ECOLOGICAL STUDIES OF THE BOREAL FOREST GRIZZLY BEAR (*Ursus arctos* L.) -- ANNUAL REPORT FOR 1977

by

J.A. Nagy and R.H. Russell

March 1978

CANADIAN WILDLIFE SERVICE

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March 31, 1978

Canadian Wildlife Service

Mr. Gordon Kerr,
Assistant Deputy Minister
Fish and Wildlife
9363 - 108 Street
Edmonton, Alberta
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Dear Mr. Kerr:

Enclosed herewith please find the report "Ecological Studies of the Boreal Forest Grizzly Bear (*Ursus arctos* L.) -- Annual Report for 1977" by J.A. Nagy and R.H. Russell. The study was conducted as a cooperative venture between the Canadian Wildlife Service and the Alberta Fish and Wildlife Division with a contribution by the Alberta Fish and Game Association. The report summarizes the results of field investigations conducted during 1977 in relation to those obtained during previous years.

The findings prompt the authors to make the following recommendations with regard to further research and management of the grizzly bear population in the Swan Hills area:

1. If a viable population of grizzly bears is to be maintained in Swan Hills, then hunting should be curtailed for a period of time to allow recovery of the grizzly population in accessible portions of that region. The numbers of adults are very low at present. Factors such as the known number and reproductive status of resident females, minimum successful breeding ages, litter sizes, reproductive interval and rate of immigration, suggest a minimum of ten years will be required before the grizzly population recovers.

2. Alternative means of garbage disposal in the town of Swan Hills would be desirable. Grizzly bears are attracted to the refuse dump, located approximately two kilometers south of the town. Concentrations of bears near the dump makes them vulnerable to hunting and prone to become a problem in the town site.

3. The Swan Hills study area appears to serve as a population sink for excess animals from peripheral populations. Sound management would require studies directed at delineating the areas of source populations. It may be necessary to establish a reasonably large habitat reserve contiguous with the present centre of industrial activity. If present hunting seasons are not closed, immigrants from such a reserve would maintain population levels on the core development areas, and provide hunters with some game animals.

...2

Mr. Kerr, continued.

Although development of oil and forest resources need not be excluded from such a reserve, access must certainly be restricted (i.e. no "all-weather roads") if a grizzly population is to be conserved. Logging and drilling could be restricted to winter and pumping stations maintained through helicopter support.

4. Although more data would be useful, we have a sound working knowledge of the status of grizzly and black bear populations ranging in the "accessible" portions of the Swan Hills region. We strongly recommend shifting the study to adjacent "undeveloped" habitat west or east of the present study area. Data from the relatively unexploited populations are desirable for comparative purposes. Future studies would not only explore population parameters in those areas, but provide additional information on the general biology of the Swan Hills grizzly bear.

We would welcome the comments of you and your staff on this study.

Yours sincerely

M.R. Robertson
Regional Director

Encl.

ACKNOWLEDGEMENTS

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D. Hocking and E.D. Lane critically read the manuscript.

F. Anderka, Canadian Wildlife Service, Ottawa built some of the radio transmitters used in the study.

Ecological Studies of The Boreal Forest

Grizzly Bear (*Ursus arctos* L.) -- Annual Report for 1977

by

J.A. Nagy and R.H. Russell

Canadian Wildlife Service

March 1978

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1. INTRODUCTION

The grizzly bear (*Ursus arctos* L.) ranges over much of western and northern Canada in areas with limited human access or where killing of the species is prohibited (as in National Parks). Only one sub-species is recognized by the scientific community, but the species occupies many diverse ecosystems and certain ecotypes are acknowledged (e.g. Barren Ground grizzly, Northern Interior grizzly, etc.). Research on ecological parameters of specific populations is required in order to adequately preserve and manage the ecotypes. At present information on one ecotype cannot be applied to another with any degree of confidence.

Early literature inferred that the Swan Hills grizzly, which ranged in the boreal forest ecosystem, was a remnant population of the Great Plains grizzly surviving now only in the Swan Hills of Alberta (Oeming - various newspaper and popular magazine articles). Preliminary studies suggested the distribution of grizzly bears was considerably more extensive than had been previously recorded and that they should be considered a general Boreal Forest ecotype (Nielsen 1975).

The Boreal Forest in Alberta has remained relatively undisturbed until recent years. However, there has been a rapid encroachment by forestry, agriculture, mining, gas and oil exploration and development, and recreational activities during the past two decades. If grizzly bears are to survive in the face of human intrusion, it will be through wise management based on sound ecological data (Pearson 1975).

A study of the ecology of grizzly bears in the Boreal Forest ecosystem of Alberta was begun in 1974 as a cooperative venture between the Alberta Fish and Wildlife Division and the Canadian Wildlife Service,

Edmonton. The objectives of the study were:

1. To determine the density, age and sex composition, and the reproductive rate of the Boreal Forest grizzly bear population.
2. To measure all forms of mortality and determine the effect of hunting and killing of nuisance bears.
3. To determine habitat requirements, specificity of denning sites, home range size and normal movement patterns.
4. To determine the effects of resource development (especially logging) and expanding recreational activities.
5. To make recommendations for a long-term management plan for the Boreal Forest grizzly bear population in Alberta.

A minimum of five years of intensive field research (1974 to 1978) was deemed necessary to meet those objectives.

A preliminary survey was conducted in 1974 to determine the past and present distribution of grizzly bears in the Boreal Forest (Nielsen 1975). Four possible study areas in Alberta were recommended and the Swan Hills region was selected because of its close proximity to Edmonton and the available network of access roads.

Because conventional methods of estimating population numbers (e.g. Lincoln Index, aerial transect surveys) could not be applied to grizzly bears inhabiting forested areas, field investigations were conducted to attempt a complete enumeration of the population on the selected study area through a capture-mark-release program. In 1975 a trapping program was undertaken on a portion of the 3885 km^2 Swan Hills study area. Intensive trapping efforts were conducted on approximately 155 km^2 south and west of the town of Swan Hills (Pearson 1975). In 1976 trapping programs were conducted on an area of approximately 941 km^2, with intensive coverage

given to 395 km^2 (Nagy *et al.* 1977). During 1975 and 1976 a total of 10 grizzly and 21 black bears were captured 12 and 23 times, respectively. Trapping activities were conducted on an area of 2500 km^2 during 1977.

This report summarizes the results of the 1977 program in relation to results obtained during previous years. The conclusions drawn from the data are discussed.

2. DESCRIPTION OF THE STUDY AREA

The 1977 study area included 2500 km^2 extending from the southern limits of the Judy Creek gas field to House Mountain (Figure 1). Available access roads restricted effective coverage to about 1300 km^2. Field operations were staged from a camp situated 11 km west of the town of Swan Hills.

The Swan Hills regions is characterized by rolling to mountainous topography interspersed with bogs and muskeg. The average elevation is about 915 m.s.m. (Alberta Wilderness Association 1976). The study area falls under the Lower Foothills Transitional Forest Classification, except for the southern portion which is Boreal Mixed Wood (Nielsen 1975). Extensive homogeneous stands of spruce, pine, aspen and birch are common. Drainage is by the Athabasca River, either directly through tributaries such as the Freeman River or indirectly via Lesser Slave Lake and Lesser Slave River (Nielsen 1975).

The climate is typically continental with cold winters and short, cool, wet summers. Precipitation levels average 50 cm during the May-September period, which is 15 to 20 cm greater than that received by adjacent stations at lower elevations (e.g. Whitecourt and Fort Assiniboine). Climatic data obtained from the Alberta Forestry Swan Dive and Pimple-Imperial fire towers for the period from 1975 to 1977, are summarized

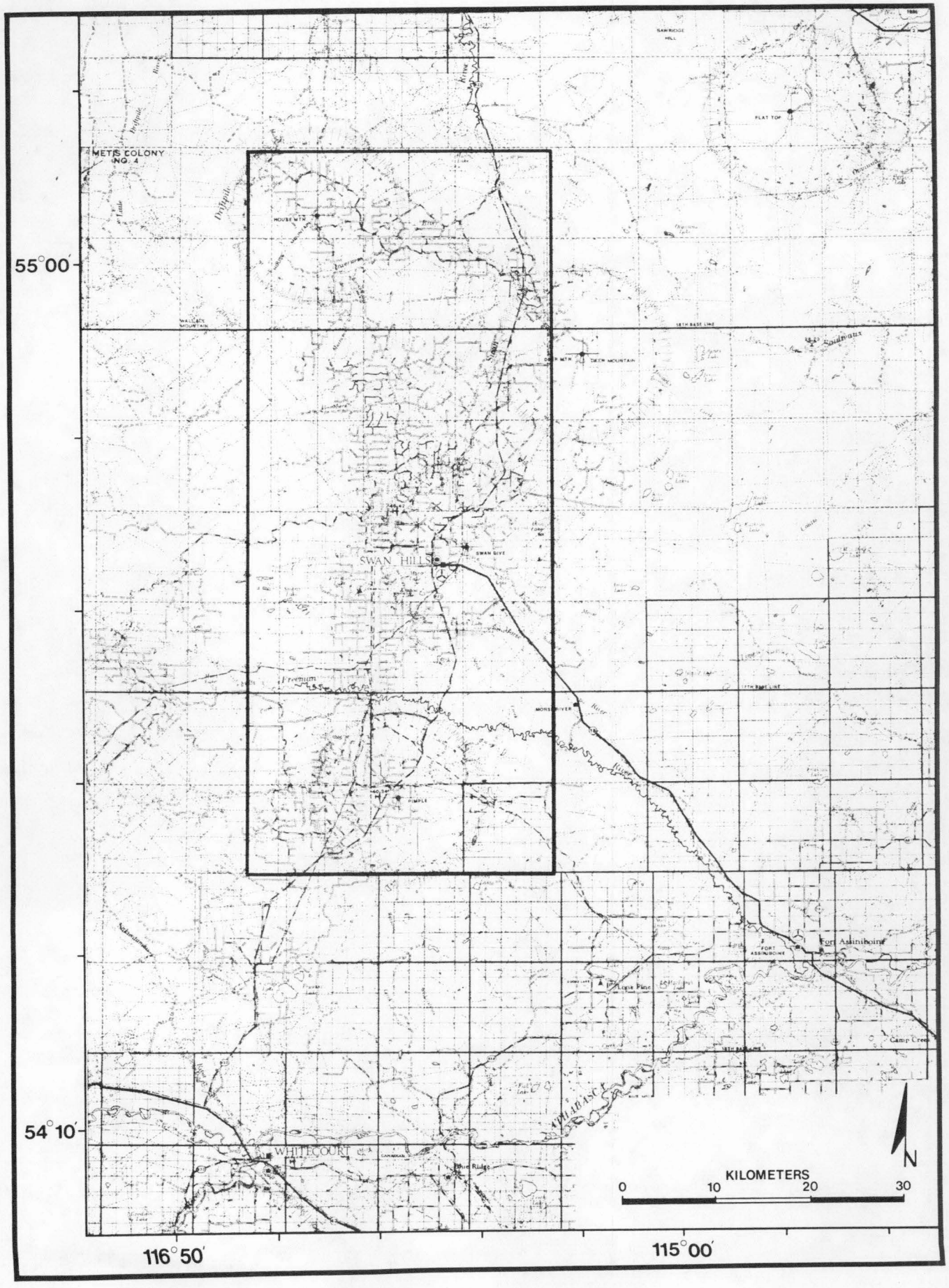

Figure 1. The Swan Hills study area.

in Tables 1 and 2. Those data are considered representative for the study area.

The most important economic factors affecting the natural character of the Swan Hills area have been petrochemical exploration and development, and the utilization of local timber reserves. With commencement of exploration activities during the late 1950's, access to the Swan Hills was improved. The impact of oil and gas exploration has not been distributed evenly, with major developments localized on approximately 1000 km^2 north and south of the town of Swan Hills (population 2000). The labyrinth of oil field roads provides total motorized access (Alberta Wilderness Association 1976). In addition, major timber leases are planned, with logging operations in effect on portions of the area (Alberta Wilderness Association 1976).

3. METHODS

Field work commenced during the second week of April, 1977. Bait sites were established in areas adjacent to available road systems and traps were set when bears began visiting the sites. Utilization of bait sites allowed us to maximize our coverage of the study area as it was not necessary to re-visit on a daily basis, those sites at which activity was not evident. Whenever possible, we attached transmitters to snares or traps to reduce the effort involved in monitoring the trap-line and to minimize human disturbance at the sites. Designated sites were trapped for 45 to 60 day periods, depending on the number of captures and recaptures made. Trap-lines varied in length from 120 to 160 km, with 30 to 40 maintained bait or trap sites.

Table 1. Precipitation recorded at the Alberta Forestry Service Swan Dive and Pimple-Imperial fire towers from April to September, 1975 to 1977.

Fire Tower and Year	Precipitation (cm) by Month						
	April	May	June	July	August	September	April-September
Swan Dive							
1975	1.12	3.81	16.84	8.59	15.24	2.64	48.24
1976	3.38	2.73	11.51	16.27	24.52	-	58.41
1977	0.57	17.34	11.80	17.31	6.23	2.94	56.19
Mean 1975-77	1.69	7.96	13.38	14.06	15.23	2.79	54.19
Pimple-Imperial							
1975	0.23	2.72	14.50	9.83	12.40	1.79	41.05
1976	0.33	2.01	10.19	15.79	15.61	2.18	46.11
1977	0.08	17.57	6.10	15.99	5.98	5.90	51.62
Mean 1975-77	0.21	7.43	10.26	13.87	11.33	3.15	46.26

Table 2. Daily maximum and minimum temperatures recorded at the Alberta Forestry Service Swan Dive and Pimple-Imperial fire towers from April to September, 1975 to 1977.

Fire Tower and Year	Daily Maximum and Minimum Termperatures (°C) By Month											
	April		May		June		July		August		September	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Swan Dive												
1975	8.5	- 0.7	10.6	1.8	14.7	6.0	20.2	11.5	13.7	5.8	13.8	4.7
1976	7.5	- 0.9	14.0	3.0	13.4	4.6	18.0	8.0	17.9	9.3	-	-
1977	11.7	1.2	12.3	3.8	17.4	7.0	16.2	7.5	14.9	6.6	11.4	4.3
Mean 1975-77	9.4	- 0.1	12.3	2.9	15.2	5.9	18.1	9.0	15.5	7.2	12.7	4.5
Pimple-Imperial												
1975	11.5	0.1	12.8	2.3	16.6	6.2	21.4	11.4	15.2	6.3	13.9	3.8
1976	11.2	0.9	14.3	2.7	14.0	4.6	18.3	8.7	17.3	9.8	15.7	7.3
1977	14.7	1.9	12.1	3.8	17.6	7.2	16.2	7.6	15.3	6.8	10.3	3.6
Mean 1975-77	13.1	1.3	13.1	2.9	16.1	6.0	18.6	9.2	15.9	7.6	13.1	5.2

Bears were captured using Aldrich leg snares and modified Newhouse foot traps (Pearson 1975). Capture devices were attached to heavy drags by a cable sufficiently long that the animals soon became entangled in the surrounding brush (Pearson 1975). Traps were set either on trails leading to the bait site or in "cubbies", the former being the most successful technique. Trapped animals were tranquilized with phencyclidine hydrochloride administered by a powder charge Cap-Chur projectile. All animals were measured, weighed and ear-marked with numbered aluminum tags prepared by Western Industrial Research and Training Center, Edmonton, Alberta. A lower premolar tooth was extracted for subsequent age determination, and the breeding condition of females was noted. Selected grizzly and black bears were marked with color coded polyvinyl chloride ear markers and equipped with radio transmitters.

Radio transmitters were prepared by the Bioelectronics Division, C.W.S., Ottawa and Biosonics Limited, Calgary. Radio frequencies were in the 150 MHz range for grizzlies and the 40 MHz range for black bears. Telemetered animals were tracked with a Cessna 180 or 185 aircraft under charter from Oriole Air Limited, Whitecourt, Alberta. Monitoring flights were made weekly, weather permitting. Data regarding trap sites, capture locations and radio telemetry recorded movements were plotted on 1:250,000 scale maps.

Minimum home range polygons for telemetered grizzly and black bears were analyzed using the method described by Pearson (1975) and were delineated whenever sufficient data were available. Home range measurements were determined with the aid of a Hewlett Packard 9864A digitizer.

Scats of both grizzly and black bears were collected, treated with 10% formalin (to inhibit fungal growth and insect infestation) and dried or frozen. Prior to analysis, the scats were washed through a series of screens. The percent volume of each food item was estimated to the nearest percent. Percent importance values for each food item were calculated for each month of the collection period using the method described by Mealey (1975).

Harvest data for the period from 1972 to 1977 were obtained from the Alberta Fish and Wildlife Division. The data were supplemented with known road kills, natural mortalities and relocations.

4. RESULTS AND DISCUSSION

4.1 Trapping Success

Bait sites were established during the second week in April. Activity was sporadic till the first week in May, when the first capture was made. In 1977 we trapped a 1300 km^2 area between the Pimple and House Mountain Forest Service fire towers (Figure 2). That area encompassed the 1975 and 1976 study areas (Figure 3). Grizzly and black bear captures were made throughout the study area during the three years of intensive trapping (Figures 4, 5, 6 and 7).

Trap night capture ratios were not calculated for the 1977 records because as many as eight to 13 snares were set over a period of several weeks at some sites before a capture resulted. Animals made wary by previous capture experiences often fouled sets for extended periods of time before a subsequent capture was made.

