested using the Cold Lake data base for comparison. Selected townships in the AOSERP study area could be intensively live-trapped to either calculate Lincoln index estimates or obtain trap success indices for comparison with those at Cold Lake. Field work at Cold Lake in 1976 included research into track counts at artificial scent posts. This method could also be used in the AOSERP study area and results compared with counts from Cold Lake where population size is known.

Field work conducted in each of the cover classes used in this report should identify the direction and extent of any biases involved in the calculation of expected densities for each cover type. Corrections could then be applied to the cover proportions in Appendix 7 and a less biased overall population estimate calculated for the AOSERP study area.

6. LITERATURE CITED

Herrero, S. 1972. Aspects of evolution and adaptation in American black bears *(Ursus americans Pallus)* and brown and grizzly bears *(U. arctos Linne)* of North America. Pages 221 - 231 in S. Herrero, ed. Bears - their biology and management. IUCN New Ser. Publ. 23. International Union for Conservation of Nature and Natural Resources, Morges, Switzerland.

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7. APPENDIX

Calculated forest cover class and expected bear population by township in the AOSERP area.

TWP	R	Forest Cover Class (MI^2) I	II	III	IV	V		Expected Population Maximum	Minimum
84	6	21.0	5.25	-	7.5	2.25		43	39
84	7	21.25	4.0	1.5	8.75	.50		44	39
84	8	3.0	1.75	6.0	22.5	2.75		22	10
84	9	2.25	2.50	13.25	17.75	.25		23	14
84	10	.25	6.75	12.0	17.0	-		24	15
84	11	3.75	2.75	3.0	26.25	.25		24	11
84	12	1.25	7.75	3.5	23.25	.25		24	13
84	13	3.25	1.75	4.75	25.25	1.0		23	10
84	14	2.75	4.00	2.25	27.00	-		24	10
84	15	1.00	5.25	-	25.75	4.00		20	7
84	16	0.5	1.0	2.0	32.0	0.5		19	3
84	17	15.5	10.75	0.75	7.25	1.75		41	37
84	18	3.75	3.75	3.25	25.25	-		25	12
85	6	18.25	6.0	0.50	10.0	1.25		41	36
85	7	5.75	5.5	3.25	20.5	1.0		27	17
85	8	10.25	15.5	1.75	2.25	.25	6.0 IR	36	35
85	9	16.25	10.0	4.75	4.50	.50		42	40
85	10	3.75	11.0	3.0	18.25	-		29	20
85	11	.50	4.75	8.75	21.5	.50		22	11
85	12	-	6.0	8.25	21.5	.25		22	12
85	13	1.75	5.0	4.0	25.25	-		23	11
85	14	10.75	4.25	0.75	20.25	-		32	22
85	15	1.50	5.75	1.00	27.75	-		23	9
85	16	-	2.50	4.00	29.25	.25		20	5
85	17	3.75	7.50	1.50	15.75	2.50		31	23
85	18	8.50	8.50	4.25	14.5	.25		33	26
86	6	3.5	6.5	.50	25.0	.50		26	13
86	7	4.75	5.5	1.25	21.5	3.0		25	14
86	8	5.75	2.75	-	17.25	7.5	2.75 IR	21	12
86	9	4.5	6.25	5.75	19.5	-		27	18
86	10	-	3.25	4.75	28.0	-		20	6
86	11	.50	5.75	11.75	18.0	-		23	14
86	12	.50	6.75	2.75	25.75	.25		23	10
86	13	4.5	9.5	3.5	18.5	-		29	20
86	14	1.25	5.0	8.25	21.5	-		23	12
86	15	2.5	4.25	7.25	22.0	-		24	13
86	16	3.0	3.5	.75	28.25	.5		23	9
86	17	.75	7.25	4.5	21.0	2.5		22	12
86	18	5.5	5.25	1.75	22.75	.75		27	16
87	6	5.25	4.25	2.25	24.25	-		27	14

Calculated forest cover class and expected bear population by township in the AOSERP area (Continued)

