BLACK BEAR DENNING STUDY, MITKOF ISLAND, ALASKA

by

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ABSTRACT

Fifteen black bears were radio-marked on Mitkof Island, Alaska, and their movements monitored during each of two years until the bears winter-denned. One of the bears subsequently moved to the mainland and was ultimately located in the vicinity of Wrangell. Another animal traveled from the Falls Creek - Bear Creek study area to Petersburg where it was recaptured and moved 22 miles to the south end of Mitkof Island where it remained.

The other 13 bears revealed differing movement traits. The composite home ranges of four yearling and two-year-old bears averaged 1.7 square miles with little seasonal difference in home range size. The composite home ranges of four adult females averaged 4.6 square miles, with spring and early summer movements exceeding late summer and fall movements. The composite home ranges of six adult male bears averaged 16.2 square miles, but the seasonal ranges and movements of the individual bears within this group were highly variable. Two of the bears were quite sedentary, while two others of the group made occasional brief trips 15-20 miles beyond the limits of their normal range areas.

Evaluation of the proportional occurrence of the habitat types in the composite home ranges of the marked bears showed close correspondence

with the availability of the habitat types in the 75-square-mile primary study area. The one habitat type showing greater use relative to availability was clear cuts.

The dens of 13 radio-marked bears were located and examined. Five of the dens were in cut hollow logs in clear cuts; four dens were in the bases of living hemlock trees; and four were in the boles of standing trees at heights ranging from 12 to 40 feet above the ground. The elevation of the dens ranged from 50 to 1,500 feet mean sea level and there appeared to be little relationship between the location of the dens and their facing directions, and slope or aspect. Photographs are presented of the dens and their surrounding area.

The nature of the den sites used by bears suggests that forest management should consider the preservation of key habitat areas to provide adequate den sites for bears. The basic consideration should be the preservation of suitable standing trees. However, consideration should also be given to the preservation of hollow logs as denning sites in clear cuts despite their probable limited longevity. It is also suggested that forest management consider the nature of their forest cutting practices so that a boom or bust ecology for bears can be avoided. However, it was postulated that the 30-40% of Mitkof Island that is muskeg bog and mixed muskeg bog and forest habitat probably provides assurance that the island will always have attractive black bear habitat despite management actions affecting habitat.

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Finally we wish to express our sincere gratitude to the many people in the Petersburg area who in so many ways assisted project personnel. Their many courtesies endeared us to Petersburg and rendered the conduct of the field studies an enjoyable experience.

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INTRODUCTION

This report presents the findings of a study assessing the denning requirements of black bears (Ursus americanus) on Mitkof Island, Alaska. The study was performed under a contract awarded to the University of Washington on 7 April 1980. The study was subsequently extended to include the 1981 field season. The specific objectives of the study were to (1) radio-mark six or more bears each year, (2) determine bimonthly the locations of the bears until they winter-denned, and (3) describe and photograph the den sites of the bears and the environmental setting of the dens. Field activities commenced on 13 July 1980 and continued through 30 November 1981.

METHODOLOGY

Study procedures included the live capture of bears using foot snares, fitting the bears with radio collars, monitoring the animals' movements, and analyzing the movements of the bears with respect to habitat use and the selection of dens.

A total of 20 bears was captured, of which 15 were fitted with radio collars and their movements monitored (Table 1). Eight of the instrumented bears were captured in late July and August of 1980 and seven were captured during July and August 1981. Daily position locations were attempted for periods of one week or more each month of the study, except during the winter denning period of 1981 when position verifications were taken once monthly.

The locations of the bears were determined primarily by triangulation from ground locations, and to a minor extent by air when it became necessary to relocate missing animals.

Table 1. Data on radio-marked black bears, Mitkof Island, Alaska.

ADF&G tag # (radio #)	Date marked	Sex	Weight (lbs)	Capture location				Radio freq.	Remarks
				Town.	Range	Sect.	1/4 Sect.		
2325 (960)	7/29/80	Adult female	151	60S	80E	5	SE	164.960	Lactating, cubs not seen.
2308 (936)	7/31/80	2.5 yr female	105	60S	80E	27	NE	164.936	Has never given birth to cubs.
2309 (850)	8/1/80	Adult male	182	60S	80E	4	NW	164.850	
2310 (885)	8/1/80	Yearl. male	63	60S	80E	4	SE	164.885	
2311 (910)	8/1/80	Adult male	178	60S	80E	15	NW	164.910	
2312 (772)	8/3/80	Adult male	156	60S	80E	7	NW	164.772	
2314 (828)	8/3/80	Adult male	286	Captured, Magill's Trailer Court, Petersburg				164.828	Nuisance bear transplanted to Balquiere Point by Butch Young of ADF&G.
2315 (786)	8/3/80	Adult male	142	60S	76E	12	NW	164.786	
2319 (193)	8/5/81	Adult male	218	60S	80E	5	SE	164.193	

Table 1, cont'd

ADF&G tag # (radio #)	Date marked	Sex	Weight (lbs)	Capture location				Radio freq.	Remarks
				Town.	Range	Sect.	1/4 Sect.		
2320 (736)	8/6/81	Yearl. male	125	60S	80E	9	NW	164.736	
2321 (693)	8/6/81	Adult male	230	60S	80E	4	SE	164.693	
2322 (152)	8/7/81	Adult female	145	60S	80E	5	SW	164.152	
2317 (071)	8/7/81	Yearl. female	66	60S	80E	5	SE	164.071	Yearling cub of 960
2323 (811)	8/7/81	Adult female	150	60S	80E	27	NE	164.811	Has had cubs previously.
2453 (091)	8/10/81	Adult female	162	60S	79E	12	NW	164.091	Has had cubs previously.