Thirteen grizzlies were captured 20 times between 8 May and 6 October. During the same period 32 black bears were captured a total

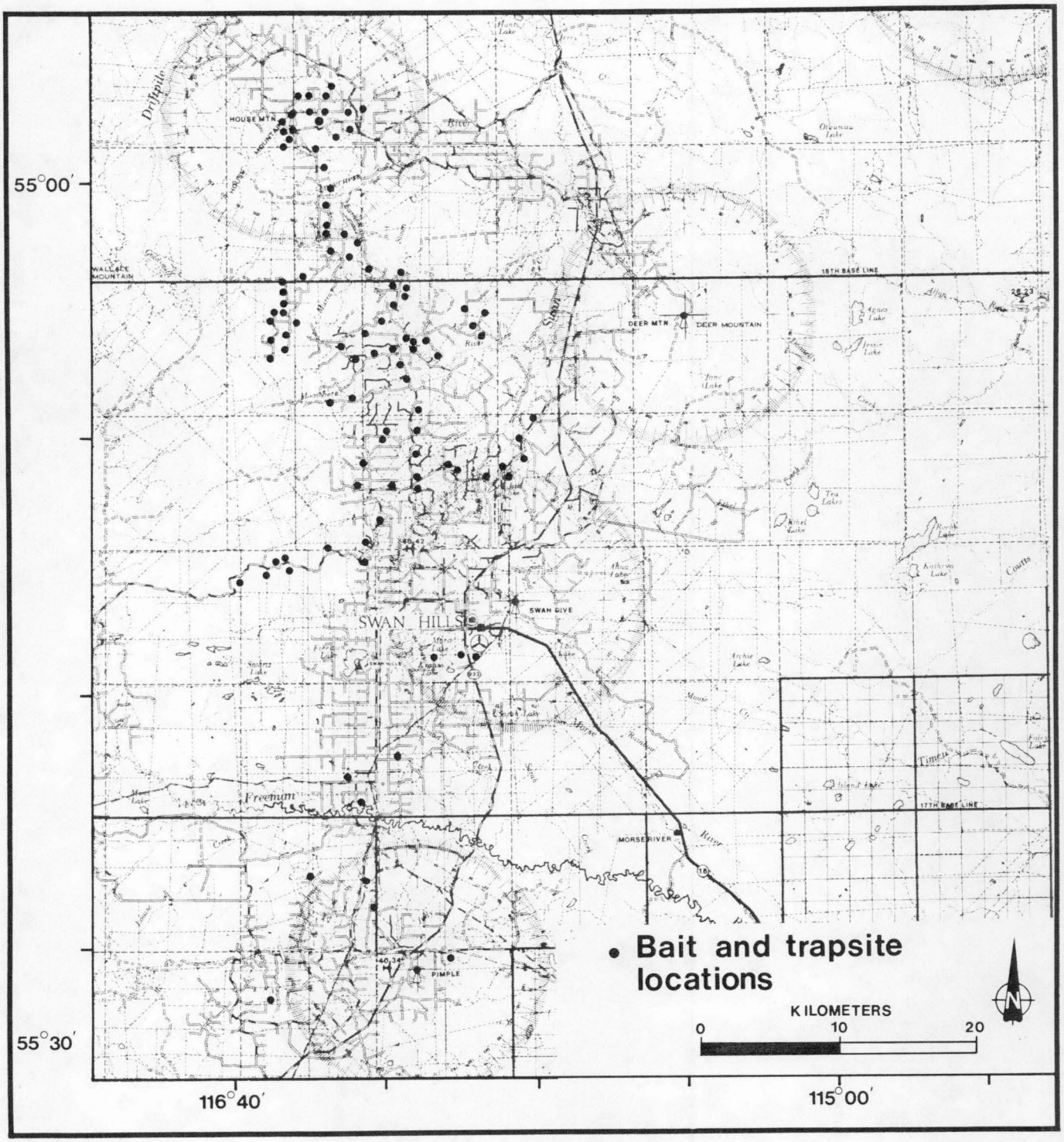

Figure 2. Distribution of bait and trapsites on the Swan Hills study area during 1977.

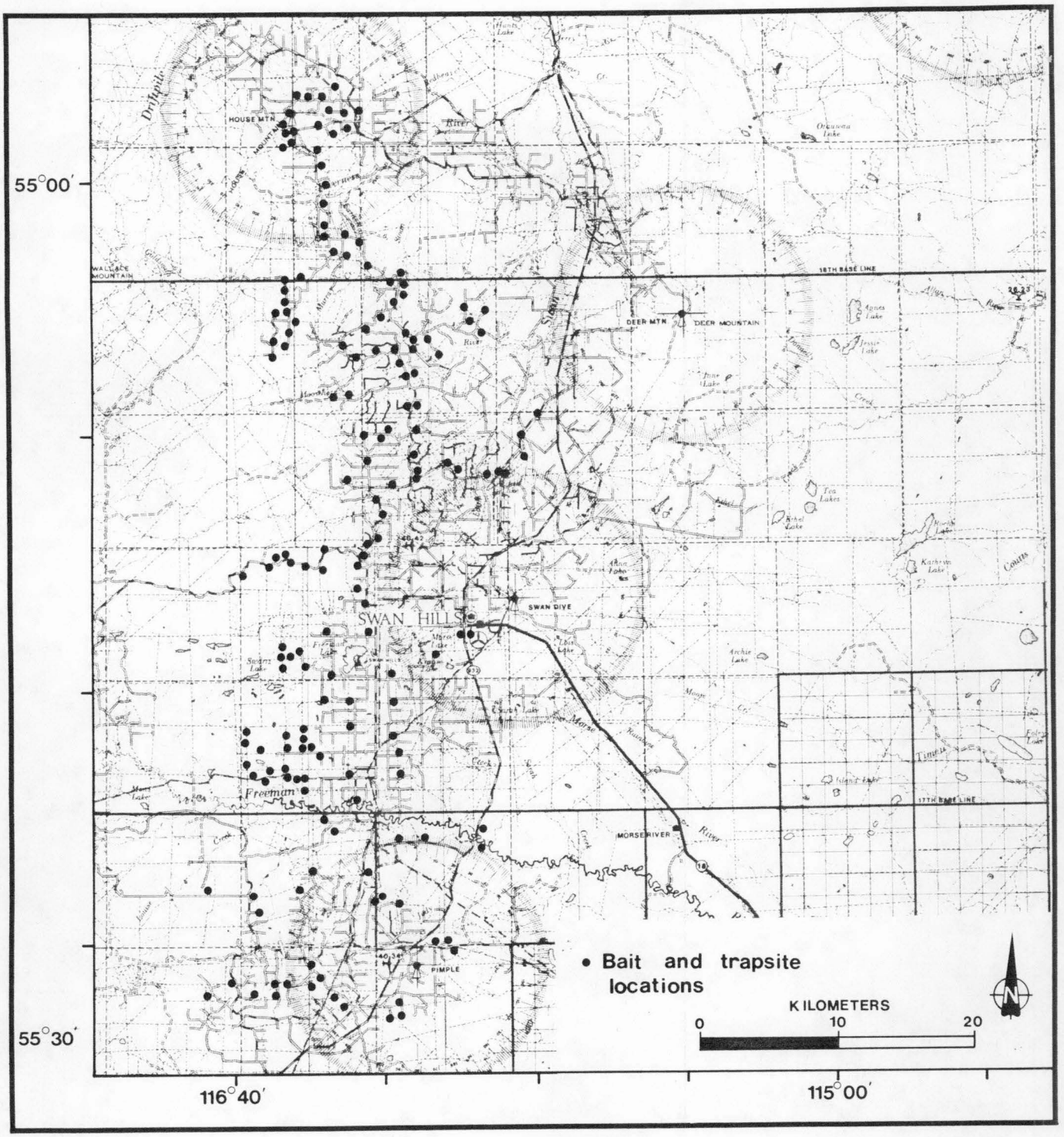

Figure 3. Distribution of bait and trapsites on the Swan Hills study area, 1975 to 1977.

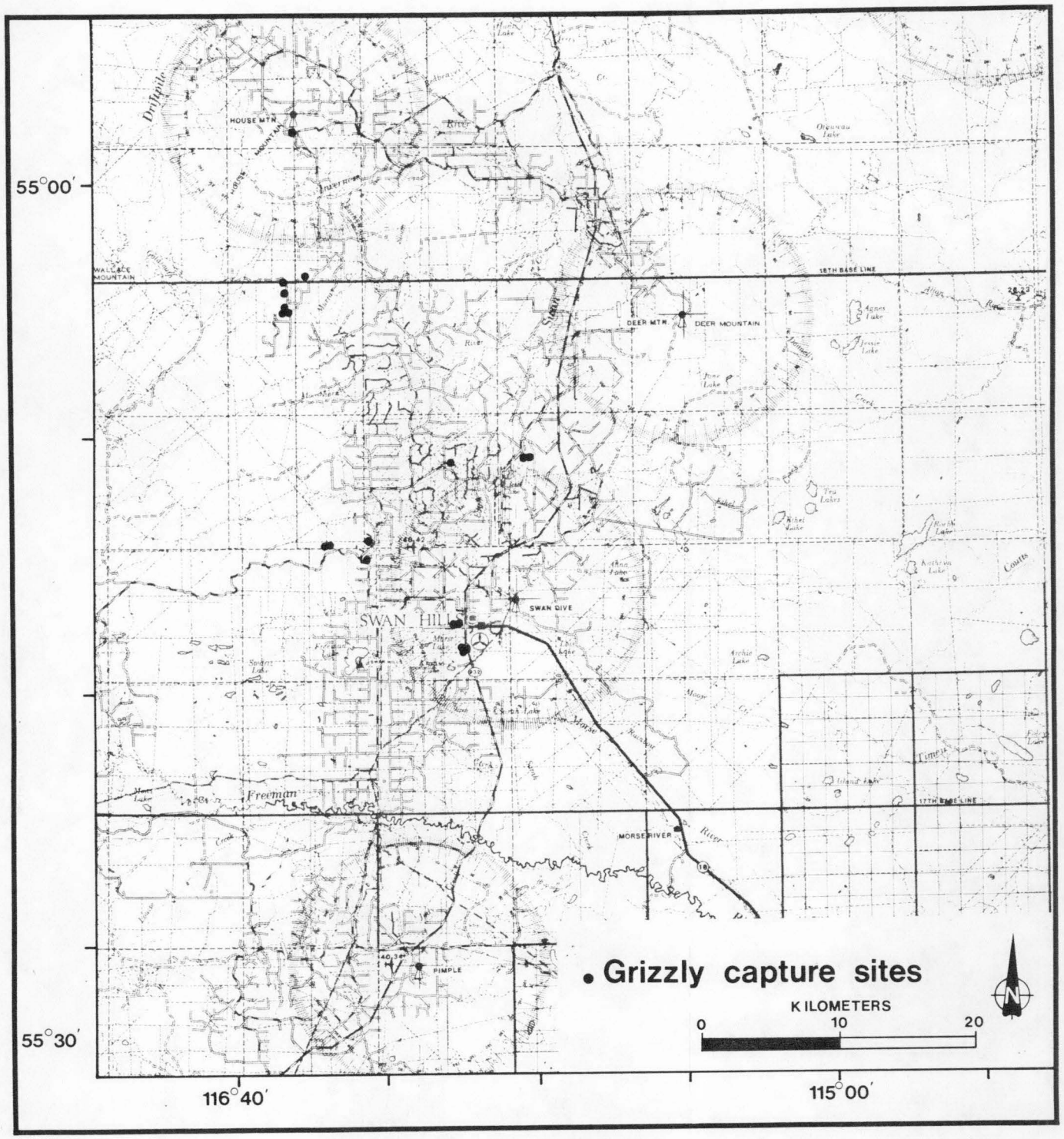

Figure 4. Distribution of grizzly bear capture sites on the Swan Hills study area during 1977.

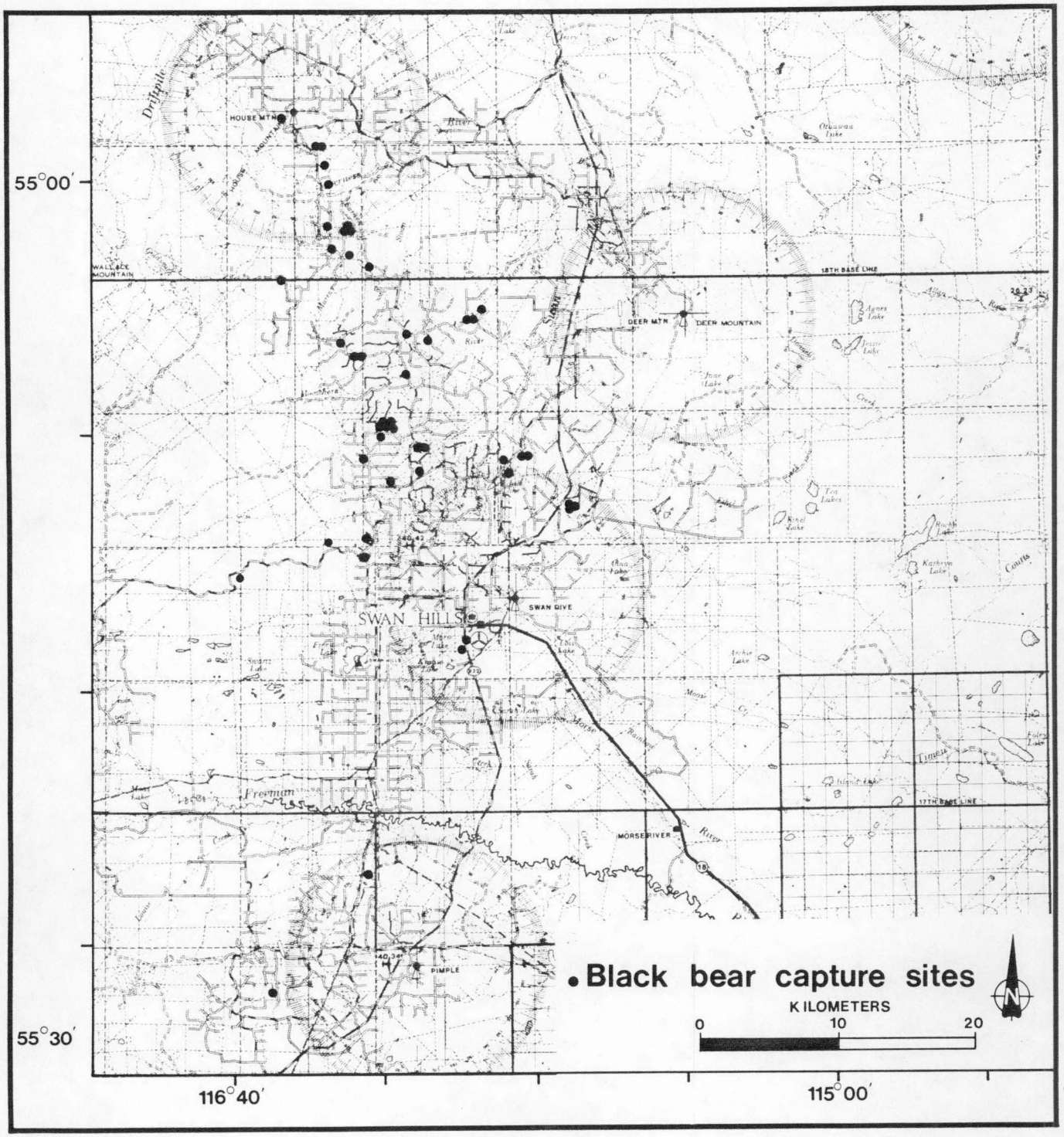

Figure 5. Distribution of black bear capture sites on Swan Hills study area during 1977.

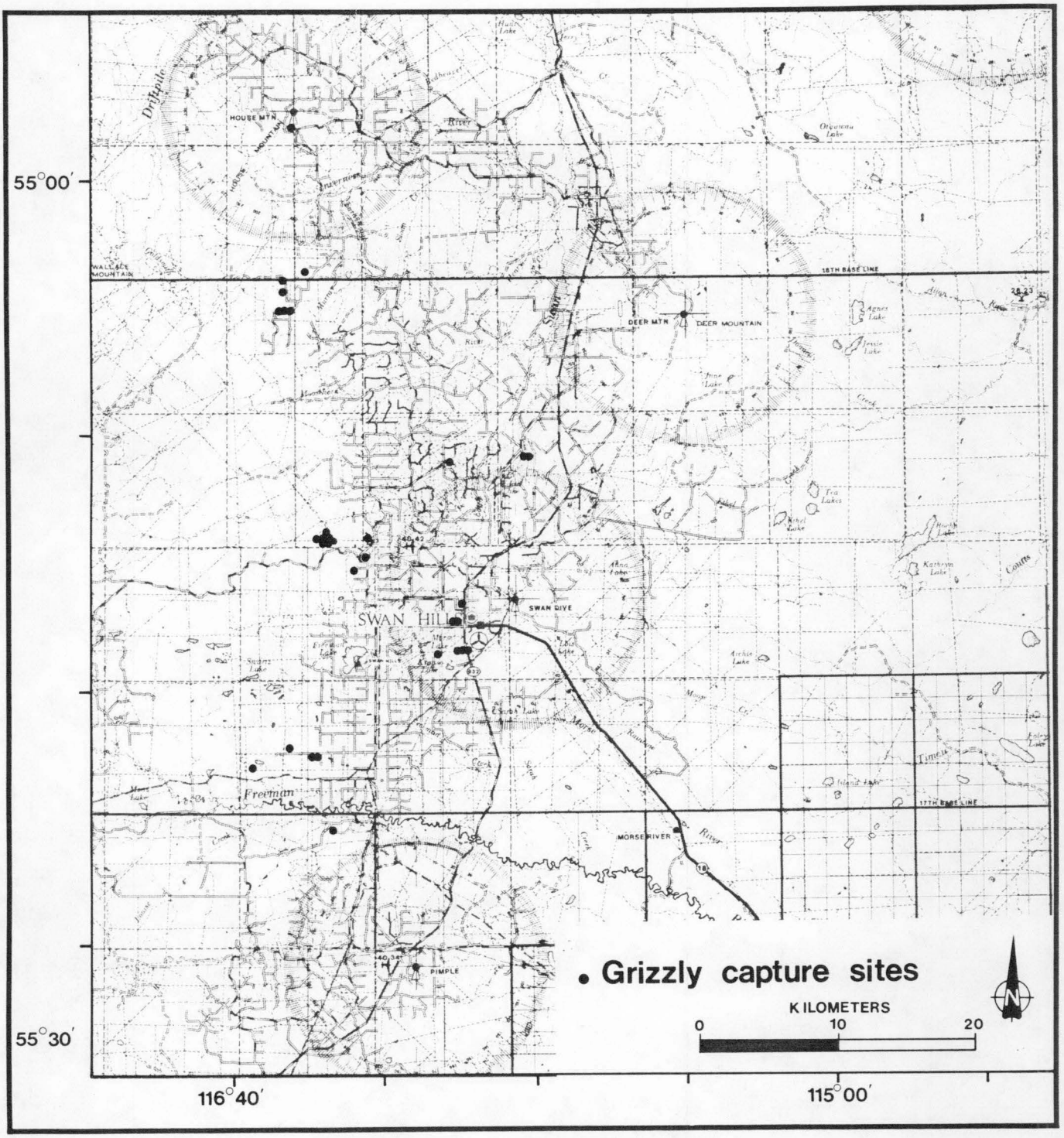

Figure 6. Distribution of grizzly bear capture sites on the Swan Hills study area, 1975 to 1977.