TWP	R	Forest Cover Class (MI^2) I	II	III	IV	V		Expected Population Maximum	Minimum
87	7	.75	1.0	4.0	29.5	.75		19	5
87	8	1.25	1.5	2.5	30.75	-		21	5
87	9	2.5	4.75	8.0	20.75	-		24	14
87	10	3.0	13.75	5.25	14.0	-		30	23
87	11	1.5	8.0	9.25	17.25	-		25	17
87	12	6.75	7.75	4.75	14.0	2.75		29	22
87	13	4.5	6.25	6.25	16.75	1.75		26	18
87	14	4.5	6.0	9.75	13.25	2.50		26	20
87	15	3.5	6.5	6.5	15.0	4.5		24	17
87	16	6.0	6.0	1.25	19.25	3.5		27	17
87	17	2.5	3.25	2.25	26.5	1.50		22	9
87	18	-	-	2.25	33.5	.25		18	1
88	6	20.0	5.0	3.75	7.25	-		43	40
88	7	3.75	9.5	1.0	13.0	-	3.75 U/C	26	17
88	8	1.25	3.0	1.75	27.75	-	2.25 U/C	20	6
88	9	1.75	13.5	3.25	19.25	-	.25 U/C	29	20
88	10	.75	6.75	4.5	22.25	1.75		22	11
88	11	7.75	13.25	2.75	10.25	2.0		34	29
88	12	3.5	5.5	1.0	25.0	1.0		25	12
88	13	1.5	4.5	9.25	20.0	.75		23	13
88	14	-	-	7.75	27.25	1.0		18	5
88	15	.75	.50	1.0	33.0	.75		19	2
88	16	-	-	2.0	34.0	-		18	1
88	17	.50	-	2.0	33.5	-		19	2
88	18	-	-	10.25	25.75	-		19	6
89	6	5.5	3.75	2.25	23.75	.75		26	14
89	7	4.75	6.5	16.5	8.25	-		29	25
89	8	1.5	.75	22.0	11.75	-		22	16
89	9	2.25	10.25	2.25	6.25	2.50	12.5 U/C Ft.McMurray	19	16
89	10	1.75	9.0	15.75	8.5	1.0		26	22
89	11	.50	4.0	8.25	23.25	-		22	10
89	12	-	3.0	.25	32.5	.25		20	3
89	13	-	1.5	4.25	29.5	.75		19	4
89	14	-	2.25	3.5	30.0	.25		20	5
89	15	-	-	1.5	34.25	.25		18	1
89	16	-	.25	10.25	25.25	.25		19	6
89	17	-	.25	2.75	33.0	-		18	2
89	18	-	-	2.75	33.25	-		18	2
90	6	1.5	4.0	6.0	24.0	.50		22	10
90	7	3.25	5.25	6.25	21.0	.25		25	15

Calculated forest cover class and expected bear population by township in the AOSERP area (Continued)

TWP	R	Forest Cover Class (MI^2) 1	11	111	1V	V		Expected Population Maximum	Minimum
90	8	4.25	2.75	8.0	21.0	-		25	15
90	9	2.5	10.25	16.5	1.75	2.5	2.5 U/C	26	25
90	10	5.0	10.0	5.0	16.0	-		30	22
90	11	2.0	9.75	9.75	14.0	.50		27	20
90	12	-	3.25	-	31.75	1.0		19	4
90	13	-	3.25	.50	30.75	1.5		19	4
90	14	-	1.25	.75	33.75	.25		19	2
90	15	1.0	2.0	2.0	31.0	-		21	5
90	16	-	1.0	3.25	31.75	-		19	3
90	17	1.25	6.0	3.5	25.25	-		23	11
90	18	1.50	-	.25	34.25	-		20	3
91	6	-	-	1.50	33.50	1.0		18	1
91	7	2.0	7.75	1.75	24.5	-		25	13
91	8	8.5	9.5	2.25	15.75	-		33	25
91	9	5.75	6.5	5.25	16.0	2.5		28	20
91	10	9.5	5.75	.75	20.0	-		32	22
91	11	7.5	13.75	3.25	11.5	-		35	29
91	12	3.5	12.5	2.75	17.25	-		30	21
91	13	2.75	10.25	5.5	17.5	-		28	19
91	14	1.25	4.75	5.25	24.75	-		23	10
91	15	.25	.50	1.50	33.75	-		19	2
91	16	-	1.25	2.0	32.5	.25		19	3
91	17	1.75	1.75	1.00	33.15	-		22	5
91	18	.50	2.0	3.25	30.25	-		20	5
92	6	1.25	1.5	4.75	28.25	.25		21	7
92	7	-	.75	4.0	31.0	.25		19	3
92	8	2.0	8.25	3.75	22.0	-		26	15
92	9	.75	3.0	2.0	29.5	.75		20	6
92	10	7.5	1.5	2.0	23.25	1.75		26	15
92	11	18.25	6.5	1.0	10.25	-		42	37
92	12	4.25	16.0	4.5	11.25	-		33	27
92	13	.75	7.0	11.0	17.25	-		24	16
92	14	.75	7.25	7.5	20.5	-		24	14
92	15	3.25	2.75	7.75	22.5	-		24	13
92	16	-	1.25	2.25	32.5	-		19	3
92	17	1.50	3.25	7.75	23.5	-		22	11
92	18	2.25	1.25	3.0	29.25	.25		21	7
93	6	.50	4.75	22.25	7.25	1.25		23	19
93	7	.50	2.25	13.25	20.0	-		21	11
93	8	.25	5.5	27.25	3.0	-		24	23