Seasonal and composite home-range sizes were determined by the minimum home range method--i.e., connecting the outer position locations of each bear and measuring the areas circumscribed using a computerized polar compensating planimeter. Home range sizes were analyzed for two seasonal periods--from den emergence to midsummer (August 1), and from midsummer to the times of winter denning.

Habitat use characteristics of the bears were evaluated by measuring the acreage of the major habitat components occurring within the seasonal and composite home ranges of each bear. They were further evaluated relative to the proportional occurrence of these habitat types within the primary study area. The habitat type classifications included muskeg bog, mixed bog and timber, forested drainage terraces, mature forests, and clear cuts.

The analysis of the denning characteristics of the bears concerned first locating the den sites, taking measurements of the dens, recording the elevations and aspect of the den settings and the facing direction of the den entrances, and photographing the dens and the surrounding habitat. This activity included also photographing three marked bears remaining in their tree dens, and anaesthetizing and handling two of these bears, together with processing two yearling cubs present with the mother in one of the dens.

RESULTS

Instrumented Bears

Table 1 and required data forms 1 through 17 (Appendix 1) present physical and descriptive data on the 15 radio-marked bears whose subsequent movements were radio-monitored. The instrumented bears

included two yearling males and one yearling female, one 2-1/2 year old female, three adult females without accompanying cubs and one with cubs, and seven adult male bears. All the bears except one large male (#910) were initially captured within a designated primary study area embracing the clear cuts found along Falls and Bear creeks (Fig. 1). The remaining bear (#828) was a large male captured as a nuisance bear in the town of Petersburg by Mr. Young of the Alaska Department of Fish and Game. Following instrumentation by us, the bear was transported 22 miles to the south end of Mitkof Island and released. Within a few days after release, the animal disappeared and was subsequently located on the mainland at the city dump in Wrangell. Thereafter, the bear was periodically observed in the vicinity of Wrangell throughout the duration of the study. To reach Wrangell from the south end of Mitkof Island, the bear presumably had either to cross mid-Frederick Sound, an unlikely prospect, or to cross Dry Strait of Frederick Sound, cross the Stikine River, proceed south along the mainland, and either cross or proceed around the eastern end of Wrangell Passage. The minimum distance required to accomplish the latter route would have exceeded 50 miles. The movement of this bear is a most unusual record, not because of the distance involved, but rather because of the physical challenge of whichever route the animal traveled.

Bear Movements and Home Ranges

Table 2 and Figures 2-16 present movement and home range data on the remaining 14 project area bears radio-monitored in 1980 and 1981. The movements and home range characteristics of these bears were varied, particularly as regards the different sex and age group classifications.

Table 2. Home range data on 14 radio-marked black bears, Mitkof Island, Alaska.

Age & sex[1]	Radio No.	Seasonal & composite home ranges in square miles: Late summer & fall 1980	Spring & early summer 1981	Late summer & fall 1981	Composite	Remarks
Yearling F	71	2/	1/	0.3	0.3	2/ Cub of female #960.
" M	885	1.3	1.2	Mortality	1.8	
" M	736	--	--	1.1	1.1	
2-yr F	936	1.4	2.9	1.2	3.4	
Group average		1.4	2.1	0.9	1.7	
Adult F	91	--	--	1.1	1.1	
" "	811	--	--	1.3	1.3	
" "	152	--	--	3.6	3.6	
" "	960	4.0	9.6	2.9	12.3	Mother of yearling #71.
Group average		4.0	9.6	2.3	4.6	
Adult M	193	--	--	4.5	4.5	
" "	693	--	--	12.0	12.0	
" "	772	--	7.6	1.2	7.7	
" "	786	14.0	18.6	3.6	23.5	
" "	910[3]	5.1	5.1	--	5.1	3/ Movements following translocation.
" "	850	26.2	35.3	10.8	44.2	
Group average		15.1	16.7	6.4	16.2	
Composite average		8.7	11.5	3.6	8.7	