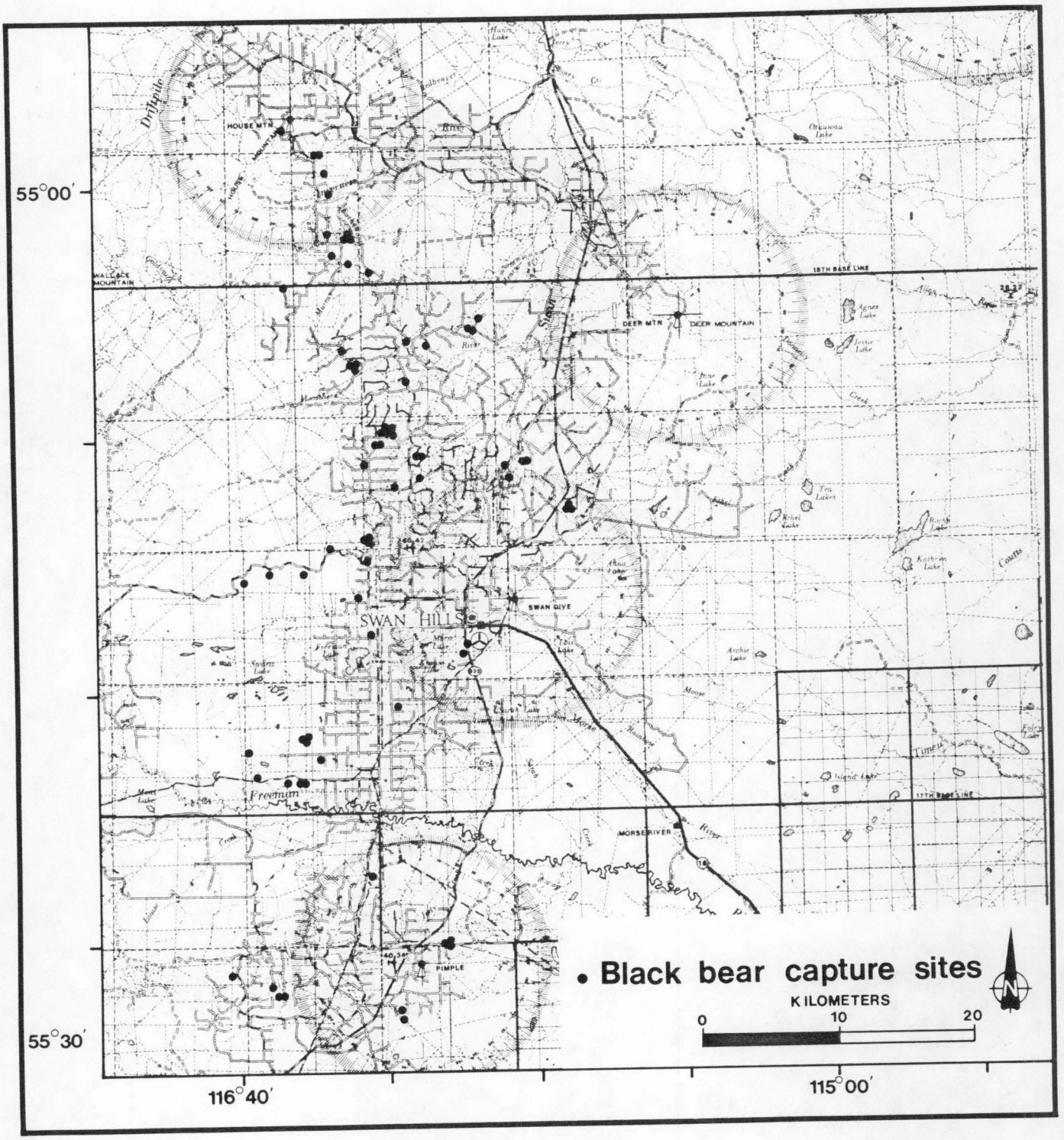

Figure 7. Distribution of black bear capture sites on the Swan Hills study area, 1975 to 1977.

of 49 times. One grizzly had been captured originally in 1975, four during 1976 while eight were new captures. We also recaptured three black bears tagged in 1976. The sex ratio for grizzlies was 6 females:7 males, while that for black bears was 9 females:23 males.

During the period 1975-77 grand totals of 18 grizzlies and 50 black bears have been handled on the study area. The overall sex ratio was 9 females:9 males for grizzlies, and 13 females:37 males for black bears. The color, sex, capture locations, identification markings, weights and measurements of all grizzly and black bears handled since 1975 were recorded (Appendices 1, 2, 3 and 4).

4.2 Physical Characteristics

4.2.1 Pellage coloration

4.2.1.1 Grizzly bears

The color of grizzlies ranged from the more usual brown to animals with brown underfur and blonde to almost white guard hairs over the head, shoulders and back, with dark leggings. The latter pattern gave the animals the characteristic "silver tipped" appearance. Some variations among individuals may be attributed to seasonal bleaching as observed in other regions (Pearson 1975).

4.2.1.2 Black bears

The color ratio for 50 black bears for which descriptions were obtained, was 45 black:5 brown (cinnamon). Variations in the black phase ranged from a uniform black to black with brown facial markings. Similarly, the brown phase ranged from a blonde, almost pink coloration, to dark chocolate brown with black leggings. White chest and neck markings were fairly common on both color phases.

4.2.2 Body weights

4.2.2.1 Grizzly bears

Mean weights and weight ranges by sex and age classes for 20 different grizzly bears were obtained during the study (Table 3). The largest male, captured twice (as a 20 and 22 year old), weighed 218 kg. The largest female was a 21 year old weighing 206 kg. Both were in excellent condition. The average weight for three mature females ($\geq$ 6 years) was 178 kg. Only one mature male has been captured. Although the sample sizes were small, the weights were about 79 and 83 kg greater than average weights reported for mature males and females, respectively, in the interior Yukon (Pearson 1975). However, they were considerably less than those reported for Swan Hills by Oeming (Alberta Wilderness Association 1976).

Although the data are too discontinuous to reflect growth rates, a comparison of maximum weights attained by adults and sub-adult weights suggest that there is sexual dimorphism in size, a trend similar to that reported elsewhere (Pearson 1975).

4.2.2.2 Black bears

Mean weights and weight ranges by sex and age classes were recorded for 50 different black bears (Table 4). The largest male captured was a six year old weighing 138 kg. In comparison, the largest female, a nine year old, weighed 127 kg. The average weight of three males over five years of age was 130 kg, while that for nine females was 80 kg. Sexual dimorphism in size was reflected in all age classes for which mean weight comparison data were available (Table 4).

Table 3. Mean weights and weight ranges by sex and age class for twenty different grizzly bears captured on the Swan Hills study area from 1975 to 1977.*

Age (years)	Males			Females		
	N	Mean	Weight Range	N	Mean	Weight Range
0- 0.9	-	-	-	1	22.70	-
1- 1.9	3	56.69	49.9- 68.04	4*	41.05	40.82- 41.28
2- 2.9	10	81.20	72.7-111.10	7	65.43	47.60- 90.72
3- 3.9	-	-	-	-	-	-
4- 4.9	-	-	-	1	115.67	-
5- 5.9	-	-	-	1	154.22	-
6- 6.9	-	-	-	-	-	-
16-16.9	-	-	-	1	167.80	-
17-17.9	-	-	-	-	-	-
18-18.9	-	-	-	-	-	-
19-19.9	-	-	-	-	-	-
20-20.9	1	217.73	-	-	-	-
21-21.9	-	-	-	1	206.39	-
22-22.9	1	217.73	-	1	158.80	-

*Includes the weights of two yearling females destroyed after being injured by a motor vehicle in the Swan Hills area.

Table 4. Mean weights and weight ranges by sex and age class for fifty different black bears for which weights were obtained, 1975 to 1977.

Age (Years)	Males			Females		
	N	Mean	Weight Range	N	Mean	Weight Range
0- 0.9	4	13.04	11.34- 13.61	-	-	-
1- 1.9	6	35.91	22.68- 58.97	-	-	-
2- 2.9	19	56.48	36.29- 97.52	3	39.31	34.02- 43.09
3- 3.9	10	79.07	54.43-111.13	3	52.92	47.63- 61.24
4- 4.9	7	81.20	72.58- 90.72	4	78.25	52.16-104.33
5- 5.9	1	117.94	-	2	74.85	68.04- 81.65
6- 6.9	1	138.35	-	1	80.74	-
7- 7.9	-	-	-	2	75.98	68.04- 83.92
8- 8.9	-	-	-	2	73.71	72.58- 74.84
9- 9.9	-	-	-	1	127.01	-
10-10.9	-	-	-	-	-	-
11-11.9	-	-	-	-	-	-
12-12.9	1	133.81	-	-	-	-
13-13.9	-	-	-	-	-	-
14-14.9	-	-	-	1	58.97	-
15-15.9	-	-	-	-	-	-

The mean weights reported here were 2 to 74% greater by sex and age class, than those reported by Poelker and Hartwell (1973). However, Poelker and Hartwell (1973) point out that weight data are highly variable, depending on the season during which animals were captured. When seasonal weight changes are considered, apparent differences become less, and in fact may not exist.

4.2.3 Seasonal weight changes

The seasonal rates of weight change reported here for grizzly and black bears should be considered as means. The rate of change in body weight cannot be considered constant over the active period, but most likely varies with the seasonal availability of various food items (Folk *et al.* 1972). Bears feeding on seasonally available berries or animal material would presumably have a greater daily rate of gain than those feeding exclusively on green vegetation.

4.2.3.1 Grizzly bears

Weight changes were recorded during the active period for five subadult grizzlies (Table 5). The average rate of gain was 0.39 (0.13 to 0.68) and 0.28 (0 to 0.48) kg/day for males and females, respectively. Male no. 28 recorded the greatest percent change in weight, increasing its body weight by 330% at an average rate of 0.51 kg/day over 148 days (Table 5). A 91% increase in body weight at an average rate of 0.36 kg/day over 120 days was recorded by female no. 26 (Table 5). The greatest weight gain for that bear occurred during the period from 27 July to 5 October. As with black bears, rapid increases in body weight may not occur till after mid-July (Jonkel and Cowan 1971). This probably reflects the increased availability of berries.

Table 5. Seasonal weight changes observed for grizzly bears between successive captures during 1977.

Sex and Number of Bear	Age (years)	Capture Dates (day/month)	Number of Days	Weight Range (kg)	Weight Change (kg)	Weight Change (%)	Daily Rate of Change (kg/day)
M-28	2	7/5 - 29/9	118	22.7 - 97.52	+74.82	+330.0	+0.51
M-29	2	18/5 - 28/7	72	49.9 - 59.00	+ 9.10	+ 18.0	+0.13
M-50	2	10/6 - 19/6	10	104.3 - 111.10	+ 6.80	+ 7.0	+0.68
F-26	2	8/6 - 27/7	50	47.6 - 56.70	+ 9.10	+ 19.0	+0.18
		27/7 - 5/10	71	56.7 - 90.72	+34.02	+ 60.0	+0.48
		8/6 - 5/10	120	47.6 - 90.72	+43.12	+ 91.0	+0.36
F-34	2	8/5 - 9/6	33	61.2 - 61.20	+ 0.00	+ 0.0	+0.00

Pearson (1975) reported average daily weight increases of 0.413 kg/day over 126 days for an adult male; and an average increase of 0.635 kg/day over a 16 day period between August and September, for a subadult female feeding on soap berries (*Sheperdia canadensis*). Average rates of gain observed on the Swan Hills study area, though highly variable, can be considered comparable with those reported by Pearson (1975).

4.2.3.2 Black bears

Seasonal weight changes for eight male and four female black bears were obtained (Table 6). Changes varied with sex and age class. Two males registered weight losses of 5.0 and 16.0% between capture dates in June and July. Average losses of weight per day were 0.16 and 0.85 kg, respectively. Body weights of six males increased an average of 12.0% at an average rate of 0.14 (0 to 0.35) kg/day between successive captures in June, July and October (Table 6).

One female lost 19% of her body weight (0.47 kg/day) between early and late July. Three females showed an average increase in weight of 22% (3 to 44%) at an average rate of 0.33 (0.07 to 0.70) kg/day between successive captures from May to August (Table 6).

Black bears of all age classes in the spruce-fir forest of Montana either gained weight slowly or lost weight during the spring and early summer, an observation confirming earlier reports (Jonkel and Cowan 1971). Bears foraged extensively on a great variety of forbs and grasses during that period (Tisch unpublished masters thesis cited by Jonkel and Cowan 1971). Jonkel and Cowan (1971) reported average gains of only 0.04 kg/day during that period. The greatest loss was 0.29 kg/day over a 14-day period by a subadult female. Bears reached their lowest weights in late June or

Table 6. Seasonal weight changes observed for black bears between successive captures, 1975 to 1977.

Sex and Number of Bear	Age (years)	Capture Dates (day/month)	Number of Days	Weight Range (kg)	Weight Change (kg)	Weight Change (%)	Daily Rate of Change (kg/day)
M- 5	4	17/6 - 14/7	28	90.72 - 86.18	- 4.54	- 5.0	- 0.16
M-44	3	5/6 - 20/6	16	61.24 - 65.77	+ 4.53	+ 7.0	+ 0.28
M-48	2	7/6 - 11/7	35	45.36 - 45.36	+ 0.00	+ 0.0	+ 0.00
		11/7 - 23/7	13	45.36 - 49.90	+ 4.54	+10.0	+ 0.35
		7/6 - 23/7	47	45.36 - 49.90	+ 4.54	+10.0	+ 0.10
M-51	2	11/6 - 18/6	8	54.43 - 47.63	- 6.80	-12.0	- 0.85
		18/6 - 19/7	32	47.63 - 45.63	- 2.00	- 4.0	- 0.06
		11/6 - 19/7	39	54.43 - 45.63	-16.00	-16.0	- 0.23
M-59	2	9/7 - 21/7	13	56.70 - 61.24	+ 4.54	+ 8.0	+ 0.35
M-60	3	14/7 - 3/10	82	72.58 - 77.20	+ 4.62	+ 6.0	+ 0.06
M-64	1	21/7 - 2/8	13	27.22 - 29.48	+ 2.26	+ 8.0	+ 0.17
M-65	1	22/7 - 7/10	78	22.68 - 36.29	+13.29	+60.0	+ 0.17
F-35	4	11/5 - 8/6	29	72.60 - 83.90	+11.30	+16.0	+ 0.39
		8/6 - 4/8	58	83.90 -104.33	+20.43	+24.0	+ 0.35
		11/5 - 4/8	86	72.60 -104.33	+31.73	+44.0	+ 0.37
F-45	7	18/6 - 21/7	34	72.58 - 74.84	+ 2.26	+ 3.0	+ 0.07
F-58	3	2/7 - 25/7	24	61.24 - 49.94	-11.34	-19.0	- 0.47
F-63	2	19/7 - 31/7	13	54.43 - 63.50	+ 9.07	+17.0	+ 0.70

early July. From mid-July until October, all age classes of both sexes gained weight rapidly. In an average of 30 days, 14 bears gained 0.38 kg/day, with one adult female gaining 0.70 kg/day for 22 days. Although our sample size for animals captured during the summer and fall period is small, a trend similar to that observed by Jonkel and Cowan (1971) is apparent in the Swan Hills area.

4.3 Breeding Biology

4.3.1 Grizzly bears

We captured four female grizzly bears which appeared to be sexually mature. In 1975 a four year female exhibiting vulvar swelling was captured on 25 June. In 1977 we captured a 16 year old female on 20 July which was in a post-estrous condition. These observations suggest a June-July breeding season, however, further field work is required before the season can be delineated more accurately.

Two females were observed with yearling and two-year old young at ages 5 and 22. Breeding would have occurred at ages 3.5 and 19.5, respectively, which are likely minimum and maximum successful breeding ages for females in the population. Craighead (1969) reported earliest successful breeding ages of 4.5 to 8.5 years for young female grizzlies in Yellowstone National Park and Pearson (1975) found 6.5 years to be the youngest breeding female in the interior Yukon. Pearson (1975) also observed a sexually active 24.5 year old female in the interior Yukon population but was not able to confirm a successful mating. Craighead (1976) suggested that reproductive longevity approximates physical longevity, with most adult females capable of producing offspring as long as they live. The occurrence of a young sexually active female on the Swan Hills study

area suggests either excellent habitat conditions and/or an over-harvested population.

We have observed five females accompanied by young since 1975. One female was observed with cubs of the year, three with yearlings and one with two-year olds. The average litter size was 2.2 young (range 1 to 3) which is comparable with mean litter sizes reported for the Alaska Peninsula (Lentfer 1966), Kodiak National Wildlife Refuge (Troyer and Hensel 1964) and Glacier National Park, Canada (Mundy and Flook 1973).

The age of self-sufficiency occurs during the third year of life, suggesting a minimum reproductive interval of three years for females successfully rearing young. Some deviations from that pattern occur, and may be a function of litter size and growth rates. In 1977 we captured weaned two-year old subadults as early as the first week in May. In comparison, female no. 31 was observed with her three two-year old young in October. She apparently denned with her three young again over the 1977-78 winter. The young will be three-year olds when they emerge from the den in the spring 1978. Mean spring weights for weaned two-year old subadults were 68 and 14 kg greater than those for the unweaned male and female young of no. 31. Early development of young in large litters may be retarded, resulting in later ages of self-sufficiency. A similar phenomenon has been observed on the Tuktoyaktuk Peninsula, N.W.T. (Pearson *et al.* in preparation).

4.3.2 Black bears

Pre-estrous female black bears were captured on 8 and 18 June and 2 July, and post-estrous females on 16 and 21 July and 4 August. The onset of the breeding season appears to occur from mid to late May, with

the peak occurring between mid June and mid July. These breeding dates are similar to those reported by Jonkel and Cowan (1971).

The youngest female observed in estrous was 3.5 years old. Another female captured as a 4.5 year old in 1975 was in estrous but did not breed successfully until age 5.5 years. She was observed with cubs of the year in 1977. The minimum and maximum known successful breeding ages were consistent with those reported by Jonkel and Cowan (1971).

Observations of bears on the study area were infrequent because of dense vegetation. Therefore, observations of litter size were limited. We have observed a total of five black bear litters since 1975. The average litter size was 2.2 young (range 2 to 3). The sample size was too small to make direct comparisons with other populations, but the average observed litter size appears similar to those reported for other regions in North America (Poelker and Hartwell 1973).

Capture records suggest that the age of self-sufficiency for black bears occurs at age 1.5 years, with a minimum reproductive interval of two years for females in the population.

4.4 Food Habits

4.4.1 Grizzly bears

A total of 97 grizzly bear scats were collected during the 1977 field season. Food items found in scats included herbaceous material (*Trifolium* sp. and *Heracleum lanatum* and unidentified material); monocots (grasses and sedges); *Equisetum* sp.; insects (ants and beetles); berries *Vaccinium* sp., *Viburnum* sp. and *Ribes* sp.); and bait (Table 7).

The major proportion of grizzly bear diets consisted of herbaceous material, *Equisetum* sp. and monocots in 1977. Although berries registered

Table 7. Five most important food items found in grizzly bear scats collected on the Swan Hills study area during 1976 and 1977.