Calculated forest cover class and expected bear population by township in the AOSERP area (Continued)

TWP	R	Forest Cover Class (MI^2) I	II	III	IV	V	Expected Population Maximum	Minimum
93	9	.50	2.75	23.25	9.5	-	23	18
93	10	7.5	6.75	12.25	6.0	3.5	30	27
93	11	4.5	8.75	12.75	10.0	-	29	24
93	12	1.75	23.25	8.0	3.0	-	35	33
93	13	14.5	11.5	1.75	8.25	-	41	37
93	14	14.75	5.75	6.5	9.0	-	38	34
93	15	5.75	4.0	18.0	8.25	-	29	24
93	16	1.50	7.0	16.0	11.5	-	25	20
93	17	1.0	1.25	7.25	26.5	-	21	7
93	18	1.5	.25	1.25	33.0	-	20	3
94	6	-	-	24.0	11.5	.50	20	14
94	7	.25	2.25	27.0	6.5	-	22	19
94	8	.50	5.75	22.75	7.0	-	24	21
94	9	2.75	3.0	18.75	11.5	-	25	19
94	10	3.25	3.75	20.75	7.25	1.0	25	22
94	11	5.5	7.25	10.75	7.25	1.5 3.75 U/C	27	23
94	12	2.25	2.0	20.75	11.0	-	24	18
94	13	19.5	2.25	4.0	10.25	-	41	36
94	14	8.0	3.75	6.75	17.5	-	30	21
94	15	10.25	8.75	11.5	5.25	.25	36	33
94	16	9.5	6.0	12.0	7.75	.75	33	29
94	17	2.75	3.75	3.75	21.75	4.0	22	11
94	18	5.25	2.75	3.5	23.75	.75	25	14
95	6	.25	-	26.25	8.5	1.0	20	16
95	7	.75	4.5	29.0	1.75	-	24	24
95	8	1.25	8.5	13.75	11.5	1.0	25	20
95	9	0.75	3.0	24.25	3.0	-	23	19
95	10	1.0	1.25	20.0	12.75	1.0	21	15
95	11	4.75	4.0	19.5	6.0	1.75	27	24
95	12	2.0	1.25	26.0	6.75	-	24	20
95	13	4.0	1.75	28.25	2.0	-	26	25
95	14	12.75	7.5	7.25	8.25	.25	37	33
95	15	3.5	13.75	7.0	11.0	.75	30	25
95	16	10.0	4.5	6.75	14.0	.75	32	25
95	17	10.5	9.5	6.0	8.75	1.25	35	31
95	18	6.75	6.75	8.5	13.5	.50	30	23
96	6	1.50	2.75	28.25	3.5	-	24	22
96	7	3.75	5.75	18.25	8.25	-	27	23
96	8	6.75	2.25	14.25	11.75	1.0	28	22
96	9	1.5	9.25	4.5	20.5	.25	26	15

Calculated forest cover class and expected bear population by township in the AOSERP area (Continued)