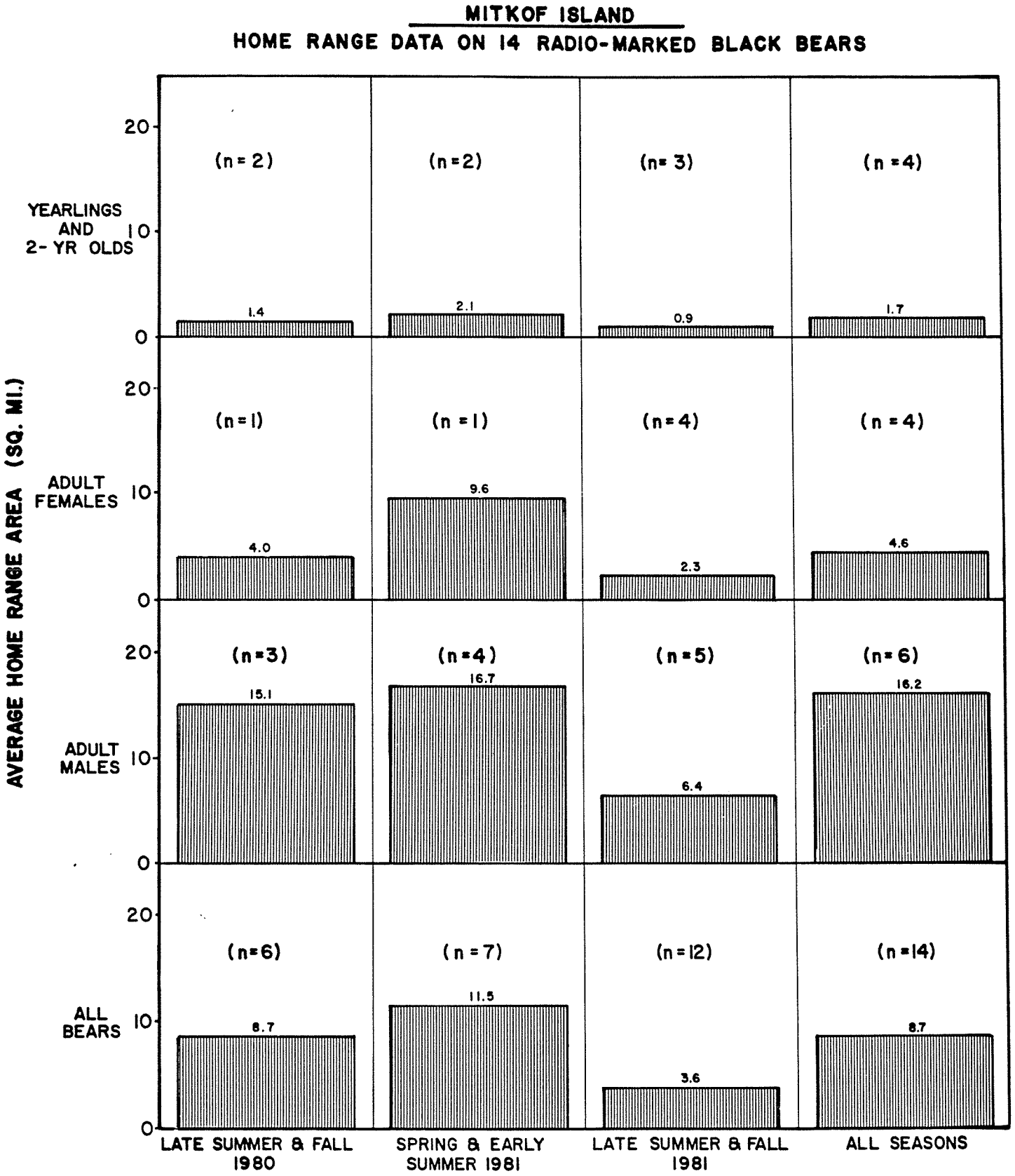
[1] At time of marking.

Fig. 1. Primary study area.

The composite 1980 and 1981 summer and fall home ranges of four adult female bears averaged only 4.6 square miles and the median consecutive day movements of these bears were less than 0.7 miles (Table 2, Figs. 2-6). Three of these females (Nos. 152, 91, and 811) were without cubs and one (#960) had two cubs of the year when first captured in July 1980. The home range of the female with cubs was 4.0 square miles in the late summer and fall of 1980 and 9.6 square miles in the spring and summer of 1981, but only 2.9 square miles during the late summer and fall of 1981 (Table 2, Fig. 3c). The reduced activity during the latter period may have been related in part to the fact that she was no longer tending cubs.

The composite home ranges of three yearling bears averaged only 0.9 square mile and there were no significant differences in the movements of the animals seasonally (Table 2, Figs. 7-9). The activity area of yearling female No. 71 of the group was extremely interesting (Fig. 7b). This bear was one of the two cubs captured with the female (#960) referred to in the paragraph above. The 1980 late summer and fall home range of this bear can be presumed to be the same as that of the animal's mother, although the animal was not radio-collared during this period. The cub was initially ear-tagged when the mother and cubs were taken from their tree den on March 21, 1981 (Figs. 3a,b). The cub was subsequently foot-snared on August 7, 1981, at the exact site where the mother had been first captured in 1980. At the time of the 1981 capture, the cub, now a yearling, had separated from its mother. Surprisingly, the animal remained almost exclusively within a 200-acre block of clear cut the entire summer and fall of 1981 (Fig. 7b).

Figure 2


MITKOF ISLAND
HOME RANGE DATA ON 14 RADIO-MARKED BLACK BEARS
AVERAGE HOME RANGE AREA (SQ. MI.)
YEARLINGS AND 2-YR OLDS
ADULT FEMALES
ADULT MALES
ALL BEARS
(n=2)
(n=2)
(n=3)
(n=4)
1.4
2.1
0.9
1.7
(n=1)
(n=1)
(n=4)
(n=4)
4.0
9.6
2.3
4.6
(n=3)
(n=4)
(n=5)
(n=6)
15.1
16.7
6.4
16.2
(n=6)
(n=7)
(n=12)
(n=14)
8.7
11.5
3.6
8.7
0
10
20
LATE SUMMER & FALL 1980
SPRING & EARLY SUMMER 1981
LATE SUMMER & FALL 1981
ALL SEASONS

The home ranges of the two yearling male bears, Nos. 885 and 736, remained seasonally constant at 1.1 and 1.3 square miles, respectively (Table 2, Figs. 8c, 9b). One of these animals (#885) was captured in the summer of 1980. In July 1981 the animal was apparently killed and devoured either by wolves or by another bear.

The composite home range of bear #936, marked as a 2-1/2-year-old immature female in August 1980, was 3.4 square miles (Table 2, Fig. 10b). The 1981 spring and early summer range of this animal measured 2.9 square miles, twice the size of the animal's 1980 and 1981 late summer and fall home ranges. The consecutive day movement distance of this animal averaged only 0.7 miles during the late spring and early summer of 1980, as opposed to only 0.4 miles during the late summer and fall of 1980 and 1981.