Food Items	Percent Importance Values By Month									
	May		June		July		August		Sept.-Oct.	
	1976	1977	1976	1977	1976	1977	1976	1977	1976	1977
	-	(n=1)	(n=6)	(n=11)	(n=3)	(n=27)	-	(n=43)	(n=7)	(n=15)
Herbaceous matter	-	19.0	75.5	72.5	63.2	41.5	-	83.6	0.0	96.6
Equisetum sp.	-	0.5	0.0	26.3	0.0	51.5	-	0.8	0.0	0.0
Monocots	-	80.0	2.9	1.1	27.9	1.5	-	4.6	0.0	2.3
Bait matter	-	0.0	20.1	0.1	3.3	3.3	-	0.9	0.1	0.0
Insects	-	0.5	1.0	0.1	0.0	0.0	-	0.0	0.0	0.0
Berries	-	0.0	0.4	0.0	0.3	1.5	-	10.2	99.2	1.1
Wood fiber	-	0.0	0.0	0.0	4.9	0.0	-	0.0	0.0	0.0
Bryophytes	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.7	0.0

an importance value of 99.2% during September-October in 1976, they occurred only in trace amounts during that period in 1977. We attribute the dramatic decline in berry consumption in 1977 to a crop failure, i.e. production of blueberries and huckleberries on the study area. Sweet clover constituted 64% of the identifiable component of all herbaceous material found in scats during June, 61% in July, 56% in August and 88% in October. Sweet clover, therefore, appeared to have been substituted as an alternate food source to berries in late 1977.

Small mammals (particularly ground squirrels), legume roots and bulbs were notable for their absence. Ground squirrels are important food items in the pre-denning diets of grizzly bears in the northern Yukon and Tuktoyaktuk Peninsula, N.W.T. (Pearson *et al.* in preparation), while heavy utilization of legume roots (*Hedysarum* sp.) has been reported for grizzlies in the interior Yukon (Pearson 1975) and in Banff and Jasper National Parks (Hamer *et al.* 1977 and Russell *et al.* 1978). Swan Hills is the only known grizzly range where ground squirrels are not found (Banfield 1973). In addition, no other evidence of predation has been observed in scats collected to date. The apparent lack of roots and bulbs cannot be explained. The apparent marked differences in food habits of the Swan Hills grizzly compared with other populations suggest that further food habit studies be undertaken. Such work is needed in order to define habitat requirements to assist in the preservation of this ecotype.

4.4.2 Black bears

A total of 137 black bear scats were collected in 1977. Food items found in scats included herbaceous material (*Trifolium* sp. and unidentified material); monocots (grasses and sedges); *Equisetum* sp.; berries (*Viburnum* sp., *Lonicera involucrata, Vaccinium* and *Ribes* sp.); insects (ants and beetles) and bait material (Table 8).

Black bears fed primarily on herbs, *Equisetum* sp. and monocots (Table 8). Berries were consumed from spring through summer with heaviest use in July and August 1977. Bracted honeysuckle berries (*Lonicera involucrata)* and high bush cranberries (*Viburnum* sp.) occurred most often in the sample during that period. In contrast to 1976, berries were absent in the September-October scat sample. As with grizzlies sweet clover replaced berries as the most widely consumed forage in autumn 1977. Sweet clover was also eaten extensively during the sample period, representing 30% of the identifiable component of herbs found in scats collected in May, 83% in June, 55% in July and 83% during September-October.

A comparison of grizzly and black bear food habits (Table 7 and 8), suggests both species utilize and possibly compete for the same food items.

4.5 Mortality Records

4.5.1 Grizzly bears

Mortality records for the study area show that of 20 grizzly bears removed from the population since 1972, eleven were harvested by hunters, two were shot as "nuisance" bears, two were destroyed after being injured by a motor vehicle, four nuisance bears were relocated in the Wilmore Wilderness or Grande Prairie areas and one succumbed to natural predation (Table 9 and Appendix 5). The majority of the mortality sites were primarily around the town of Swan Hills (Figure 8). Therefore, it is reasonable to assume that the mortality noted above is minimal. A certain amount of poaching and vandal shooting of bears is inevitable.

During 1977 four subadult males were removed from the population (Appendix 5). Two were identified as problem bears and relocated to the

Table 8. Five most important food items found in black bear scats collected on the Swan Hills study area during 1976 and 1977.

Food items	Percent Importance Values by Month									
	May		June		July		August		Sept.- Oct.	
	1976	1977	1976	1977	1976	1977	1976	1977	1976	1977
	-	(n=6)	(n=46)	(n=31)	(n=9)	(n=82)	-	(n=11)	(n=31)	(n=7)
Herbaceous matter	-	66.8	85.0	53.1	50.9	51.9	-	10.7	14.7	84.3
Bait matter	-	2.5	5.9	8.4	5.0	3.7	-	14.2	13.9	15.8
Berries	-	0.8	3.5	2.3	0.0	10.4	-	57.0	69.0	0.0
Monocots	-	2.6	2.6	13.6	20.1	0.6	-	0.9	0.0	0.0
Equisetum sp.	-	26.5	2.1	22.6	0.0	31.5	-	17.2	0.0	0.0
Insects	-	0.0	0.0	0.1	13.8	2.2	-	0.0	0.0	0.0
Wood fiber	-	0.0	0.0	0.0	9.9	0.0	-	0.0	0.0	0.0
Bryophytes	-	0.0	0.0	0.0	0.0	0.0	-	0.0	1.6	0.0
Black bear hair	-	0.0	0.0	0.0	0.0	0.0	-	0.0	0.7	0.0

Table 9. Number and mean ages of animals harvested or removed from the Swan Hills grizzly bear population, 1972 to 1977.

Removal Circumstance	Females		Males		Overall	
	N	Mean Age	N	Mean Age	N	Mean Age
Hunter kill[1]	4	2.5	6	4.0	10	3.4
Nuisance kill	1	2.0	1	2.0	2	2.0
Natural predation	-	-	1	1.0	1	1.0
Road kill	2	1.0	-	-	2	1.0
Relocated[2]	2	2.0	2	2.0	4	2.0
Overall	9	2.0	10	3.1	19	2.6

[1]Excludes one adult male shot by hunters during 1972 -- age of bear not available.
[2]Bears captured and relocated after becoming a problem near Swan Hills townsite.

Grande Prairie area, while two were shot by Treaty Indians at the Swan Hills dump.

Three aspects of the harvest data are of particular interest: 1) the average age for all animals removed from the population approximates the observed age of self-sufficiency (i.e. 2.5 years; 2) both males and females are being removed from the population and 3) the relocation or destruction of nuisance bears was a significant factor in mortality data for grizzly bears. After weaning, subadult bears may be more vulnerable to hunter pressure and habituation to garbage than adults. The removal of both males and females from the study area probably reduced recruitment to the resident breeding population.

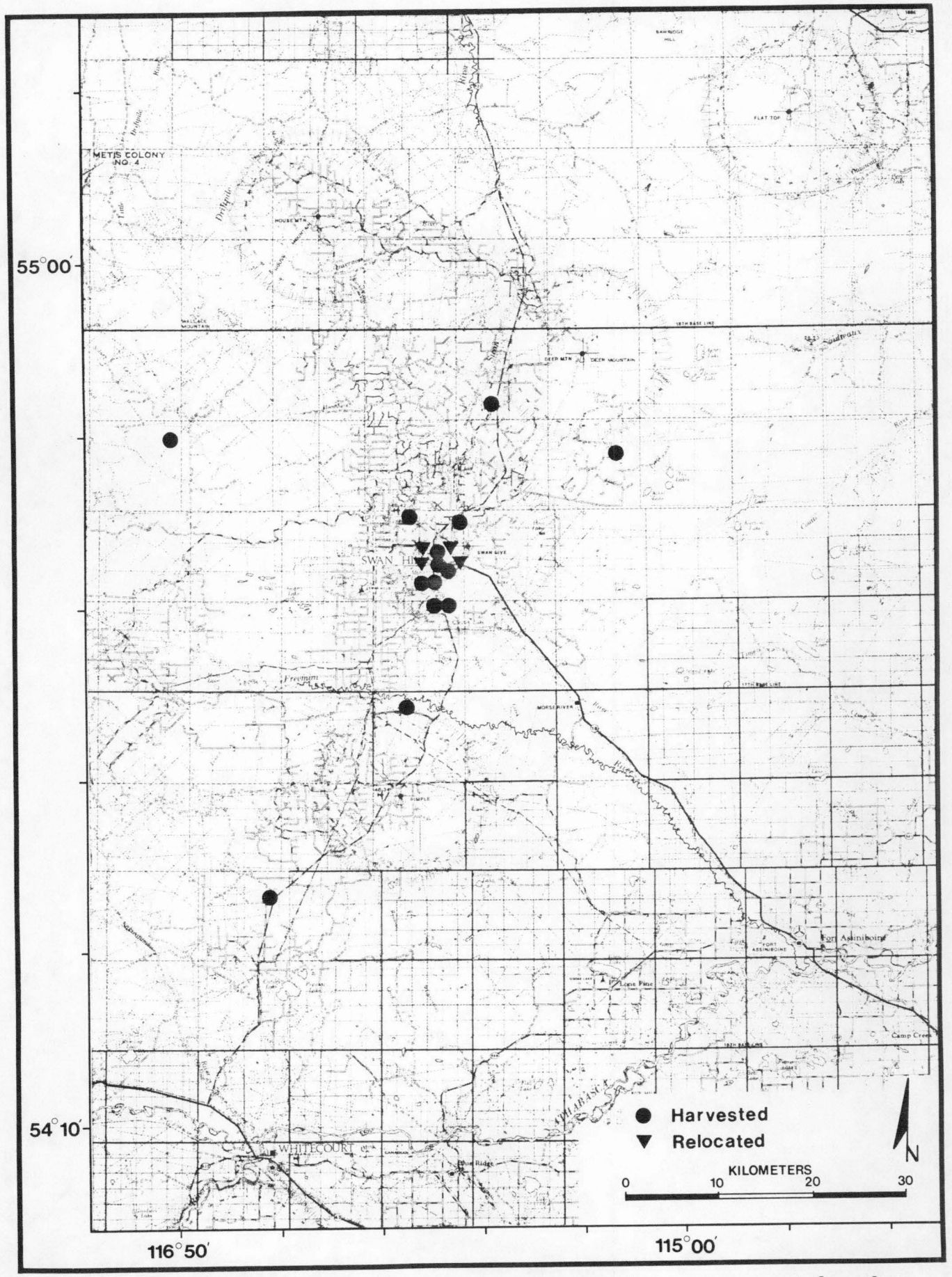

Figure 8. General kill and capture locations of grizzly bears removed from Swan Hills, 1972 to 1977.

4.5.2 Black bears

Black bear harvest records are incomplete because hunters are not required to register their kills. As a result the greatest proportion of recorded data are based on voluntary tag returns by hunters. Known harvest records for the area were compiled (Appendix 6). The average age of legally harvested animals was 3.0 years (range 2 to 4 years) of which all were males.

Two instances of illegal kills of black bears were recorded during 1977. A female was shot approximately 13 km north of the town of Swan Hills during the spring bear hunt. Her cubs of the year were captured by oil field workers and sent to the Storyland Zoo, Edmonton. A brown phase male black bear was shot at the Swan Hills refuse dump on 8 July. Only the feet of the bear were taken. The poacher may have thought the bear was a grizzly.

4.6 Home Ranges

One of the more difficult aspects of field work has been maintaining functioning radio collars on study animals. We equipped eight grizzly and 10 black bears with radio collars since 1975. Transmitter failures were observed after several days to a year on four grizzlies and one black bear. One grizzly and four black bears were harvested, while one grizzly died of natural predation. As a result home range data are discontinuous. Actual home ranges for both grizzly and black bears, therefore, may be considerably larger than reported here. In all cases movements recorded through telemetry were supplemented with data from direct observations and capture locations.

4.6.1 Grizzly bears

We have obtained home range data for four females and two males. The minimum home ranges for males and females are shown (Figures 9 and 10). A summary of all home range data is also given (Table 10).

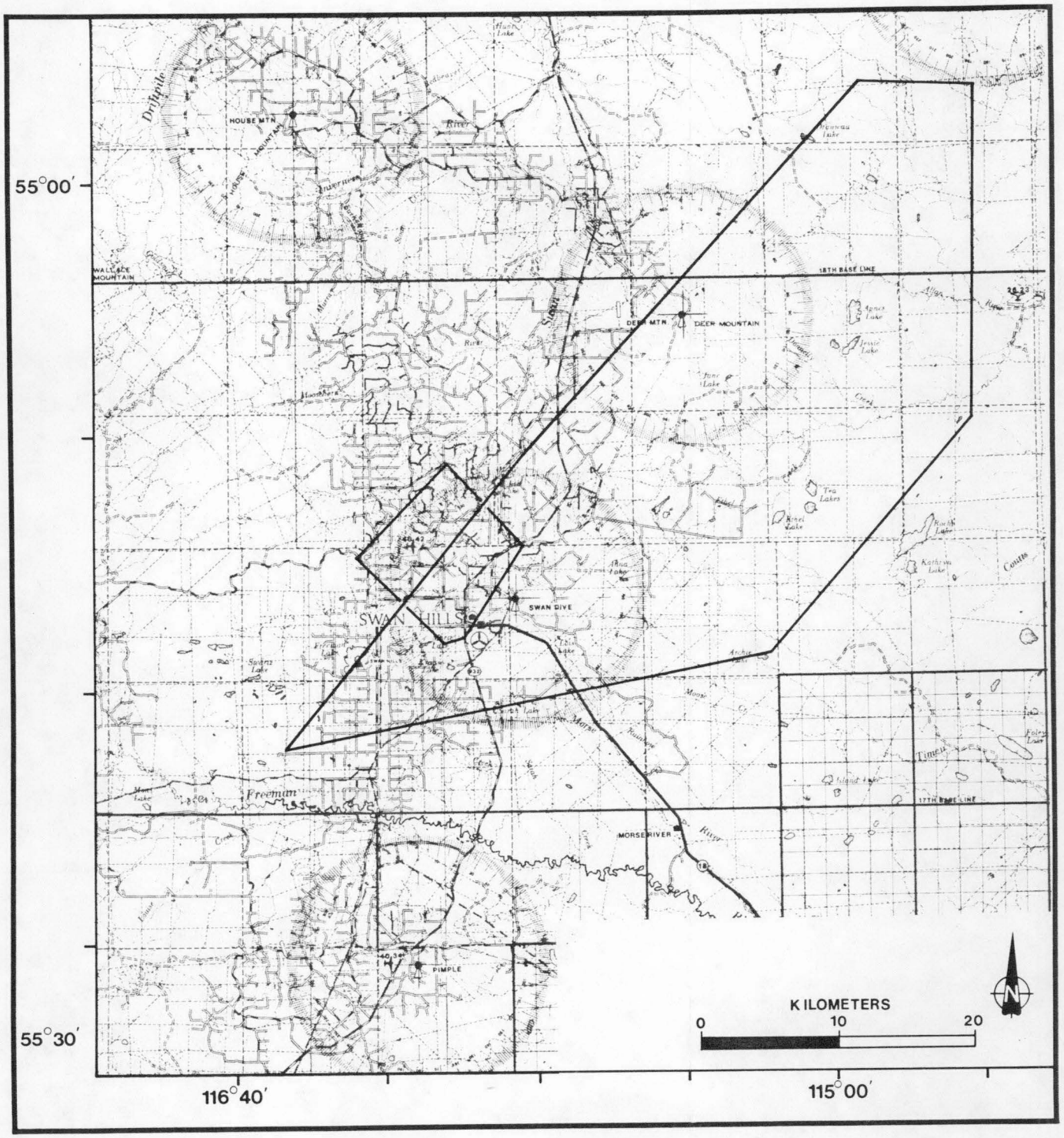

Figure 9. Minimum home range polygons for two male grizzly bears on the Swan Hills study area.

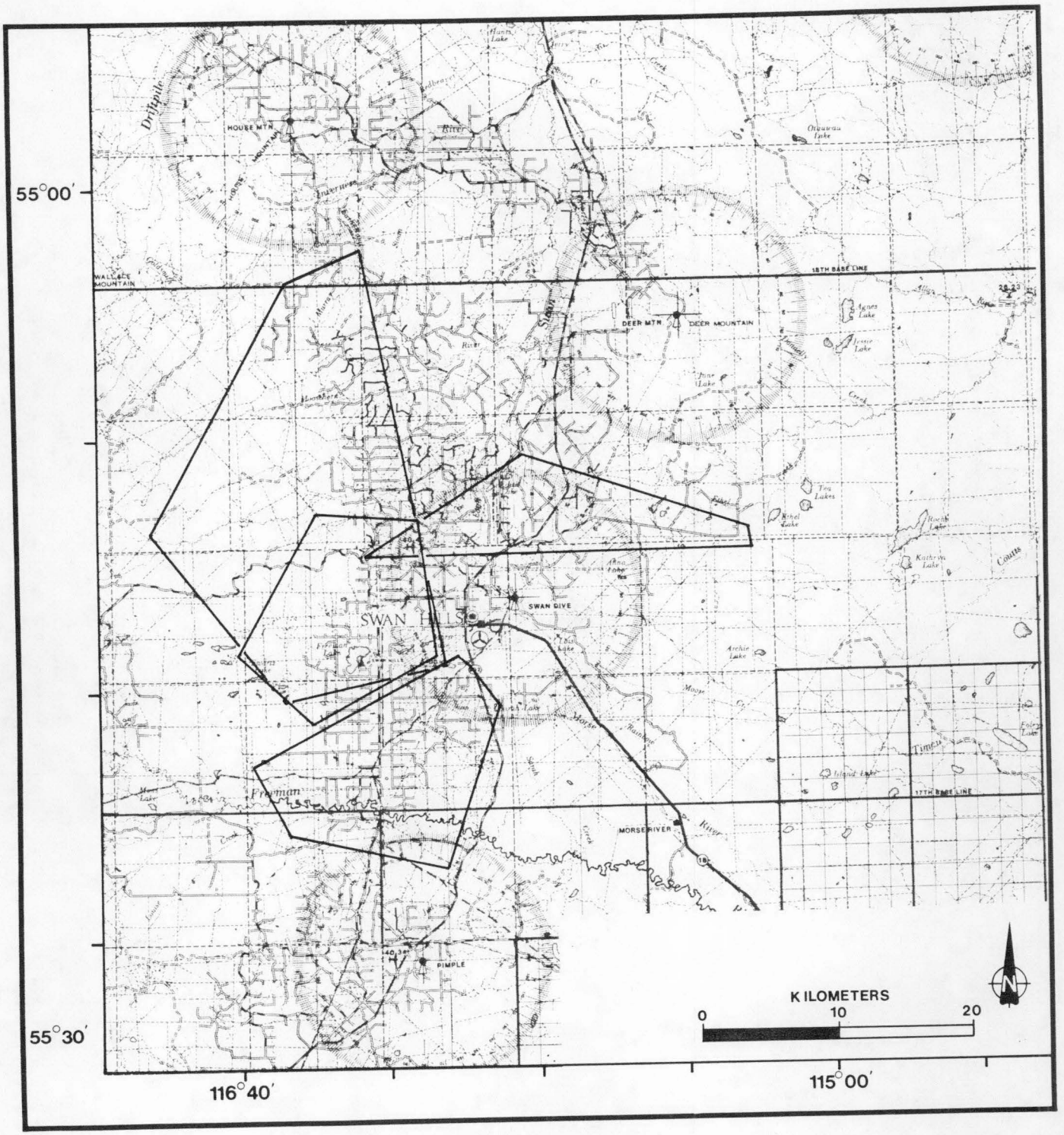

Figure 10. Minimum home range polygons for four female grizzly bears on the Swan Hills study area.