TWP	R	Forest Cover Class (MI^2) I	II	III	IV	V		Expected Population Maximum	Minimum
96	10	6.75	6.75	11.75	10.25	.50		30	25
96	11	7.75	6.75	10.75	8.25	2.5		30	26
96	12	3.5	6.75	21.25	4.5	-		28	26
96	13	8.25	11.75	15.5	.5	-		36	35
96	14	4.5	10.25	17.5	3.5	.25		31	29
96	15	1.75	13.25	7.25	12.75	1.0		28	22
96	16	2.5	23.75	7.75	1.75	.25		36	35
96	17	5.25	17.25	6.0	4.25	3.25		33	31
96	18	1.0	26.0	3.75	4.25	1.0		35	32
97	6	2.0	14.75	13.5	5.5	.25		30	28
97	7	22.5	4.0	4.25	5.0	.25		45	43
97	8	1.0	5.75	2.25	26.5	.50		23	9
97	9	8.75	12.0	3.5	10.25	1.5		34	29
97	10	10.5	1.5	17.0	6.0	1.0		32	29
97	11	8.0	16.25	2.5	7.5	1.75		36	32
97	12	6.75	20.0	8.0	1.25	-		38	38
97	13	7.75	7.25	19.5	1.5	-		33	32
97	14	1.0	4.5	25.5	4.0	1.0		24	22
97	15	.75	18.25	11.75	4.0	1.25		30	28
97	16	1.75	16.5	8.75	2.75	1.75	4.5 U/C IR	28	26
97	17	.25	3.25	4.25	4.25	16.0	8.0 U/C IR	9	7
97	18	-	2.5	17.25	11.75	4.5		19	13
98	6	2.25	3.75	18.25	10.5	1.25		24	19
98	7	1.5	5.5	23.5	5.5	-		25	23
98	8	-	3.5	23.0	6.75	2.75		21	18
98	9	-	2.0	3.0	24.5	6.5		16	4
98	10	6.0	8.25	6.0	13.5	2.25		29	22
98	11	3.0	8.0	4.5	20.5	-		27	16
98	12	10.25	16.0	7.25	2.5	-		40	38
98	13	3.0	4.0	27.5	1.0	.5		26	26
98	14	-	1.0	31.75	2.5	.75		21	20
98	15	2.0	1.0	23.75	7.0	2.25		22	19
98	16	2.0	6.5	9.25	3.5	7.5	7.25 U/C IR	18	16
98	17	-	6.75	24.75	3.0	1.25	.25 U/C IR	24	22
98	18	-	12.5	12.5	10.0	1.0		26	21
99	6	.75	.25	20.25	13.0	1.75		20	14
99	7	1.75	5.0	25.0	4.0	.25		25	23
99	8	-	1.25	33.75	1.0	-		22	22
99	9	.50	8.00	19.75	6.75	1.00		25	21
99	10	1.50	16.75	3.25	12.5	2.00		29	23

Calculated forest cover class and expected bear population by township in the AOSERP area (Continued)