In contrast to the relatively regular and limited movements of the radio-marked mature female and immature bears, the movements and home ranges of the seven radio-marked mature male bears were more extensive generally and highly variable (Table 2, Fig. 2).

The movement of radio-marked male No. 828 (Fig. 17), which moved from Mitkof Island to the Wrangell area, has already been described. Another large male (#910) was captured and instrumented on 1 August 1980 in the primary study area. Shortly thereafter, the animal traveled to the Petersburg area where he was observed regularly at the city dump and became a nuisance. On 9 September 1980 the bear was captured by the Fish and Game Department and transported to the south end of Mitkof Island and released at the same location as the bear noted above. This male subsequently remained within a 5.1-square-mile area at the southern end of the island (Fig. 11b). The animal was observed on several

occasions along the beach and at least one hunter relented from shooting the animal during the 1981 spring hunting season after observing the animal's radio collar. The bear abruptly disappeared on 23 May 1981 and has not been accounted for since. It is our belief that the animal was killed by a hunter but the kill was not reported.

The late summer and fall 1981 home ranges of adult male bears Nos. 193 and 693 were only 4.5 square miles (Fig. 12b) and 12.0 square miles (Fig. 13b), respectively. The 1980 and 1981 composite home ranges of adult male bears Nos. 772, 786, and 850 were 7.7, 23.5, and 43.6 square miles, respectively (Table 2, Figs. 14a, 15a, 16a). Interestingly, however, the seasonal home ranges of these bears were markedly different. The spring and early summer 1981 home ranges of these bears were 7.6 square miles (#772), 18.6 square miles (#786), and 35.3 square miles (#850). Conversely, the late summer and fall 1981 home ranges of the same bears were only 1.2, 3.6, and 10.8 square miles, respectively, while the late summer and fall 1980 home ranges of Nos. 786 and 850 were 14.0 and 26.2 square miles, respectively. These figures indicate major differences in the movements of the bears both seasonally and between the same seasons of different years.

The movements of adult male bear No. 850 are worthy of additional comment. This bear primarily resided in a limited range area of about eight square miles. Periodically, however, the animal would make rapid and abbreviated trips to the southern end of the island (Fig. 16b). These excursions markedly increased the composite home range of this animal to 44.2 square miles. The daily mean movements of this animal during the period that the bear remained in its principal home range

averaged only 0.7 miles per day as opposed to daily movement distances of 2.9 miles when the animal traveled beyond its principal home range.

As may be noted by referring to Figure 2, the home ranges of almost all sex and age categories of bears were more extensive during spring and early summer of 1981 than during late summer and fall of 1980 and 1981. The combined mean home ranges for all the bears for these periods averaged 11.5, 8.7, and 3.6 square miles, respectively (Table 2, Fig. 2). The significance of the fact that the 1981 composite late summer and fall home ranges of the bears were significantly less extensive than the home ranges during the other two seasons is unknown (Table 2, Fig. 2). Perhaps food sources, particularly the availability of blueberries, were locally more abundant during the fall of 1981, thus providing adequate food availability within the major activity areas of the bears.

Habitat Use Characteristics

Appendix 2 portrays the distribution of the five habitat components present within the 75-square-mile study area as typed from color and infrared aerial photography. The percentage occurrence of the five principal habitat types within the study area was 11.4% clear cut area (CC), 16.9% muskeg bog (MK), 17.6% mixed muskeg bog forest (MF), 12.0% stream terrace (ST), and 42.1% commercial saw timber (CF) (Table 3). The commercial timber classification was 90% or more mature decadent hemlock and Sitka spruce. Lesser elements of this type included pole stage age classes of the same type, and some Alaska yellow cedar. The mixed bog forest type included finger strands of timber scattered throughout the bogs. The stands ranged from stunted non-commercial trees to commercial stands. The majority of the trees were hemlock and

Sitka spruce; lesser elements included lodgepole pine and Alaska yellow cedar. The stream terrace classification consisted largely of mature hemlock and Sitka spruce commercial timber with lesser elements of non-commercial alder and grasses. A 2.4% beach fringe area was included in this classification.

Table 3 and Figure 18 present the percentage occurrence of habitat types in the study area and the percentage occurrence of the habitat types existing within the composite home ranges of the 14 individual radio-marked bears. The composite home ranges of these 14 bears totaled 132.6 square miles of area. The percentage occurrence of the five habitat types represented in the composite home range of these bears was 40.8% commercial timber stands, 17.4% clearcut areas, 16.6% muskeg, 15.0% mixed muskeg timber, and 10.2% stream terrace. These values are remarkably correspondent to the availability of the habitat types present in the study area. The major difference in greater indicated use as contrasted with availability was the greater use of clear cuts relative to their proportional occurrence. This observation suggests that early age clear cuts constitute attractive habitat for bears on Mitkof Island.