Table 10. Home range data for radio-collared grizzly bears in Swan Hills, 1975 to 1977.

Sex and Identifying Number of Bear	Age (years)	Days Under Observation	No. of Point Locations	Home Range (km^2) By Year			Total Home Range (km^2)
				1975	1976	1977	
M-34	20	97	11	1022.3	-	-	-
	22	2	2	-	-	-	1085.8
M-50	2	44	9	-	-	81.8	81.8
F- 8	4	112	10	160.6	-	-	160.6
F-14	5	85	12	145.5	-	-	145.5
F-31	21	29	5	-	39.0	-	-
	22	179	19	-	-	424.5	424.5
F-34	2	125	6	-	-	113.1	113.1

The mean home ranges for three mature and one immature female were 244 (146 to 425) and 113 km^2, respectively. The minimum home range for one adult and one subadult male were 1086 and 82 km^2, respectively. Home ranges of males and females overlapped.

The movements of female no. 31 (accompanied by three young) have been monitored since we first captured her in October, 1976. A full year of data were obtained on her movements from den to den during 1977. Her home range of 425 km^2 in 1977 encompassed that observed in 1976. No. 31's den site in autumn 1977 was located approximately eight kilometers south southeast of her 1976 den location. Both dens were located within the central core of her home range.

Minimum home ranges for all telemetered bears in Swan Hills were larger than those recorded in the interior Yukon where the mean minimums for mature and immature females were 86 and 88 km^2, respectively, and 287 and 70 km^2 for adult and subadult males (Pearson 1975). However, the Swan Hills data are comparable to those in Jasper where the mean minimum home ranges for adult females and males were 257 and 606 km^2, respectively (Pearson and Nolan 1976; Russell *et al.* 1978).

4.6.2 Black bears

Minimum home ranges for male and female black bears were calculated (Figures 11 and 12). A summary of the data is also given (Table 11).

Mean minimum home ranges for four females were 123 (71 to 246) km^2 and for nine males were 151 (13 to 443) km^2, respectively. Minimum home ranges were considerably larger than those reported for black bears in Washington State (Poelker and Hartwell 1973). Home ranges of males and females overlapped.

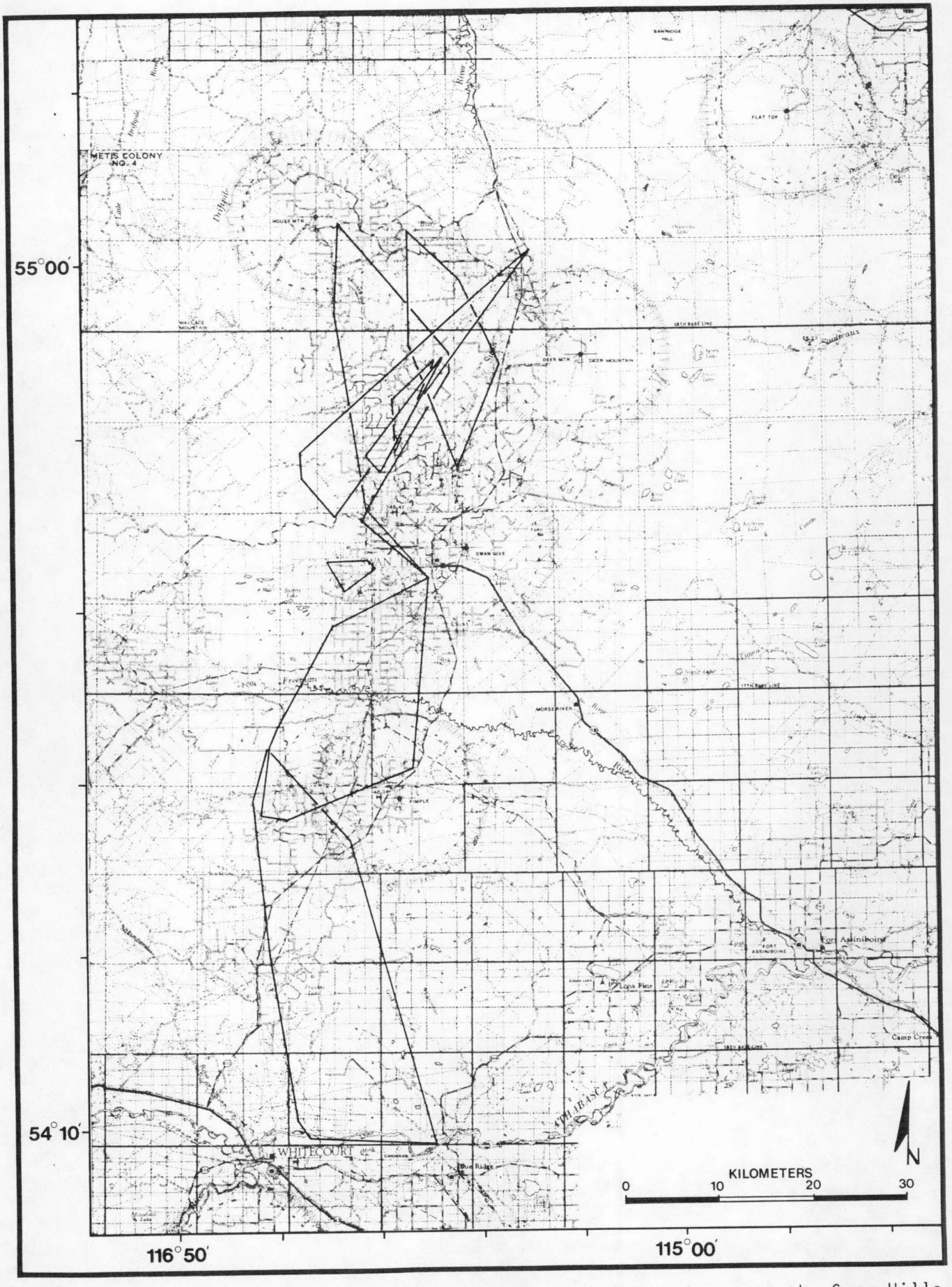

Figure 11. Minimum home range polygons for nine male black bears on the Swan Hills study area.

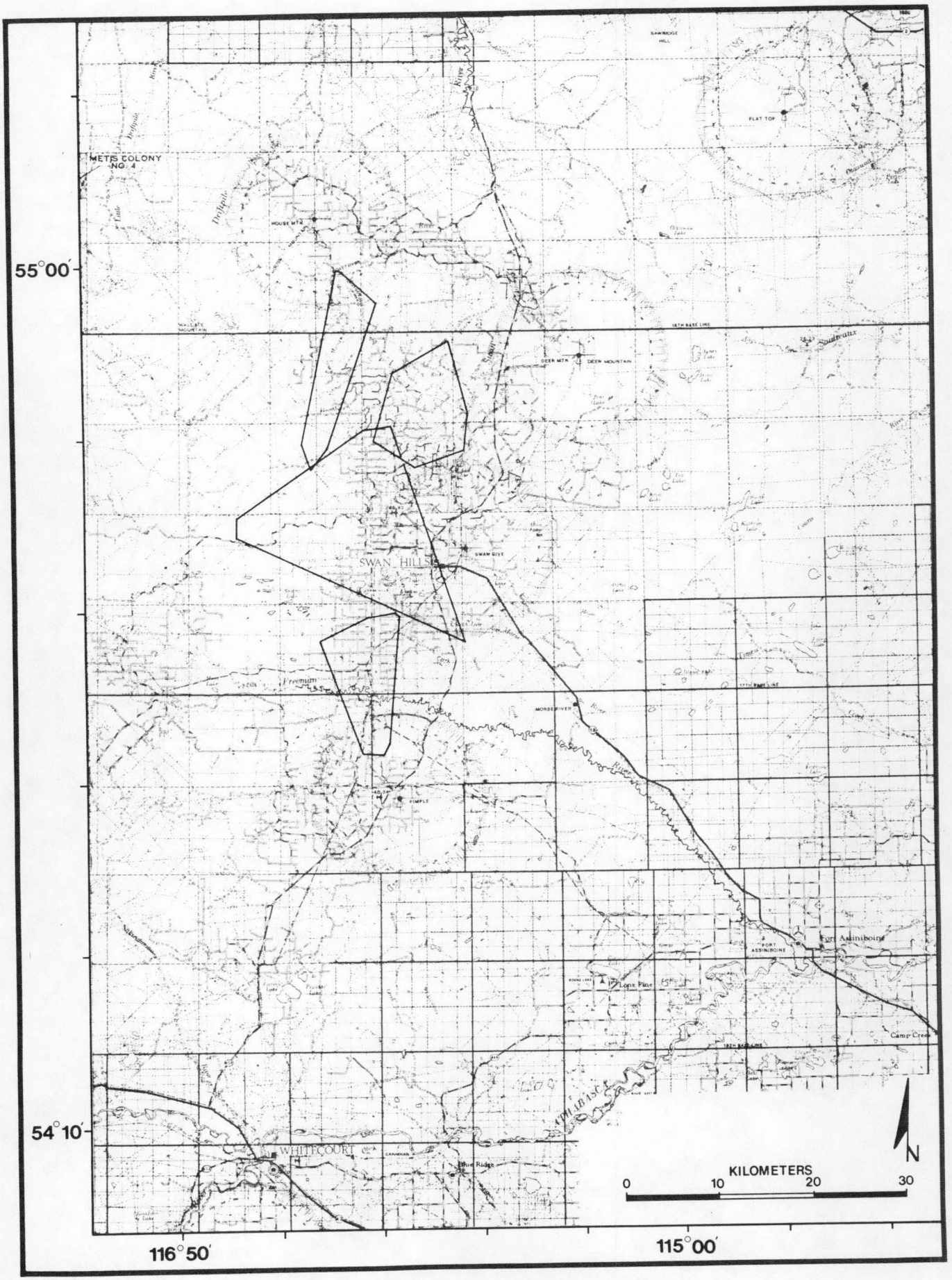

Figure 12. Minimum home range polygons for four female black bears on the Swan Hills study area.

Table 11. Home range data for black bears telemetered in Swan Hills, 1975 to 1977.

Sex and Identifying Number of Bear	Age (years)	Days Under Observation	No. of Point Locations	Home Range (km^2) By Year			Total Home Range (km^2)
				1975	1976	1977	
M-15	4	66	8	13.6	-	-	13.6
M-19	3	143	14	-	442.8	-	442.8
M-20	3	132	19	-	118.3	-	-
	4	84	5	-	-	115.8	273.1
M-36	3	89	11	-	-	188.4	188.4
M-44	3	152	13	-	-	129.6	129.6
M-54	12	140	10	-	-	128.9	128.9
M-48*	2	47	3	-	-	12.9	12.9
M-51*	2	39	3	-	-	16.4	16.4
M-25*	2	1	1	-	-	-	-
	3	70	2	-	-	-	8.5
F-21	5	55	9	-	16.5	-	-
	6	170	15	-	-	246.1	246.1
F- 6	5	123	17	-	80.9	-	-
	6	20	2	-	-	-	81.0
F-35	4	94	10	-	-	90.7	90.7
F-66	7	99	8	-	-	71.2	71.2

*Home ranges delineated using capture locations.

4.7 Habitat Utilization

A detailed analysis of habitat preferences has not been undertaken. However, two aspects of habitat utilization are evident from a subjective analysis of the data. In 1977 we captured four grizzlies on the immediate periphery of the Swan Hills refuse dump, and know of at least three others which frequented the area. Three grizzlies and a minimum of two black bears have been shot at or near the dump since 1975. In addition, eight grizzlies have either been shot near or removed from the townsite of Swan Hills by Fish and Wildlife officers since 1972. It is quite probable that the dump is a major attractant to bears. It is apparent that garbage serves as a rich food source for some bears whose movements take them to the dump.

A comparison of minimum home ranges for grizzly and black bears (Figures 8, 9, 10, and 11) suggest most radio collared black bears restricted their movements to areas developed for oil exploration and production. Although home ranges of collared grizzlies included developed regions their home ranges also extended into undisturbed habitat east and west of the main development core.

Under reclamation laws oil companies are required to reseed road and pipeline right of ways and well sites to prevent erosion. A grass-sweet clover seed mixture is commonly used. The result is an altered habitat of open areas with productive growth of grasses and sweet clover which transect homogeneous natural stands of spruce, pine, aspen and birch. Scat analysis suggest a significant degree of utilization of that "improved habitat" by both grizzly and black bears. Sweet clover appeared particularly important, perhaps because it remained lush after natural vegetation had cured, and therefore, could be utilized as a food source. Such artificially produced

meadows, cutlines, and road embankments may be especially well used by bears in years such as 1977 when berry production is low. The improvement of habitat conditions may be a factor contributing to expansion of the black bear population in Swan Hills, a region not considered to be prime black bear habitat (Kemp pers. comm.).

4.8 Population Densities

Total numbers of bears on the study area were determined by direct enumeration including identifiable untagged individuals (e.g. females with captured young). It was difficult to provide an accurate estimate of the black bear population, as hunter harvest records are not available. Population estimates do not take into account unknown mortality, therefore should be considered minimum figures.

4.8.1 Grizzly bears

We captured and marked 18 grizzlies on the study area from 1975 through 1977, and know of 10 others. Of these, 10 have been removed from the population. Therefore, at the completion of field investigations in 1977, a total of 18 grizzly bears were known to occur on the study area, giving a density of one bear per 139 km^2.

Pearson (1975) suggests an accurate estimate of population levels could be determined by doubling the total number of free roaming females, and adding the known number of young accompanying those females. This method assumes a 50:50 adult sex ratio. Figure 13 shows the core home ranges for eight females known to occur on the study area. We know that at least eight young accompanied those females. Using the above method the estimated population on the study area would be 24 individuals, or one bear per 104 km^2.

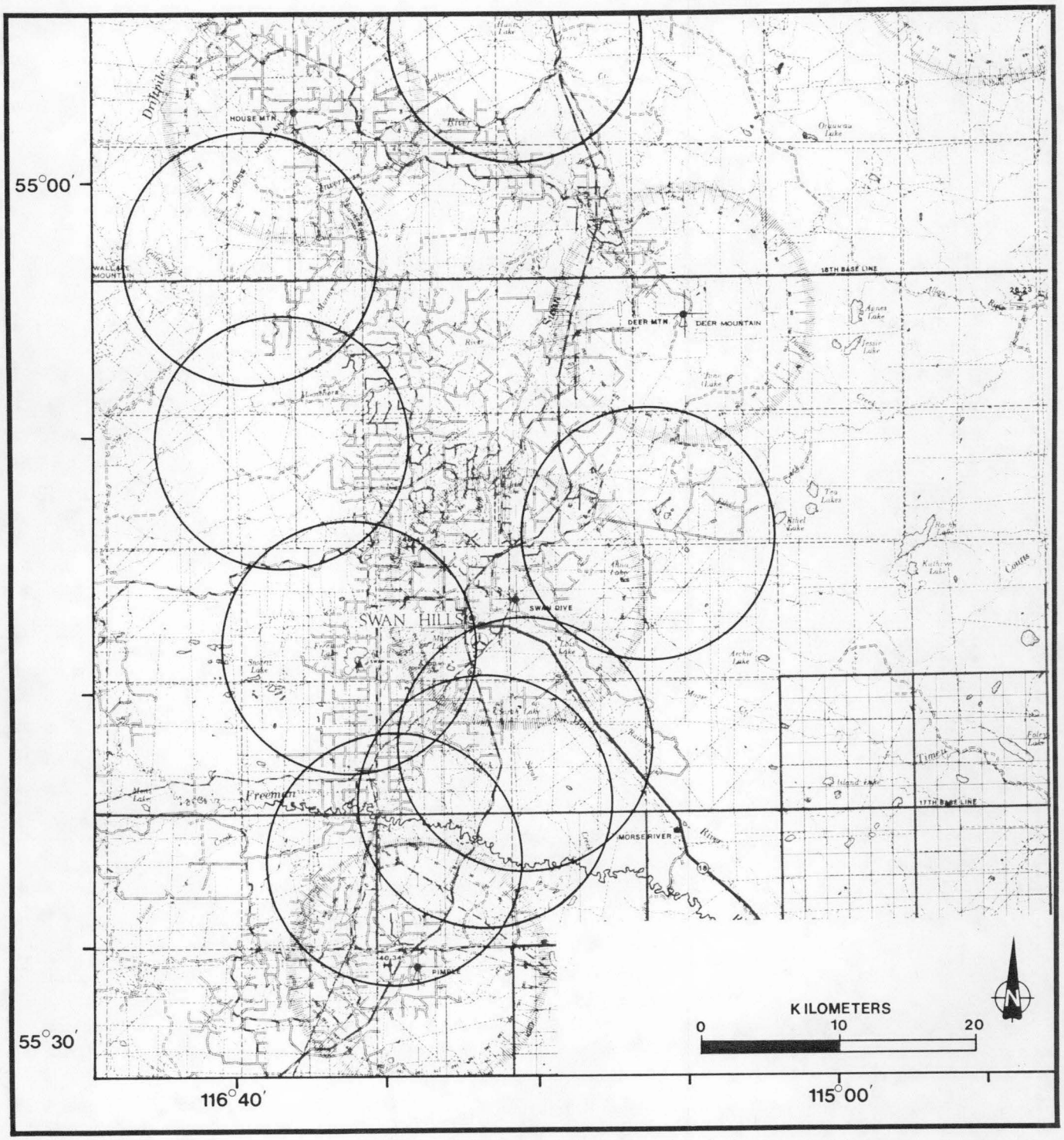

Figure 13. Core home ranges of eight female grizzly bears known to occur on the Swan Hills study area, 1975 to 1977.