TWP	R	Forest Cover Class (MI^2) I	II	III	IV	V		Expected Population Maximum	Minimum
99	11	13.75	6.5	.75	15.00	-		37	30
99	12	13.25	10.25	11.0	1.25	.25		40	39
99	13	-	5.75	18.25	10.5	1.5		23	17
99	14	-	17.0	11.5	6.0	1.5		29	26
99	15	.50	20.75	7.5	2.0	5.25		29	28
99	16	-	16.25	7.25	4.75	7.75		25	22
99	17	-	7.25	9.5	15.5	3.75		21	14
99	18	.25	20.25	4.75	8.75	2.0		30	26
100	6	-	3.0	7.5	23.5	2.0		20	8
100	7	-	.25	32.0	3.75	-		21	19
100	8	-	2.5	28.75	4.25	.50		22	20
100	9	6.5	10.25	11.5	5.25	2.5		31	29
100	10	4.75	8.5	6.5	15.75	.50		29	21
100	11	18.75	4.5	2.5	10.25	-		42	36
100	12	7.75	4.75	18.75	4.0	.75		31	29
100	13	-	7.75	21.0	5.0	2.25		24	21
100	14	-	11.25	17.0	4.75	3.0		25	23
100	15	-	17.75	4.5	8.25	5.5		26	22
100	16	-	19.75	6.74	7.75	1.75		30	26
100	17	-	7.0	5.75	21.0	2.25		22	11
100	18	.5	5.75	8.25	20.75	.75		22	12
101	6	-	-	8.25	27.75	-		19	5
101	7	-	-	13.5	22.0	.50		19	8
101	8	-	-	33.5	2.5	-		21	20
101	9	3.25	11.0	8.5	10.0	3.25		27	22
101	10	3.25	3.75	5.75	23.0	.25		24	13
101	11	10.0	4.5	3.5	18.0	-		32	23
101	12	5.75	4.5	23.0	1.75	1.0		29	28
101	13	-	-	33.25	.50	2.25		20	20
101	14	-	3.75	27.0	2.5	2.75		22	20
101	15	-	3.75	22.0	8.5	1.75		22	17
101	16	-	4.25	5.5	24.75	1.5		20	8
101	17	-	-	5.25	30.0	.75		18	3
101	18	-	.25	13.5	21.75	.50		19	8
102	6	-	.75	22.25	10.75	2.25		20	14
102	7	-	-	30.75	3.25	2.0		20	18
102	8	-	-	30.75	4.5	.75		21	18
102	9	1.0	7.5	14.75	7.0	4.25	1.5 IR	22	19
102	10	1.75	3.25	16.5	13.5	1.0		23	16
102	11	3.5	1.25	6.75	24.0	.50		23	11

Calculated forest cover class and expected bear population by township in the AOSERP area (Continued)

TWP	R	Forest Cover Class (MI^2) I	II	III	IV	V		Expected Population Maximum	Minimum
102	12	7.75	3.75	21.75	2.25	.50		31	30
102	13	-	-	33.5	1.75	.75		21	20
102	14	-	.25	32.5	3.75	.50		22	20
102	15	-	1.0	16.25	17.0	1.75		19	11
102	16	-	1.0	6.25	27.75	1.0		19	5
102	17	-	-	26.75	8.5	.75		20	16
102	18	-	-	6.25	28.25	1.5		18	4
103	6	.50	-	28.25	1.75	5.5		19	18
103	7	-	-	20.5	6.25	9.25		15	12
103	8	-	-	28.75	1.75	5.5		18	17
103	9	1.75	7.5	.5	10.75	4.5	2.0 IR	22	17
103	10	-	4.25	21.5	7.0	3.25		21	18
103	11	1.75	1.0	8.75	23.25	1.25		21	9
103	12	4.75	5.75	16.0	9.5	-		28	24
103	13	-	8.0	28.0	-	-		26	26
103	14	1.0	3.25	29.5	1.75	.5		24	23
103	15	-	1.0	15.75	18.25	1.0		20	11
103	16	-	.50	24.25	10.75	.50		20	15
103	17	-	-	17.5	18.25	.25		20	11
103	18	-	3.75	27.5	4.5	.25		23	21
104	6	-	-	28.5	4.25	3.25		19	17
104	7	-	-	22.75	12.25	1.0		20	14
104	8	.50	11.5	17.0	5.25	1.75		26	24
104	9	2.75	10.25	10.25	10.25	2.5		27	22
104	10	-	1.5	10.0	23.5	1.0		19	8
104	11	.75	5.25	17.5	11.5	1.0		23	17
104	12	1.25	10.0	16.0	8.25	.50		27	23
104	13	-	14.0	21.25	.75	-		29	28
104	14	-	-	29.25	5.25	1.50		20	18
104	15	-	-	25.5	10.25	.25		20	15
104	16	-	-	22.0	13.25	.75		20	13
104	17	-	-	11.0	24.5	.50		19	7
104	18	1.0	6.5	5.75	22.75	-		24	12
105	6	-	-	31.5	2.0	2.5		20	19
105	7	.25	-	24.0	11.5	.25		21	15
105	8	-	3.5	14.25	18.25	-		22	12
105	9	-	4.75	3.0	1.75	-	26.5 water & outside study area	8	7
106	9	-	1.75	13.25	.50	-	20.5 water & out	10	10
107	6	-	1.25	28.0	6.75	-		22	18
107	7	.25	1.75	23.0	10.25	.75		21	16
107	8	-	-	32.0	4.0	-		21	19
106	6	-	2.75	24.0	8.25	1.0		22	17
106	7	-	-	28.5	7.25	.25		21	17
106	8	-	-	29.0	7.00	-		21	17