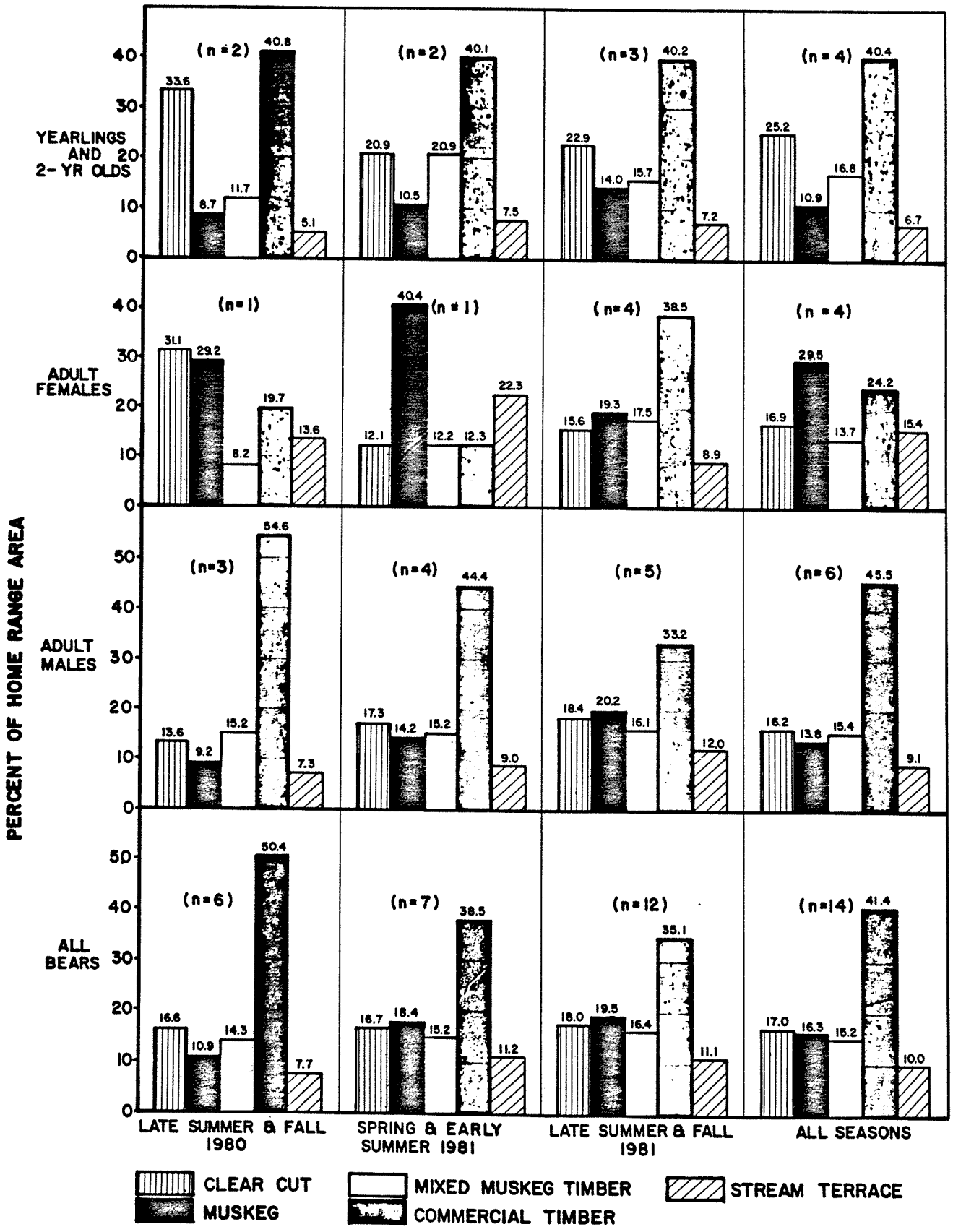
Table 3. Habitat Use Characteristics of 14 Radio-Marked Bears

	Percentage Occurrence	
Habitat Type	In Study Area	In Composite Home Range
Commercial timber	42.1	40.8
Mixed muskeg timber	17.6	15.0
Muskeg bog	16.9	16.6
Clear cuts	11.4	17.4
Stream terraces	12.0	10.2

Figure 18

MITKOF ISLAND

HABITAT USE CHARACTERISTIC OF 14 RADIO-MARKED BLACK BEARS



As shown in Figure 18, the habitat types occurring within the home ranges of radio-marked bears were remarkably similar for all sex and age categories for both the composite and seasonal home ranges. The 45.5% occurrence of commercial timber in the home ranges of adult males was, however, appreciably greater than the 24.2% and 34.3% occurring in the home ranges of adult female bears and yearling and 2-1/2-year-old bears, respectively. This difference is attributed to the generally larger size of the male home ranges which resulted in the inclusion of major blocks of commercial timber. Two additional habitat use differences were the high (25.2%) use of clear cuts by yearling and 2-1/2-year-old bears, as contrasted with values of 16.9% and 16.2% for adult females and adult males, respectively; and the high (29.5%) use of muskeg habitat by adult females as compared with the 13.8% and 10.9% use of this habitat type by adult males and yearling and 2-1/2-year-old bears, respectively. The indicated heavy muskeg use by adult females was accentuated by the inclusion of major elements of this habitat type in the home range of female #960. This adult female was the only bear of this category for which habitat data were obtained in 1980 and during the early spring and summer of 1981. This, plus the fact that her home range was the most extensive of the adult female bears, distorted the data on overall habitat use characteristics for the adult female category.

The seasonal habitat use characteristics of the Mitkof Island bears were remarkably uniform. For all the bears combined, there was a slightly greater percentage use of commercial timber included in the home ranges during the late summer and fall of 1980. This was

largely the result of the large representation of this habitat type in the home ranges of the more widely ranging males (Fig. 18). This contrasts with the 32% use of clear cuts by the combined other categories of bears during this season. Differences in habitat use characteristics for the remaining seasons were appreciably alike except for the previously noted data for adult females during the early 1981 spring and summer.

The foregoing analysis, while indicative of the habitat use characteristics of the black bears on Mitkof Island, does not reveal as precise information on the habitat use characteristics of the bears as may be ascertained by further analysis of the data collected. However, further analysis will require additional time and is beyond the scope of this contract. Nonetheless, the analyses are being separately performed, and as the results become known, the information will be forwarded to the contract coordinator. The essence of these findings will turn on the analysis of the habitat types immediately surrounding each daily position location of the bears as opposed to the total of all the habitat types included in the home ranges.