Whether or not we use densities based on enumerated or estimated populations, the densities are lower than reported for other regions in Canada. Densities of one bear per 22.8 to 27.2 and 18.1 to 28.5 km^2 were reported for the interior Yukon (Pearson 1975) and Glacier National Park, Canada (Mundy and Flook 1973), respectively.

4.8.2 Black bears

We captured 50 black bears and know of four other untagged individuals on the study area during the period from 1975 to 1977. A minimum of 10 black bears have been removed from the population during the three years of intensive study. A total of 44 black bears were known to occur on the study area at the end of the 1977 field season, giving a density of one bear per 56.8 km^2. Population estimates were not calculated using the method described by Pearson (1975), as the reproductive status of most females on the study area is not known.

Densities of one bear per 0.6 to 8.8 km^2 are commonly cited in the available literature (Poelker and Hartwell 1973; Jonkel and Cowan 1971 and Kemp 1972) -- figures which suggest that densities of black bears in Swan Hills are considerably lower than the norm elsewhere.

4.9 Population Age-Sex Composition

4.9.1 Grizzly bears

Pearson (1975) constructed life tables for a grizzly bear population in the southwestern Yukon based on hunter harvest statistics. Four assumptions were made:

1. the sample was treated as if the bears had been randomly selected from the population;
2. that the age-sex distribution of bears remained constant over the sample period;

3. the age-sex composition of the population was similiar over the entire area sampled; and

4. that each bear had an equal chance of being selected by hunters.

Given these assumptions, then the harvest data would reflect the age-sex composition of the population. However, it is reasonable to assume that some age and sex classes would beunder represented, especially cubs of the year, yearling and some females. Females with young are protected from hunting pressure.

Figures 14 and 15 summarize the age and sex composition of grizzlies captured on or removed from the study area. The most notable aspects of those histograms are the lack of adults and the large number of subadults in both captured and harvested populations. The subadult:adult ratios for captured animals was 13:5 and for harvested animals was 18:2. Male:female sex ratios for captured and harvested bears was 9:9 and 11:9, respectively. In comparison, Russell *et al.* (1978) reported that the known subadult:adult ratio of captured and observed bears was 6:11 in a study of an unharvested grizzly bear population in Jasper National Park. Four of the six subadults were observed but not captured. Fifty-eight percent of the bears captured in Jasper were adult males.

If capture and harvest statistics accurately reflect the age-sex structure, then the Swan Hills grizzly population is an extremely young one. Of 13 grizzlies captured on the study area in 1977, nine were two-year olds. Only three of the nine were positively identified as young of known females on the study area, although two others may have been weaned in early 1977 by female no. 62. It seems likely that four to six subadults had dispersed onto the study area from outlying regions. We suggest that

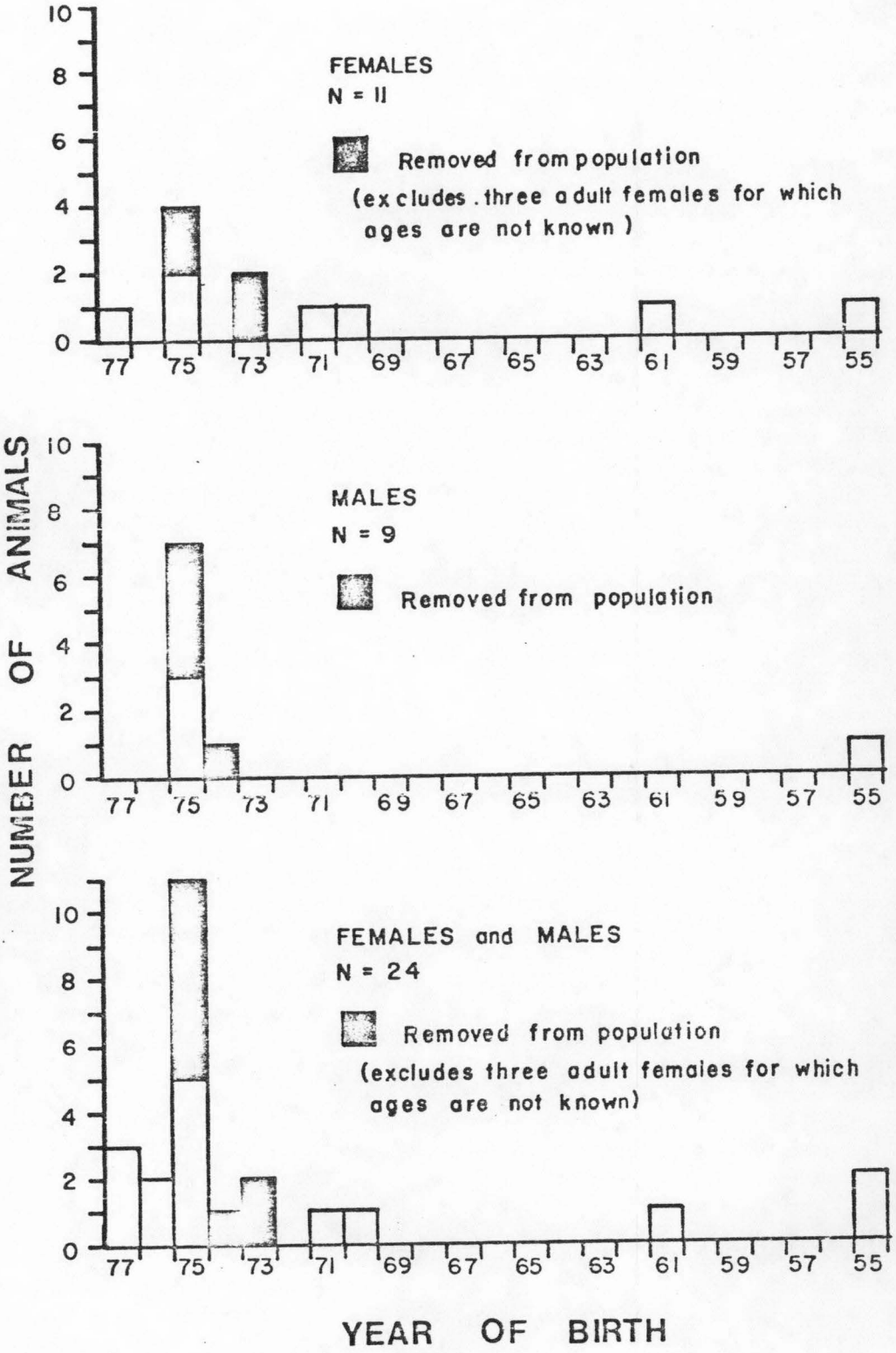

Figure 14. Age-sex composition of grizzly bears captured in Swan Hills, 1975 to 1977.

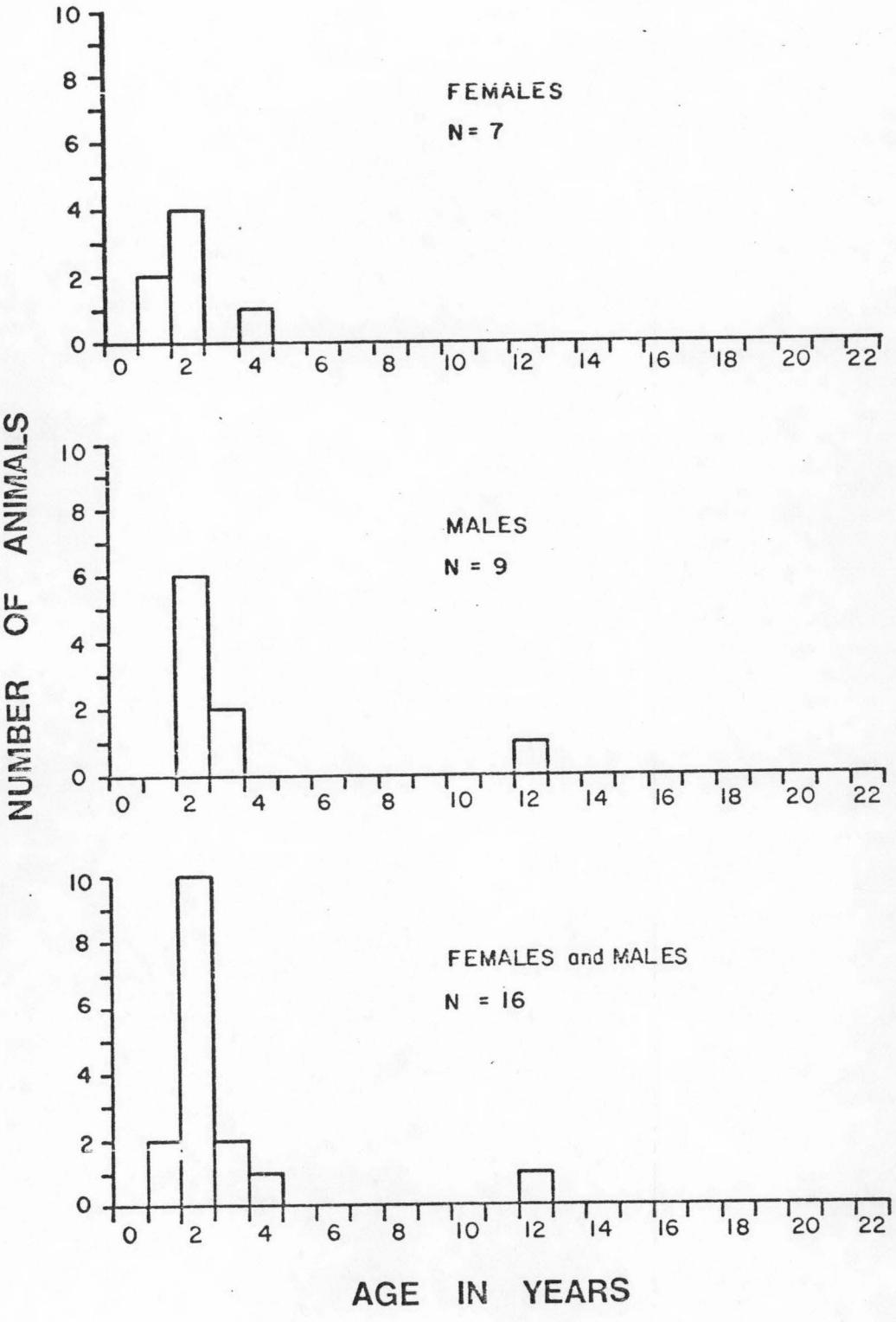

Figure 15. Age-sex composition of grizzly bears harvested in Swan Hills, 1972 to 1977.

subadults are dispersing onto the study area where densities are relatively low in comparison with relatively inaccessible adjacent lands. Hunter mortality of grizzlies is very low in the inaccessible areas and, therefore, densities of grizzlies are probably higher. The displaced subadults may be moving onto the study area where mortality of residents has been high from hunting or removal, thereby leaving available habitat for immigrants.

4.9.2 Black bears

Figure 16 summarizes the age-sex composition of black bears captured on the study area. The most notable aspects of the population histogram are the large number of bears in cohorts less than five years of age and the large number of males. Of the unharvested animals 75% were less than five years of age, while 74% of the captured animals were males. These statistics suggest a young expanding population.

4.10 Inter-relationship Between Grizzly and Black Bear Populations

Kemp (1976), investigated the regulatory dynamics in a black bear population in northern Alberta. He showed that the subadult:adult ratio can be increased by the removal of adult males. Following removal of adult males the number of subadults increased from a three year pre-manipulation mean of 45% of the total population to a two year post-treatment mean of 63%. The increase was partially attributed to an ingress of subadult males into vacancies created by removal of adult males. The sex ratios of captured bears favored the male cohort during the six year study. The high proportion of males during the pre-manipulation period (52 to 71%) was attributed to increased mobility of dispersing subadult males, and to the ingress of subadult males following manipulation (males 76 to 81% of the captured animals). This study supports the widely held view that bear

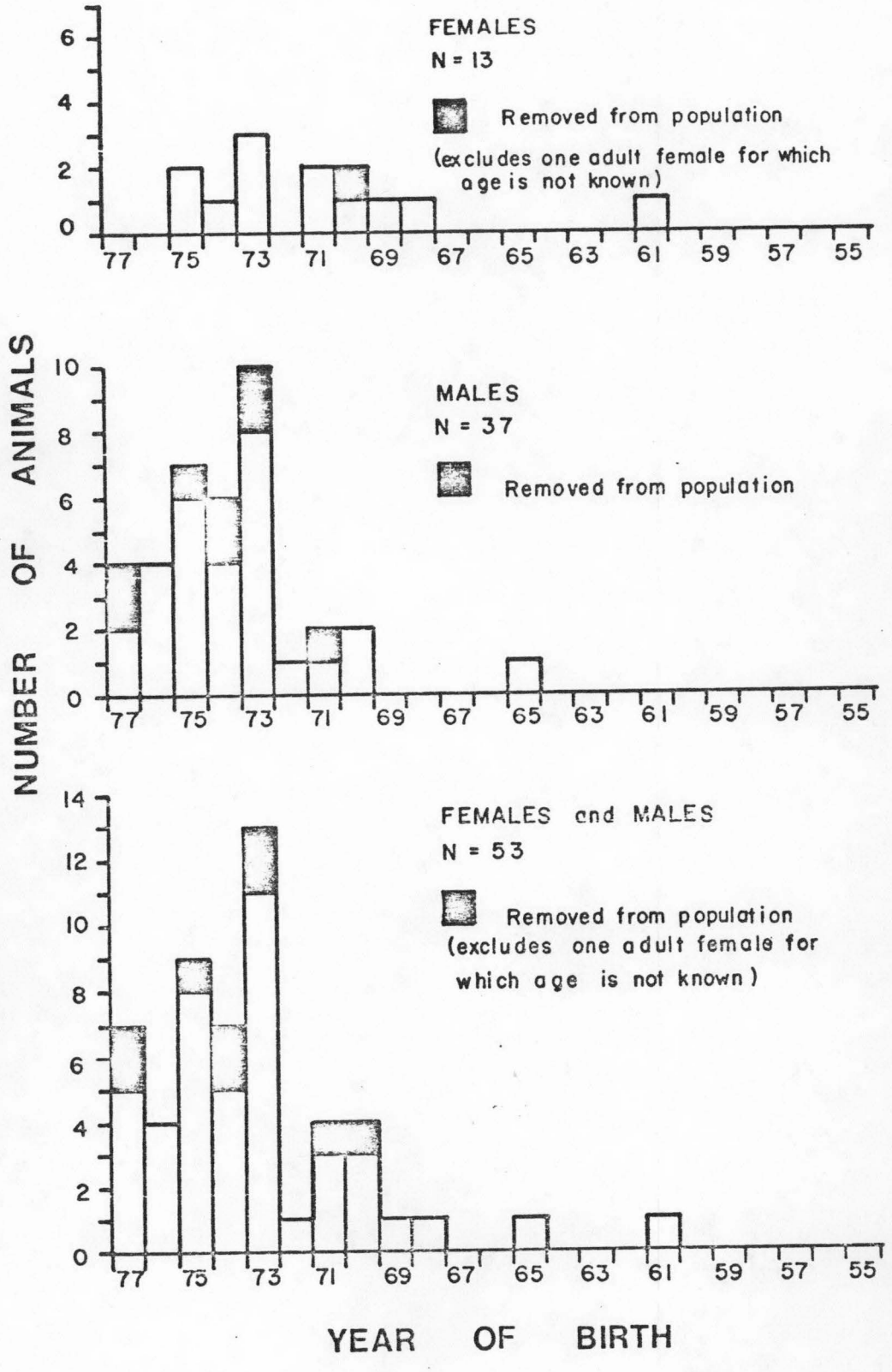

Figure 16. Age-sex composition of black bears captured or known to occur on the Swan Hills study area, 1975 to 1977.

populations are largely self-regulating, with long term regulation a function of adult male induced mortality in the subadult cohort (Kemp 1976). With the removal of that natural regulatory mechanism a subsequent population increase can be expected.

Although the black bear population has not been subjected to selective manipulation, the subadult:adult and sex ratios of captured black bears suggests that a similar phenomenon is occurring on the Swan Hills study area.

We offer the hypothesis that where two competing species occur sympatrically, regulation of the subdominant population would occur at both interspecific and intraspecific levels. The subdominant population (black bears in this case) would be limited by direct predation or displacement of members by the dominant species (grizzlies) and by intraspecific competition for available space. Densities of the subdominant species would be a function of the density of the dominant species and the frequency of interspecific and intraspecific encounters. A decline in the dominant species number would result in a subsequent expansion of the subdominant population.

Based on comparative size and aggressiveness, grizzlies could compete more effectively on an area where they occur sympatrically with black bears. Consequently, in regions supporting high densities of grizzly bears one would expect few black bears.

Densities of grizzly bears in Swan Hills are considerably lower than those reported for other regions in Canada (Mundy and Flook 1973 and Pearson 1975). Although capture and harvest statistics indicate a young and possibly expanding population, the rate of removal of both males and

females suggests recruitment to the resident breeding population is relatively low. An overall assessment suggests a declining population.

On the other hand, black bear densities were found to be 2.5 times greater than those for grizzlies and capture statistics suggest an expanding population.

We believe that the characteristics of the two populations of bears are mainly a result of development in the Swan Hills area. The history of grizzly populations in North America documents a threshold of human development beyond which grizzlies cannot survive (Russell 1967). Grizzlies simply do not adapt well to human encroachment on their range. The Swan Hills grizzly may be at such a crossroads. On the one hand there has been a fortuitous addition to utilizable forage (sweet clover) through reseeding programs. However, this has been more than offset by increased access to vehicular traffic, hence greatly increasing the vulnerability of grizzlies to both legal and illegal harvest. With the elimination of resident adults, and low levels of successful recruitment from surrounding areas, grizzly bear populations have declined in Swan Hills.

Black bears present a quite different picture. Reduced interspecific competition, improved habitat and high productivity have enhanced survival of black bears in Swan Hills. The ensuing effect has been an expansion of the black bear population.

5. SUMMARY AND CONCLUSIONS

During the period from 1975 to 1977 grand totals of 18 grizzlies and 50 black bears were captured on the study area. Overall sex ratios were 9 females:9 males for grizzlies, and 13 females:37 males for black bears.

Maximum weights attained by adult grizzly bears were greater than those reported for the interior Yukon (Pearson 1975). However, our sample size was small and preliminary data suggest that grizzlies in the Swan Hills area are similar in stature to those in other regions of Canada. Mean weights for males and females in all age classes for which comparative data were obtained, indicate that sexual dimorphism in size occurs. That trend has been reported by Pearson (1975).

Mean weights for black bears were 2 to 74% greater by sex and age class than those reported for Washington State (Poelker and Hartwell 1973). Mean weights for males and females by age class indicate that sexual dimorphism in size occurs.