Calculated forest cover class and expected bear population by township in the AOSERP area (Concluded)

TWP	R	Forest Cover Class (MI^2) I	II	III	IV	V	Expected Population Maximum	Minimum
107	9	.25	.75	30.25	1.75	- 3.0 water & out	20	19
107	10	-	-	.25	-	- 35.75 water & out	0	0
108	6	-	4.5	18.5	7.5	- 5.5 water & out	20	16
108	7	.25	.25	5.25	7.75	22.5	8	4
108	8	.25	1.25	11.25	18.5	4.75	18	9
108	9	.25	1.25	18.0	13.75	2.75	19	13
108	10	2.0	2.75	1.25	1.25	3.0 25.75 water & out	8	7
109	6	-	.50	-	3.5	- 32.0 water & out	2	1
109	7	1.25	-	-	15.75	- 19.0 water & out	10	2
109	8	3.0	.75	2.25	21.75	6.75 1.5 out	18	7
109	9	5.25	.75	3.75	10.5	- 15.75 water & out	17	11
109	10	1.25	-	1.75	.75	- 32.25 water & out	3	3
110	6	-	-	-	-	- 36.0 IR	0	0
110	7	1.5	-	.25	9.0	- 25.25 water & out	7	3
110	8	1.0	-	-	3.25	- 31.75 water & out	3	1
111	6	-	-	-	-	- 36.0 water & IR	0	0
111	7	-	-	-	2.75	- 33.25 water & out	1	0
111	8	-	-	-	-	- 36 water & outside	0	0
112	6	-	-	-	-	36.0	0	0
112	7	.50	5.5	2.5	2.5	22.75 2.5 Ft Chip SMT	10	8
112	8	.50	.25	1.0	.25	- 33.5 water & out	2	2
113	6	-	2.0	15.0	11.25	7.75	17	11
113	7	.25	1.25	9.0	22.25	3.25	18	7
113	8	1.0	3.5	.75	4.25	5.0 21.5 river & out	8	6
114	6	-	4.5	12.5	15.5	3.5	20	12
114	7	1.25	5.75	5.75	20.5	2.5 .25 outside	22	12
114	8	.25	1.50	1.25	2.25	- 30.75 water & out	4	3
115	6	1.0	2.75	3.5	19.0	9.75	16	7
115	7	2.75	3.75	2.25	21.75	5.5	21	10
115	8	.50	3.75	1.75	23.5	3.5 3.0 outside	18	6
115	9	.25	2.0	.50	3.25	- 30.0 water & out	5	3

8. AOSERP RESEARCH REPORTS

1.		AOSERP First Annual Report, 1975
2.	AF 4.1.1	Walleye and Goldeye Fisheries Investigations in the Peace-Athabasca Delta
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 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 Investigation 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
14.	HE 2.4	Athabasca Oil Sands Historical Research Design (3 volumes) (in review)
15.	ME 3.4	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	Alberta Oil Sands Region Stream Gauging Data
19.	ME 4.1	Calculations of Annual Averaged Sulphur Dioxide Concentrations at Ground Level in the AOSERP Study Area
20.	HY 3.1.1	Evaluation of Organic Constituents (in review)
21.		AOSERP Second Annual Report, 1976-77
22.	HE 2.3	Maximization of Technical Training and Involvement of Area Manpower (in review)
23.	AF 1.1.2	Acute Lethality of Mine Depressurization Water on Trout Perch and Rainbow Trout (in review)
24.	ME 4.2.1	Review of Dispersion Models and Possible Applications in the Alberta Oil Sands Area (in review)
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 (in review)
28. VE 2.1 Interim Report on a Soils Survey in the Athabasca Oil Sands Area.

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

Alberta Oil Sands Environmental Research Program
15th Floor, Oxbridge Place
9820 - 106 Street, Edmonton, Alberta
T5K 2J6