Den Description and Occupancy

A total of 13 winter dens of radio-monitored bears was located (Table 4). The dens of six of the seven bears whose movements were monitored in 1980 were located. The den of the seventh bear was isolated as to general location but the actual den was not located. A second den of one of the bears (#936), which deserted its first den when disturbed, was also found. In 1981 the dens of six bears were located. These included the dens of four of six bears first marked in 1981 and the dens of two bears whose 1980 dens had also been located.

Table 4. Locations and descriptions of black bear dens on Mitkof Island, Alaska.[1]

ADF&G tag # (radio #)	Sex & status	Date den entered - deserted	Den location[2]				Habitat type[2]	Description	Den opening		Den			Remarks
			Town.	Range	Sect.	1/4 Sect.			Height	Width	Elev.	Aspect	Slope	
2308 (936)	2.5 yr female	10/20/80 - 3/19/81	60S	80E	27	SW	Clearcut	Hollow log	19"	17.5"	1035'	WSW	45°	Bear left den when disturbed on 3 occasions; see next entry.
"	"	11/02/80 - 1/21/81	60S	80E	27	SW	Mature hemlock stand	Hollow hemlock tree base	11"	3'	1200'	WSW	55°	Den occupied after second disturbance, returned to original den when disturbed on 1/21/81.
2309 (850)	Adult male	11/18/80 - 3/20/81 approx.	60S	80E	4	SE	Clearcut	Hollow log	30"	37.5"	150'	WSW	30°	Bear left den when first located and once thereafter.
2310 (885)	Yearl. male	10/23/80 - 4/17/81	60S	80E	9	SW	Mature hemlock stand	Hollow hemlock tree base	20"	9.5"	750'	SW	40°	Bear remained in den following handling on 3/19/81.
2311 (910)	Adult male	11/24/80 - 3/15/81 approx.	61S	82E	15	SW	Shale slope in a cirque	Hollow mt. hemlock tree base	14.5"	13.5"	1275'	NW	50°	Bear left den when first located and again when visited 3/15/81.
2312 (772)	Adult male	12/18/80 - post-3/22/81	59S	80E	8	NW	Mature hemlock stand on ridge	Hollow hemlock tree trunk, entrance 13 ft from ground	33"	11"	1500'	NE	20°	
2325 (960)	Adult female	10/29/80 - 3/21/81	59S	80E	26	NW	Mature hemlock stand	Hollow hemlock tree trunk, entrance 12 ft from ground	40"	10"	300'	E	30°	Denned with two yearling cubs.
"	"	11/18/81 - 5/2/82 approx.	59S	80E	25	SW	Clearcut	Hollow log	26"	28"	50'	NE	5°	

Table 4, cont'd

ADF&G tag # (radio #)	Sex & status	Date den entered - deserted	Den location[2]				Habitat type[2]	Description	Den opening		Den			Remarks
			Town.	Range	Sect.	1/4 Sect.			Height	Width	Elev.	Aspect	Slope	
2317 (071)	Yearl. female	10/20/81 - 4/27/82 approx.	60S	80E	4	NW	Clearcut	Hollow log	17.25"	19.5"	300'	NE	5°	Deserted den upon approach.
2315 (786)	Adult male	12/1/81 - 5/6/82 approx.	60S	80E	3	SW	Mature hemlock stand on ridge	Hollow hemlock tree base	12"	19"	1100'	SW	50°	Tree base circumference 9'10"; had been in and out of den previously.
2323 (811)	Adult female	11/16/81 - 5/2/82 approx.	60S	80E	26	NE	Clearcut	Hollow log	26"	33"	600'	W	15°	Den heavily lined with grass and ferns.
2320 (736)	Yearl. male	10/21/81 - 4/28/82 approx. approx.	60S	80E	16	NW	Mature hemlock stand on ridge	Hollow hemlock tree trunk, entrance est. 40 ft from ground	?	?	600'	NW	20°	Bear ascended nearby tree to cross to den tree with basal diameter of 47".
2322 (152)	Adult female	Before 11/18/81 - 4/25/82	59S	80E	32	NE	Mature hemlock stand on ridge	Hollow hemlock tree trunk, entrance 25 ft above ground	12" est.	20" est.	1400'	NW	30°	Bear poked head out of hole to observe us.

[1]Approximated dates within 2 or 3 days of actual dates.

[2]Appendix 3 presents map sections and aerial photographs identifying exact den site locations geographically and within habitat type.

The den of the third bear surviving from 1980 was not located in 1981 (Table 4). Appendix 3 presents mapped displays of the geographic locations of the individual den sites and the identification of the sites on aerial photographs.

The nature of the 13 winter dens located was as follows. Five of the dens were in hollow logs (Figs. 3i, 6c, 7c, 10c, 16c). Four dens, including the second den of a bear (#936) which deserted its original den upon being disturbed, were in the bases of living hollow hemlock trees (Figs. 8d, 10i, 11c, 15c). The remaining four dens were in the boles of hollow living hemlock trees with entrances ranging from 12 to 40 feet above the ground (Figs. 3a, 4c, 9c, 14c).

The habitat types in which the bears denned included six dens occurring in mature hemlock stands in areas classified as commercial forest (Figs. 4, 8, 9, 10i, 14, 15, 30); five dens were in clear cuts in hollow logs (Figs. 3i, 6, 7, 10c, 16); one was in a hollow hemlock tree along a stream terrace (Fig. 3a); and another was in a solitary hemlock located on the talus slope of a cirque basin (Fig. 11).