Seasonal weight changes were recorded for a number of grizzly and black bears. Although the data is highly variable, seasonal weight changes appear similar to those reported for grizzlies in the interior Yukon (Pearson 1975) and black bears in spruce-fir forest of Washington State (Jonkel and Cowan 1971).

Pellage coloration among grizzlies was variable, but were considered to be similar to color patterns reported for other regions (Pearson 1975). Black was the dominant color phase for black bears.

The breeding season for grizzly bears occurs during June and July. However, insufficient data has been collected to delineate the breeding

season more precisely. Minimum and maximum known successful breeding ages were 3.5 and 19.5 years. The average litter size for five litters observed on the study area since 1975 was 2.2 young (range 1 to 3). The age of self-sufficiency occurs during the third year of life, suggesting a minimum reproductive interval of three years. Deviations from that pattern occurred. Further research is required before definitive comparisions of the breeding biology of the Swan Hills grizzly can be made with other regions in Canada.

The breeding season for black bears occured during the period from mid to late May to early August, with the peak occurring between mid June and mid July. The minimum and maximum known successful breeding ages were 5.5 and 13.5 years, respectively. However, one 3.5 year old female was observed to be in estrous. The mean litter size for five litters observed on the study area since 1975 was 2.2 young (range 2 to 3). Capture records suggest that the age of self-sufficiency occurs at 1.5 years, with a minimum reproductive interval of two years for females in the population.

The major proportion of grizzly bear diets consisted of herbaceous material, *Equisetum* sp. and monocots in 1977. Although berries registered an importance value of 99.2% during September-October in 1976, they occurred in trace amounts for the same period in 1977. The dramatic decline in berry comsumption was attributed to low blueberry and huckleberry production on the study area. Sweet clover constituted a major proportion of grizzly bear diets throughout 1977, and was of particular importance during the fall pre-denning period.

The apparent lack of small mammals (ground squirrels), roots and bulbs in grizzly bear diets was of interest. Swan Hills is the only known

grizzly range where ground squirrels are not found (Banfield 1973). No other evidence of predation was observed. The lack of roots and bulbs could not be explained. The apparent marked difference in food habits of the Swan Hills grizzly compared with other populations (Pearson *et al.* in preparation; Pearson 1975; Hamer *et al.* 1977 and Russell *et al.* 1978) suggests that further food habit studies be undertaken. Such work is needed in order to define the habitat requirements of the Swan Hills grizzly to conserve this ecotype.

A comparison of grizzly and black bear food habits suggest both species utilize and possibly compete for the same food items.

Mortality records for the study area show that 20 grizzly bears have been removed from the population since 1977. Three aspects of the harvest data were of interest: 1) that the average age for all animals removed from the population approximates the observed age of self-sufficiency (i.e. 2.5 years); 2) both males and females are being removed from the population; and 3) that the relocation or destruction of nuisance bears was a significant factor in mortality data.

Mortality records for black bears are incomplete as hunters are not required to register their kills.

Home range data have been obtained for four females and two males since 1975. Mean minimum home ranges for three mature and one immature female were 244 and 113 km^2, respectively. Minimum home ranges for one adult and one subadult male were 1086 and 82 km^2, respectively. Minimum home ranges for subadults and adults were larger than the means reported for the interior Yukon (Pearson 1975).

The mean minimum home ranges for four female black bears were 123 km^2 while that for 10 males was 151 km^2. Those home ranges were considerably

larger than those reported for black bears in Washington (Poelker and Hartwell 1973).

Two aspects of habitat utilization were evident from a subjective analysis of the data. First, in 1977 four grizzlies were captured on the immediate periphery of the Swan Hills refuse dump, while at least three others frequented the area. Three grizzlies and a minimum of two black bears have been shot at or near the dump since 1975. In addition, eight grizzlies have been either shot near or removed from the Swan Hills townsite by Fish and Wildlife officers since 1972. It is quite probable that the dump is a major attractant to bears.

Secondly, under reclamation laws, oil companies are required to reseed road and pipeline right-of-ways and well sites to prevent erosion. A grass-sweet clover mixture is commonly used. The result is an altered habitat of open areas with a productive growth of grasses and sweet clover which transect homogeneous stands of spruce, pine, aspen and birch. Home range and scat analysis suggest a significant degree of utilization of those areas of "improved habitat" by both species of bears. The improvement of habitat conditions may be a significant factor contributing to the expansion of the black bear population in Swan Hills, a region not considered to be prime black bear habitat (Kemp pers. comm.).

Grizzly bear densities based on enumerated and estimated population numbers were one bear per 139 and 104 km^2, respectively. Those densities are lower than those reported for other regions in Canada (Pearson 1975; Mundy and Flook 1973). In comparison, black bear densities based on enumerated population numbers were one bear per 56.8 km^2, or 2.5 times greater than those observed for grizzly bears.

Grizzly bear population histograms indicated a lack of adults and large numbers of subadults in both captured and harvested animals. The subadult:adult ratio for captured animals was 13:5, while that for harvested animals was 18:2. If capture and harvest data accurately reflect the age structure of the population, then the Swan Hills grizzly bear population is an extremely young one.

During 1977 we captured nine two-year old grizzlies on the study area. Only three of those were positively identified as young of known females on the study area. Preliminary indications are that the study area serves as a population sink for subadults dispersing from more remote peripheral areas. Dispersing subadults are attracted to an area which is relatively devoid of resident grizzlies.

In comparison, population age-sex histograms for black bears indicated that 75% of unharvested animals were less than 5 years of age, while 74% of all captured animals were males. Those statistics suggest a young expanding population.

We believe that the characteristics of the two populations of bears on the study area are mainly a result of past and present development activities in the Swan Hills. It is felt that a large number of resident grizzlies were either displaced or killed during early phases of development. With the removal of subadult males and females from the area, effective recruitment to the resident population has been low. As a result the grizzly population appears to be in a state of decline. Reduced interspecific competition, improved habitat and high productivity have enhanced the survival of black bears. The ensuing effect has been an expansion of the black bear population.

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APPENDIX 1

Appendix 1. Raw data recorded from live-capture of female grizzly bears in Swan Hills, 1975-1977. (Measurements in cm and kg unless specified otherwise.)

DATE	COLOUR	SEX	LOCATION Long.	LOCATION Lat.	PLASTIC TAGS Left	PLASTIC TAGS Right	ROPES Left	ROPES Right	FLAGS Left	FLAGS Right	BODY WEIGHT	TOTAL LENGTH	TAIL LENGTH	EAR LENGTH	HEART GIRTH	NECK GIRTH	SKULL LENGTH	ZYGO BREADTH	MUZZLE LENGTH	MUZZLE WIDTH	SNOUT HEIGHT	HEAD WIDTH	MUZZLE THICKNESS	EAR HEIGHT	CANINE LENGTH	CANINE WIDTH	BACULUM LENGTH	HIND FOOT
26/06/75	B	♀	115°34'	54°34'	P554	P555	Y	Y	LB	W	116	159.0	8.0	12.0	105.0	64.0	34.2	18.2	14.5	7.6	11.6	27.3	9.5	5.0	2.90	1.64	-	29.5
15/07/75	B	♀	115°38'	54°36'	P554	P555	Y	Y	LB	W	104	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23/07/75	Y	♀	115°35'	54°36"	P562	P563	Y	Y	Y	R	154	190.0	12.5	12.3	110.5	61.0	33.5	19.1	15.8	6.9	11.8	24.7	9.5	8.5	2.37	1.70	-	34.0
11/08/75	B	♀	115°32'	54°45'	P446	P447	BW	BW	G	R	61	136.0	15.0	13.0	81.0	47.0	30.2	15.5	12.0	8.3	11.1	19.3	9.0	10.0	2.62	1.38	-	27.0
04/09/75	B	♀	115°24'	54°42'	P325	P380	BW	BW	P	B	79	150.5	12.5	12.0	89.0	53.0	30.3	16.2	13.9	7.1	10.4	-	9.4	4.5	2.55	1.49	-	29.3
30/07/76	Y	♀	115°34'	54°40'	R125	R126	-	-	-	-	41	114.0	7.0	11.0	70.0	40.0	23.4	12.5	9.4	5.4	8.7	18.9	6.7	5.0	1.38	0.97	-	23.0
18/10/76	Y	♀	115°34'	54°40'	R125	R126	-	-	-	-	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
08/06/77	B	♀	115°31'	54°46'	R125	R126	-	-	-	-	48	128.9	9.2	11.2	71.7	44.2	26.3	14.2	11.0	6.7	9.4	18.7	7.5	5.4	1.50	1.20	-	23.0
28/07/77	B	♀	115°38'	54°55'	R125	R126	-	-	-	-	57	-	-	10.0	81.5	45.5	28.6	15.0	12.1	6.8	9.8	17.8	8.7	9.5	2.02	1.32	-	-
05/10/77	B	♀	115°38'	54°56'	R125	R126	-	-	-	-	91	140.0	8.0	10.0	96.0	54.0	29.3	15.3	12.2	6.7	10.4	23.0	8.0	3.0	2.60	1.41	-	26.5
14/06/77	B	♀	115°26'	54°42'	R137	R138	-	-	-	-	23	101.0	6.0	8.0	53.0	33.0	21.2	11.0	9.0	5.0	8.5	16.8	6.2	5.5	1.18	0.81	-	19.6
08/05/77	B	♀	115°32'	54°45'	R101	R102	W	Y	Y	B	61	142.0	9.8	9.0	83.5	51.0	30.3	15.7	10.1	6.6	8.9	24.8	8.5	4.0	3.6	2.40	-	26.6
09/06/77	B	♀	115°21'	54°49'	R101	R102	W	Y	Y	B	61	153.0	12.0	11.0	78.0	48.0	30.6	15.6	13.2	6.5	11.5	26.2	8.6	4.0	2.72	1.45	-	28.0
19/07/77	B	♀	115°36'	54°57'	R132	R147	BW	BW	B	W	158	179.0	10.0	12.0	114.0	70.0	36.4	21.0	16.0	8.3	13.4	30.9	10.1	6.5	3.20	1.85	-	32.5
18/10/76	B	♀	115°34'	54°40'	R164	R174	BW	BW	L	G	206	195.0	7.0	13.0	140.0	77.0	38.1	21.4	14.8	8.6	12.9	30.6	11.2	6.0	1.23	2.17	-	35.0
28/07/77	B	♀	115°38'	54°55'	R164	R174	-	-	-	-	159	183.0	8.0	12.0	123.0	67.0	36.5	21.9	14.0	9.3	12.3	24.8	11.8	10.5	1.35	2.21	-	33.1

APPENDIX 2

Appendix 2. Raw data recorded from live-capture of male grizzly bears in Swan Hills, 1975 to 1977. (Measurements in cm and kg unless specified otherwise.)

DATE	COLOUR	SEX	LOCATION Long.	LOCATION Lat.	PLASTIC TAGS Left	PLASTIC TAGS Right	ROPES Left	ROPES Right	FLAGS Left	FLAGS Right	BODY WEIGHT	TOTAL LENGTH	TAIL LENGTH	EAR LENGTH	HEART GIRTH	NECK GIRTH	SKULL LENGTH	ZYGO BREADTH	MUZZLE LENGTH	MUZZLE WIDTH	SNOUT HEIGHT	HEAD WIDTH	MUZZLE THICKNESS	EAR HEIGHT	CANINE LENGTH	CANINE WIDTH	BACULUM LENGTH	HIND FOOT
11/07/75	B	♂	115°39'	54°36'	R143	R144	BW	BW	O	G	218	204.0	18.0	12.0	130.0	87.0	38.8	23.7	15.9	9.6	13.3	30.2	12.4	7.0	-	2.35	17.0	36.5
21/06/77	B	♂	115°22'	54°49'	R143	R144	BW	BW	O	G	218	208.0	11.0	12.0	130.0	81.0	40.5	23.5	16.1	9.6	13.5	31.5	12.7	7.0	1.28	2.57	16.5	36.0
27/07/75	B	♂	115°35'	54°36'	P438	P439	BW	BW	LB	LB	68	150.0	12.0	11.0	80.0	46.0	-	15.0	13.0	6.9	10.9	17.4	7.9	8.0	1.91	1.18	10.0	26.0
10/06/77	B	♂	115°27'	54°49'	R153	R154	BW	BW	B	Y	104	150.0	9.4	11.0	95.0	58.0	31.7	16.4	14.0	7.3	11.3	20.7	-	6.5	1.71	1.23	10.0	33.0
13/06/77	B	♂	115°27'	54°49'	R153	R154	BW	BW	B	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19/06/77	B	♂	115°26'	54°42'	R153	R154	BW	BW	B	Y	111	-	-	-	92.0	-	-	-	-	-	-	-	-	-	-	-	-	-
05/07/77	B	♂	115°26'	54°43'	-	R136	-	-	-	-	91	144.4	7.0	-	89.0	58.0	28.8	15.7	13.4	7.5	10.6	-	9.9	-	2.35	1.23	10.0	29.3
05/07/77	B	♂	115°26'	54°43'	-	R146	-	-	-	-	89	145.0	8.5	11.5	93.0	51.5	29.7	16.0	13.0	7.5	11.3	-	8.6	-	2.23	1.37	10.4	30.0
07/10/76	Y	♂	115°34'	54°40'	Y280	Y390	-	-	-	-	52	120.0	9.0	11.0	75.0	43.0	24.3	13.5	9.8	5.7	8.8	21.8	7.9	5.0	1.24	1.00	5.0	26.0
07/05/77	B	♂	115°34'	54°46'	Y280	Y390	-	-	-	-	23	110.0	10.0	9.8	59.4	36.7	23.2	13.3	8.2	5.5	9.1	19.8	6.8	3.3	0.70	0.70	6.9	22.0
29/09/77	B	♂	115°38'	54°56'	Y280	Y390	-	-	-	-	98	148.0	10.0	12.0	86.0	52.0	28.8	15.1	11.8	6.9	10.4	24.2	9.8	7.0	2.12	1.17	10.0	29.5
07/10/76	Y	♂	115°34'	54°40'	R115	R116	-	-	-	-	50	117.0	6.0	10.5	80.0	44.0	24.1	12.9	9.6	5.7	8.7	24.5	8.2	4.0	-	-	-	25.0
18/05/77	B	♂	115°34'	54°46'	R115	R116	-	-	-	-	50	121.6	6.9	10.1	72.6	44.5	36.0	13.7	11.0	6.3	8.9	17.1	7.2	5.8	1.00	0.80	7.2	25.1
28/07/77	B	♂	115°38'	54°55'	R115	R116	-	-	-	-	59	-	-	10.3	79.8	47.8	28.4	14.8	12.7	6.6	9.3	17.6	8.5	7.6	1.67	1.23	-	-
X 21/05/77	B	♂	115°26'	54°42'	R118	R117	BW	G	B	L	104	152.4	8.6	11.8	93.3	55.4	-	16.2	29.7	7.3	11.3	20.5	8.5	7.8	1.70	0.90	10.5	28.7
06/10/77	B	♂	115°37'	54°57'	R 89	R 90	-	-	-	-	84	146.0	7.5	10.0	93.5	53.5	26.7	15.9	13.4	7.0	11.4	21.2	8.7	6.0	2.42	1.58	10.0	29.0

APPENDIX 3

Appendix 3. Raw data recorded from live-capture of female balck bears in Swan Hills, 1975 to 1977. (Measurements in cm and kg unless specified otherwise.)

DATE	COLOUR	SEX	LOCATION Long.	LOCATION Lat.	PLASTIC TAGS Left	PLASTIC TAGS Right	ROPES Left	ROPES Right	FLAGS Left	FLAGS Right	BODY WEIGHT	TOTAL LENGTH	TAIL LENGTH	EAR LENGTH	HEART GIRTH	NECK GIRTH	SKULL LENGTH	ZYGO BREADTH	MUZZLE LENGTH	MUZZLE WIDTH	SNOUT HEIGHT	HEAD WIDTH	MUZZLE THICKNESS	EAR HEIGHT	CANINE LENGTH	CANINE WIDTH	BACULUM LENGTH	HIND FOOT
09/06/75	C	♀	115°21'	54°27'	P471	P519	-	-	-	-	59	147.0	9.0	12.0	88.0	51.0	28.2	16.7	15.3	6.1	9.6	23.5	7.3	5.0	2.98	1.79	-	26.0
24/06/75	B	♀	115°36'	54°36'	P515	P517	-	-	-	-	52	147.0	13.0	12.0	77.0	42.0	27.3	15.2	12.0	6.2	10.0	24.6	7.3	6.5	2.59	1.45	-	25.8
16/07/76	B	♀	115°36'	54°38'	P515	P517	-	-	-	-	68	156.0	14.0	13.0	80.0	48.0	29.3	15.8	12.3	6.5	11.1	19.4	8.1	8.0	2.66	1.57	-	26.0
18/07/75	B	♀	115°40'	54°36'	P532	P475	-	-	-	-	41	128.0	11.5	13.0	71.0	38.0	23.0	13.2	10.6	5.3	8.4	15.2	6.7	9.5	2.33	1.37	-	23.5
13/06/76	B	♀	115°37'	54°28'	P521	P459	-	-	-	-	48	137.0	10.2	12.5	77.7	44.5	25.5	13.8	11.0	4.5	8.1	16.3	5.8	13.0	3.00	1.54	-	23.0
22.09/76	B	♀	115°35'	54°45'	P368	P367	-	-	-	-	82	155.0	9.0	13.0	84.0	49.0	28.7	15.6	11.6	6.7	10.6	25.3	7.5	5.0	2.68	1.62	-	25.0
26/05/77	B	♀	115°30'	54°50'	P368	P367	BW	BW	W	B	81	135.2	9.4	12.0	-	-	29.2	15.8	11.0	6.1	9.3	21.3	7.1	4.8	2.50	1.70	-	23.5
11/05/77	B	♀	115°30'	54°50'	R104	R103	-	-	-	-	73	160.6	12.2	12.8	84.4	50.0	32.9	16.2	11.0	6.4	9.3	22.5	7.0	6.2	2.10	1.60	-	24.3
28/06/77	B	♀	115°31'	54°50'	R104	R103	-	BW	-	LB	84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
04/08/77	B	♀	115°25'	54°54'	R104	R103	-.	BW	-	LB	104	-	-	12.5	100.0	-	-	15.9	-	6.3	-	18.3	7.8	9.0	-	-	-	-
15/05/77	B	♀	115°32'	54°33'	R107	R108	-	-	-	-	127	149.6	11.4	12.1	85.6	51.2	28.5	16.1	12.3	6.4	9.3	21.7	7.8	5.0	3.10	1.90	-	24.3
24/05/77	B	♀	115°22'	54°49'	R120	R121	-	-	-	-	34	134.3	7.9	11.3	65.7	41.8	24.6	13.3	9.7	5.2	7.3	16.8	6.1	6.2	2.10	1.30	-	20.1
03/06/77	B	♀	115°27'	54°47'	-	-	-	-	-	-	68	153.0	10.0	12.0	80.5	57.0	31.6	14.5	11.4	5.5	9.7	-	6.8	7.0	2.10	1.40	-	15.5
18/06/77	B	♀	115°23'	54°50'	R127	R128	BW	BW	G	P	73	153.0	9.0	12.0	83.0	58.0	27.3	16.1	11.2	5.9	9.5	21.0	7.3	6.0	2.64	1.58	-	23.5
21/07/77	B	♀	115°25'	54°55'	R127	R128	BW	BW	G	P	75	145.0	8.0	12.0	84.0	48.0	27.0	16.1	10.8	5.9	9.6	19.1	7.3	8.0	2.69	1.58	-	23.8
02/07/77	B	♀	115°33'	54°54'	R139	R134	-	-	-	-	61	128.4	8.2	11.3	66.4	39.2	-	13.7	10.2	5.7	9.0	18.4	6.9	5.0	2.43	1.34	-	21.6
15/07/77	B	♀	115°33'	54°57'	R129	R142	-	-	-	-	43	129.0	7.2	12.5	71.0	48.0	25.4	12.6	9.6	5.8	8.2	15.9	6.4	7.5	2.26	1.36	-	20.2
18/07/77	B	♀	115°34'	54°57'	R129	R142	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28/07/77	B	♀	115°35'	55°00'	R190	R200	BW	BW	R	P	84	166.0	10.0	12.8	93.9	50.0	28.2	15.7	11.1	6.4	8.7	16.8	6.9	9.8	2.58	1.59	-	23.2

APPENDIX 4

Appendix 4. Raw data recorded from live-capture of male black bears in Swan Hills, 1975 to 1977. (Measurements in cm and kg unless specified otherwise.)