Of the five dens in clear cuts, two were in recent, relatively non-regenerated cuts less than five years old (Figs. 6, 10c); two were in slightly older and moderately regenerated cuts 6-10 years old (Figs. 7, 16); and one was in a heavily regenerated, 15-25 year old cut (Fig. 3i).

The four dens located in the boles of standing trees included two situated on ridge crests at 1,400 and 1,500 feet elevation, Figures 4c and 14, respectively; one in a closed canopy hemlock stand at 600 feet

elevation (Fig. 9); and one located at 300 feet elevation along a stream terrace (Fig. 3a).

The four dens located in the bases of hollow trees included three dens located in closed canopy mature hemlock stands located on upper slopes at elevations ranging from 750 to 1,200 feet (Figs. 8, 10i, 15), and one in a solitary tree in talus scree at an elevation of 1,275 feet (Fig. 11).

The elevations of the dens irrespective of den type ranged from 50 to 1,500 feet mean sea level and elevation appeared to have little meaningful relationship with the type of den used (Table 4). The slope and aspect of the dens were also highly variable (Table 4).

All of the dens with entrances at ground level had some lining material except for the one secondary den which was first used in midwinter (Fig. 10i). The lining material in most of the dens was sparse and perfunctory; however, certain bears, particularly female #960 and yearling #885, had extensively lined their dens with ferns, leaves, and moss.

As is to be noted by reference to Table 4, the den occupancy periods in 1980-1981 were quite different from the den occupancy periods in 1981-1982. In large measure these differences can be attributed to the markedly different winters occurring in the Petersburg area in 1981 and 1982. The winter of 1980-1981 was unusually mild with only a limited amount of snow on the ground for any period of time. As a consequence the bears were not closely confined to their dens, although there was no evidence that they did in fact voluntarily leave their dens during the over-wintering period. By contrast the winter of

1981-1982 was marked by a mild snowfree fall period extending into mid-December, followed by heavy snow accumulations which persisted into April.

Despite the marked differences in weather between the late fall and winter of 1980-1981 and 1981-1982, the periods of initial denning by the bears were generally alike for the two years. In 1980-1981 the first bears to den were a 2-1/2-year-old female (#936) which denned on 20 October, and a yearling male (#885) which denned on 23 October (Table 4). In 1981-1982 the first bears to den were a yearling female (#71) and a yearling male (#736) which denned on approximately 20 and 21 October, respectively.

The sole adult female (#960) among the 1980-1981 bears denned on 29 October. The same female denned on approximately 18 November during the 1981-1982 season. In 1981-1982 two additional adult females denned on 16 November (#811) and on approximately 18 November (#152). The earlier denning date for female No. 960 during the fall of 1980-1981 was probably influenced by the fact that she was accompanied during that year by two cubs of the year.

The denning dates of the adult male bears in 1980-1981 included three bears that denned on 18 November (#850), 24 November (#910), and 18 December (#772). The single adult male denning record among the 1981-1982 bears denned on approximately 1 December (#786). The later denning dates for adult male bears witnessed in this study are consistent with the findings of other investigators.

In contrast to the generally similar initiation of denning by the 1980-1981 and 1981-1982 bears, the times of the emergence of the bears

from their dens in 1981-1982 were markedly later than during the 1980-1981 season (Table 4).

In 1980-1981 the dates of first den emergences were 17 April for yearling male No. 885 and 19 March for 2-1/2-year-old female No. 936. The denning periods for these bears were 177 and 150 days, respectively. The dates of first den emergences in 1981-1982 were 27 April for yearling male No. 736 and approximately 28 April for yearling female No. 71 (Table 4). The denning period for both of these bears was 189 days, which was 22 and 39 days longer, respectively, than the denning period for equivalent sex and age group bears for the 1980-1981 season.

Among adult females, the dates of den desertion by female No. 960 were 21 March 1981 and 2 May 1982. Despite the significantly later date of den emergence for this bear in 1982, the total denning period for this bear was not appreciably different--144 days as opposed to 166 days--between the two years. This was attributable to a correspondingly later date of initial denning by this bear during the fall of 1981. The actual denning periods for this bear for the two years would very likely have been quite comparable had we not anaesthetized and physically worked with her and her cubs on 19 and 20 March 1981. The animal deserted her den after these activities.

The dates of den emergence for adult females Nos. 152 and 811 in 1982 were 25 April and approximately 2 May. The minimum denning periods for these bears were 168 and 178 days, respectively.

The dates of den emergence for three adult male bears in 1980-1981 were approximately 15 March (#910), 20 March (#850), and 22 March (#772)

(Table 4). These dates were possibly abbreviated inasmuch as each of the bears was disturbed during the course of our visiting the dens, and two of the animals fled from their dens. However, track evidence in the areas immediately surrounding the dens of two of these bears indicated that they had been active before being disturbed. The third animal (#772) was in a tree den and its departure time was not closely ascertained. The minimum denning periods for these three adult males in 1980-1981 were 93, 123, and 134 days, respectively.

The den emergence date of only one adult male bear was determined for the 1981-1982 season. This bear, No. 786, deserted its den on 6 May. This animal had been active for several days in the immediate area of its den before deserting. The minimum denning period for this animal was 152 days.

DISCUSSION

Although the thrust of this study was to determine the locations and habitat setting of the dens of black bears on Mitkof Island, the study offered the opportunity to develop certain other points of information. Among these was information on the movements, home ranges and habitat use characteristics of the bears, and more specific information on the dens and denning behavior of bears. Most of these data require further analysis; however, the analyses performed to date reveal a general picture of the characteristics of the black bears on Mitkof Island.