DATE	COLOUR	SEX	LOCATION Long.	LOCATION Lat.	PLASTIC TAGS Left	PLASTIC TAGS Right	ROPES Left	ROPES Right	FLAGS Left	FLAGS Right	BODY WEIGHT	TOTAL LENGTH	TAIL LENGTH	EAR LENGTH	HEART GIRTH	NECK GIRTH	SKULL LENGTH	ZYGO BREADTH	MUZZLE LENGTH	MUZZLE WIDTH	SNOUT HEIGHT	HEAD WIDTH	MUZZLE THICKNESS	EAR HEIGHT	CANINE LENGTH	CANINE WIDTH	BACULUM LENGTH	HIND FOOT
02/06/75	B	♂	115°29'	54°27'	P511	P534	-	-	-	-	91	160.0	8.0	13.0	95.0	57.0	28.0	16.2	12.2	6.3	9.4	20.9	-	5.0	2.85	1.74	16.2	26.8
12/06/75	B	♂	115°26'	54°30'	P533	P526	-	-	-	-	36	135.0	13.0	12.0	83.0	40.0	26.3	13.6	11.7	5.8	7.2	19.9	7.1	7.5	2.28	1.29	12.5	24.5
14/06/75	B	♂	115°26'	54°30'	P531	P550	-	-	-	-	48	147.0	11.0	14.0	73.5	40.5	28.6	14.2	12.7	6.0	10.1	17.7	7.4	10.0	2.38	1.69	14.5	26.0
17/06/75	C	♂	115°26'	54°30'	P512	P535	-	-	-	-	91	171.0	12.0	14.0	102.0	58.0	30.4	17.0	14.3	6.7	10.7	22.1	8.6	9.0	2.88	1.69	18.0	31.0
14/07/75	C	♂	115°40'	54°36'	P512	P535	-	-	-	-	86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26/06/75	B	♂	115°35'	54°37'	P529	P530	-	-	-	-	61	145.0	8.0	12.5	80.0	46.0	26.2	15.1	12.9	6.1	9.7	17.1	7.2	11.5	2.65	1.54	15.0	26.5
11/07/75	B	♂	115°38'	54°36'	P472	P520	-	-	-	-	118	170.0	12.0	12.5	107.5	65.0	31.1	18.7	13.6	6.5	12.0	21.9	8.5	9.0	2.90	1.73	18.5	31.5
16/07/75	B	♂	115°35'	54°36'	P472	P520	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16/07/75	B	♂	115°39'	54°36'	P513	P516	-	-	-	-	45	140.0	19.0	13.0	-	-	25.0	13.6	9.3	5.7	7.4	15.2	7.6	14.0	2.54	1.36	12.4	22.0
11/08/75	B	♂	115°32'	54°42'	P556	P557	Y	Y	LB	O	84	165.0	17.0	12.5	90.0	52.0	33.3	16.7	12.0	7.2	4.2	18.8	8.7	9.0	3.13	1.87	18.0	27.5
25/06/76	B	♂	115°28'	54°28'	Y376	Y379	BW	BW	G	G	79	151.0	14.0	13.0	88.0	50.0	30.0	17.2	11.2	6.8	10.4	19.3	8.5	9.0	2.80	1.68	15.5	27.0
07/07/76	C	♂	115°35'	54°28'	P496	P497	Y	Y	LB	LB	54	138.0	9.5	13.0	80.0	43.0	26.6	14.5	12.0	6.1	9.7	16.8	7.7	9.0	2.80	1.66	14.5	26.0
24/09/76	B	♂	115°34'	54°40'	Y266	Y231	-	-	-	-	68	155.5	9.0	12.0	84.0	46.0	26.8	14.4	10.5	5.9	9.8	20.9	7.3	5.0	2.65	1.39	12.5	26.0
25/09/76	B	♂	115°31'	54°46'	R143	R149	-	-	-	-	75	149.0	10.0	11.0	87.0	48.0	27.4	14.5	10.7	6.0	10.7	19.3	6.4	5.0	1.64	1.55	13.0	26.5
21/06/77	B	♂	115°28'	54°48'	R148	R149	-	-	-	-	73	152.0	10.0	12.0	88.0	50.0	29.8	15.9	11.4	6.1	10.2	17.7	7.1	7.0	2.62	1.63	16.0	36.7
29/09/76	B	♂	115°32'	54°44'	Y410	Y230	-	-	-	-	86	145.0	9.5	12.5	95.0	50.0	29.3	14.2	11.8	5.7	9.4	20.7	7.7	6.0	2.68	1.47	14.0	25.5
29/09/76	B	♂	115°31'	54°46'	R133	R135	-	-	-	-	98	159.0	11.5	13.5	103.0	56.0	29.7	15.9	11.8	6.5	10.7	21.8	7.8	9.0	3.12	1.43	15.5	28.0
10/07/77	B	♂	115°32'	54°45'	R133	R135	W	Y	W	O	111	169.0	10.0	13.0	102.0	58.0	30.7	17.3	12.2	6.8	10.9	20.9	8.9	11.0	3.15	1.90	15.8	29.0

Appendix 4. (Continued)

DATE	COLOUR	SEX	LOCATION Long.	LOCATION Lat.	PLASTIC TAGS Left	PLASTIC TAGS Right	ROPES Left	ROPES Right	FLAGS Left	FLAGS Right	BODY WEIGHT	TOTAL LENGTH	TAIL LENGTH	EAR LENGTH	HEART GIRTH	NECK GIRTH	SKULL LENGTH	ZYGO BREADTH	MUZZLE LENGTH	MUZZLE WIDTH	SNOUT HEIGHT	HEAD WIDTH	MUZZLE THICKNESS	EAR HEIGHT	CANINE LENGTH	CANINE WIDTH	BACULUM LENGTH	HIND FOOT
03/10/76	B	♂	115°29'	54°39'	Y 43	Y 69	-	-	-	-	59	138.0	9.0	12.0	76.0	46.0	26.4	14.4	10.8	5.9	9.4	18.9	7.5	6.0	2.33	1.19	12.0	25.0
07/10/76	B	♂	115°38'	54°45'	Y416	Y412	-	-	-	-	138	180.0	11.0	13.0	109.0	63.0	34.0	18.1	13.2	7.0	10.6	25.9	9.2	6.0	3.48	2.10	21.0	28.0
14/05/77	B	♂	115°30'	54°50'	R105	R106	G	W	W	Y	103	151.0	11.0	10.5	84.8	62.2	29.4	15.3	12.3	5.9	9.1	20.2	7.0	7.4	2.10	1.20	14.8	14.1
20/05/77	B	♂	115''32'	54°46'	R105	R106	G	W	W	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17/05/77	B	♂	115°22'	54°49'	R109	R110	-	-	-	-	82	162.6	11.1	12.9	94.3	63.0	30.2	18.9	13.6	6.9	9.8	22.2	7.6	7.8	2.50	1.80	17.4	27.2
17/05/77	B	♂	115°30'	54°50'	R111	R112	-	-	-	-	73	155.3	10.2	11.9	88.0	56.4	30.5	16.9	12.2	6.5	9.1	20.0	8.1	10.1	2.90	1.80	16.2	25.1
10/06/77	B	♂	115°29'	54°50'	R111	R112	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18/05/77	C	♂	115°38'	54°28'	R113	R114	-	-	-	-	59	140.4	8.5	11.2	78.9	45.3	27.3	14.9	12.1	5.5	18.2	19.4	7.3	8.0	2.20	1.60	12.2	23.3
24/05/77	B	♂	115°30'	54°50'	-	-	-	-	-	-	-	110.0	7.1	11.0	52.4	37.1	12.5	12.1	9.1	5.7	7.6	-	-	-	1.30	0.90	7.9	18.2
05/06/77	B	♂	115°34'	54°46'	R119	R122	BW	BW	O	P	61	144.0	11.5	13.0	74.0	43.0	28.0	14.0	11.2	5.7	9.9	18.8	7.5	7.9	2.32	1.40	14.0	15.5
20/06/77	B	♂	115°31'	54°50'	R119	R122	BW	BW	O	P	66	-	-	-	76.0	-	-	-	-	-	-	-	-	-	-	-	-	-
05/06/77	B	♂	115°27'	54°47'	-	-	-	-	-	-	14	-	-	-	39.0	-	-	9.1	-	-	-	-	-	-	-	-	-	-
05/06/77	B	♂	115°27'	54°47'	-	-	-	-	-	-	14	-	-	-	40.0	-	-	-	9.5	-	-	-	-	-	-	-	-	-
07/06/77	B	♂	115°29'	54°50'	R151	R152	-	-	-	-	45	138.0	11.0	12.0	60.0	37.0	26.3	13.6	11.2	6.1	9.2	22.3	7.2	6.5	2.61	1.89	12.0	25.0
11/07/77	B	♂	115°29'	54°52'	R151	R152	-	-	-	-	45	136.0	10.0	12.0	67.0	39.0	27.8	14.0	11.6	5.7	8.9	16.1	6.8	11.0	2.73	1.52	11.5	23.0
23/07/77	B	♂	115°25'	54°55'	R151	R152	-	-	-	-	50	-	-	12.0	-	-	-	-	-	-	-	16.7	7.4	8.5	-	-	-	-
08/06/77	B	♂	115°40'	54°45'	R123	R124	-	-	-	-	48	141.8	10.2	11.9	73.3	41.4	27.6	13.7	11.7	6.0	9.6	16.7	7.0	8.0	2.60	1.40	13.2	25.1
11/06/77	C	♂	115°30'	54°48'	R155	R156	-	-	-	-	54	137.0	10.2	12.3	74.0	41.0	26.4	13.6	11.7	6.0	9.0	17.4	6.8	8.0	2.37	1.40	11.9	25.0
18/06/77	C	♂	115°33'	54°49'	R155	R156	-	-	-	-	48	-	-	-	71.0	-	-	-	-	-	-	-	-	-	-	-	-	-
19/07/77	C	♂	115°24'	54°55'	R155	R156	-	-	-	-	46	-	-	12.5	77.0	-	-	-	-	-	-	-	7.0	11.4	-	-	-	-

Appendix 4. (Continued)

DATE	COLOUR	SEX	LOCATION Long.	LOCATION Lat.	PLASTIC TAGS Left	PLASTIC TAGS Right	ROPES Left	ROPES Right	FLAGS Left	FLAGS Right	BODY WEIGHT	TOTAL LENGTH	TAIL LENGTH	EAR LENGTH	HEART GIRTH	NECK GIRTH	SKULL LENGTH	ZYGO BREADTH	MUZZLE LENGTH	MUZZLE WIDTH	SNOUT HEIGHT	HEAD WIDTH	MUZZLE THICKNESS	EAR HEIGHT	CANINE LENGTH	CANINE WIDTH	BACULUM LENGTH	HIND FOOT
12/06/77	B	♂	-	-	R130	R131	-	-	-	-	81	153.0	12.5	12.0	88.0	50.0	29.7	15.8	11.8	6.5	9.8	29.7	8.1	6.5	2.73	1.75	15.5	29.0
17/06/77	B	♂	115°22'	54°48'	R157	R158	Y	Y	P	Y	134	181.0	11.5	13.7	98.0	72.0	33.7	21.0	14.1	7.4	11.1	27.3	9.2	7.0	3.22	2.00	20.0	28.5
03/08/77	B	♂	115°34'	54°58'	R173	R183	-	-	-	-	11	82.5	5.0	9.0	46.6	28.0	18.1	10.0	7.0	4.4	6.0	12.7	5.3	6.5	1.01	0.65	7.3	15.5
09/07/77	B	♂	115°33'	54°53'	R141	R145	-	-	-	-	57	142.0	10.0	12.5	80.0	44.0	27.5	13.4	12.2	5.9	9.6	17.9	7.4	10.0	2.66	1.57	12.0	25.5
21/07/77	B	♂	115°28'	54°54'	R141	R145	-	-	-	-	61	-	-	-	79.0	-	-	-	-	-	-	-	-	8.0	2.81	1.66	14.0	28.5
14/07/77	B	♂	115°34'	54°58'	R140	R150	-	-	-	-	73	151.0	11.0	11.4	80.0	47.0	27.2	14.7	11.9	6.2	9.9	18.7	7.1	6.5	2.81	1.66	14.5	25.6
03/10/77	B	♂	115°35'	54°58'	R140	R150	-	-	-	-	77	156.0	7.5	11.5	85.0	53.0	-	15.2	10.8	6.3	10.1	24.4	7.6	-	-	-	-	-
19/07/77	B	♂	115°35'	55°01'	R172	R185	-	-	-	-	54	144.0	10.0	12.1	75.0	40.5	26.8	12.2	11.5	6.1	9.2	15.4	7.0	11.0	2.59	1.49	10.5	24.0
31/07/77	B	♂	115°35'	55°01'	R172	R185	-	-	-	-	64	-	-	13.0	79.0	-	-	-	-	-	-	-	-	9.8	-	-	-	-
21/07/77	B	♂	115°33'	54°53'	R159	R160	-	-	-	-	27	109.0	10.1	12.1	55.0	32.0	22.6	12.2	9.1	5.3	6.2	13.2	6.7	10.2	1.79	1.06	9.8	20.0
02/08/77	B	♂	115°32'	54°57'	R159	R160	-	-	-	-	30	-	-	10.0	58.0	-	-	-	-	-	-	-	-	8.0	-	-	-	-
22/07/77	B	♂	115°35'	55°01'	R163	R165	-	-	-	-	23	103.0	5.0	10.0	54.0	31.0	21.5	11.0	8.5	5.0	7.7	16.1	6.3	7.0	1.66	0.98	7.8	21.0
07/10/77	B	♂	115°38'	55°02'	R163	R165	-	-	-	-	36	125.0	5.0	10.0	66.0	39.0	22.7	12.3	9.4	5.1	7.7	17.7	6.6	5.5	2.08	1.20	3.0	21.0
31/07/77	B	♂	115°34'	54°58'	R166	R167	-	-	-	-	14	84.0	6.0	9.2	44.0	26.0	18.2	10.3	7.1	4.9	6.4	13.0	5.6	6.0	-	-	7.0	15.7
01/08/77	B	♂	115°33'	54°53'	R125	R192	-	-	-	-	41	118.0	7.0	9.5	67.0	40.0	23.8	12.6	9.0	5.6	8.0	16.2	6.8	6.4	-	-	9.5	21.5

APPENDIX 5

APPENDIX 5. Circumstances surrounding the removal of animals from the Swan Hills grizzly bear population from 1972 to 1977.

Year	WMU[1]	Approximate Location	Age[2] (years)	Sex	Date (day/month)	Type of Removal
1972	350	NE side of Goose River	3	M	21/04	legal kill
1973	350	Swan Hills	E 2-3	F	16/04	legal kill
	350	Swan Hills	E 4-5	F	16/04	legal kill
	350	NW Swan Hills	unknown	M	12/05	legal kill
	350	Swan River	3	M	19/05	legal kill
	350	Freeman River	E 2-3	F	19/05	legal kill
	350	16-10-62-12- W5M	2	F	24/05	legal kill
1974	350	Swan Hills	E 12-15	M	16/04	legal kill
	350	Head waters of Saulteaux River	2	F	27/07	killed; children threatened
	350	Swan Hills Town site	2	M	24/10	killed; children threatened
1975	350	Swan Hills	1	M	30/07	natural mortality
	350	Swan Hills Town site	2	F	02/09	relocated
	350	Swan Hills Town site	2	F	03/09	relocated
1976	350	Swan Hills dump area	2	M	22/05	legal kill
	350	4.2 km S. Swan Hills	1	F	28/08	road kill
	350	4.2 km S. Swan Hills	1	F	28/08	road kill
1977	350	Swan Hills dump	2	M	27/07	legal kill
	350	Swan Hills dump	2	M	27/07	legal kill
	350	Swan Hills Town site	2	M	05/07	relocated
	350	Swan Hills Town site	2	M	05/07	relocated

[1]Wildlife management unit
[2]Estimated age

APPENDIX 6

APPENDIX 6. Circumstances surrounding the removal of animals from the Swan Hills black bear population from 1975 to 1977.

Year	WMU[1]	Approximate Location	Age[2] (years)	Sex	Date (day/month)	Type of Removal
1975	350	2 km N Freeman Lake	4	M	unknown	legal kill
1976	350	18 km W Pimple Tower	3	M	22/10	legal kill
1977	350	13 km N Swan Hills Town site	0.5	M	05/05	relocated
	350	13 km N Swan Hills Town site	0.5	M	05/06	relocated
	350	13 km N Swan Hills	7	F	04/06	illegal kill; with cubs of year
	350	Near Swan Hills dump	3	M	fall	legal kill
	351	16 km SE House Mtn.	3	M	29/09	legal kill
	351	32 km N Swan Hills	2	M	fall	legal kill

[1]Wildlife management unit