Not surprisingly, the movements and home range sizes of Mitkof Island black bears did not vary significantly from previously published studies. The exceedingly small home range of the yearling and two-year-old animals ($\overline{X}$ = 1.7 square miles) was somewhat surprising, but average home range sizes for adult females ($\overline{X}$ = 4.6 square miles) and for adult males ($\overline{X}$ = 16.2 square miles) were within the range of published norms. These range sizes may have been influenced by the study area being on an island. Nonetheless, the bears generally failed to move widely, and it would appear that Mitkof Island has attractive habitat capable of providing sustenance for bears within limited areas.

The character of the habitat utilized by black bears on the island was examined on the basis of the availability of the habitat types within the primary study area and the proportional occurrence of these habitat types within the determined home ranges of the bears. This analysis showed close correspondence between the two, with little

variation in use by the separate sex and age categories of bears. This relationship was surprising inasmuch as it suggests quite general use of all habitat areas by the bears. This result is believed to be an artifact arising from two causes. The first is the interesting habitat mosaic in the primary study area (Appendix 2). This dispersed habitat mixture resulted in the inclusion of all habitat types within the home ranges of bears in near proportion to the general occurrence of the types.

To make a more meaningful determination of the actual habitat use characteristics of the study area bears, further analyses are being performed. These analyses include partitioning out the particular characteristics of the habitat types surrounding each position location of the bears, and assessing the habitat types occurring in concentrated use areas and distributed between the consecutive day location points. These analyses are expected to reveal proportionally greater use of clear cuts and muskeg bog and muskeg bog - forested areas. Clear cuts were the one habitat type which the current habitat analysis suggested was preferentially used by bears. This finding was not surprising inasmuch as the pioneer vegetation developing in clear cut areas generally provides more food for the black bear than does the mature closed-canopy hemlock and spruce forest that was removed.

If the above scenario is correct, the judgement might be made that the removal of the mature hemlock and Sitka spruce stands existing over a great extent of Mitkof Island would be beneficial to black bear populations. This may or may not be the case, as will be discussed beyond.

As detailed in the body of this report, the dens used by the black bears of this study were confined to either hollow trees or cut hollow logs. The cut log den sites represent unnatural den sites, although it seems logical that a few similar den sites would arise from the natural windthrow and falling of these old hollow trees. In any event, all 13 of the den sites identified were the product of old growth decadent trees.

The fact that the black bears of Mitkof Island apparently limit their denning to hollow standing trees or to the remains thereof was most surprising in view of the general, broad spectrum of denning sites reported for black bears elsewhere. Most of these studies found that bears would use a wide range of protected sites, most of which had some relation to an excavation beneath brush, logs, trees, etc. A few studies have documented extensive use of tree dens but none to the exclusion of other sites as identified in this study. The difference in the Mitkof Island bears is attributed to the weather and edaphic conditions on the island and presumably throughout much of coastal southeastern Alaska. The edaphic factors include the meager amount of surface soils capable of permitting water percolation and sub-surface drainage. This, coupled with the fact that Mitkof Island is in an area of near-persistent rainfall, results in ground which is continuously wet. This wet coolness is conducive to and accentuated by luxuriant moss growth. As a result, Mitkof Island bears have little choice but to seek above-surface denning areas which appear to be limited to the sites identified.

The two considerations discussed above--namely, timber removal and its bearing on the sustenance of black bears and the apparently unique denning requirements of the bears on Mitkof Island--suggest that the habitat requirements of black bears should be taken into consideration in forest management planning. The following remarks are directed toward this consideration.

As noted above, the black bears studied in this investigation showed some preferential use of clear cut areas. We are further of the opinion that this preferential use is far more extensive than is yet identified, and this opinion is expected to be substantiated when detailed analysis of the collected data is completed. Assuming that this will prove to be the case, does it follow that the clear cutting of the extensive mature hemlock and Sitka spruce forest stands on Mitkof Island would be beneficial for the black bear? The answer is probably yes in the short term, but likely no in the long term. The reason for this view is that the fairly rapid removal of the mature stands would probably initially provide more attractive habitat for the black bear and possibly result in an increased bear population for a time. The crux of the matter, however, is that the vegetation regenerating in the clear cuts after a period of 15 to 25 years would convert these areas into quite unattractive habitat for bears. The forest regeneration presently occurring in the island's clear cuts shows most of the area to regenerate to dense, closed stands of hemlock and/or spruce. These stands appear far less supportive of the habitat needs of the black bear than either clear cuts or the original mature forest stands. Many years, possibly 50 or more, would pass before these stands would gain

maturity and improve in attractiveness as habitat for bears. It further appears probable that silviculturally the stands will never again be allowed to attain advanced age. This would not be negative as regards habitat recycling, inasmuch as a short rotation recut would again create pioneer habitat. There is, however, the problem of the need for old age trees to provide dens for bears, which consideration will be addressed later in this discussion.

Assuming the validity of the above scenario, it would appear that the portent exists that forest management actions might result in a boom or bust ecology for the black bears on Mitkof Island. It appears obvious, therefore, that management should consider rotational cutting and dispersion of the cutting effort to dampen the impact of timber removal on the welfare of black bears. Realistically, I do not foresee the prospect that national timber needs will permit management of timber-producing lands on a long rotation basis. This in essence means the replacement of old age decadent stands with less diverse forests of shorter rotation. If this should develop on Mitkof Island, how would it impact the black bear population? My judgement is that it would not have as great an impact on the bears as might be expected. The reason for this evaluation is the unique habitat mosaic on the island. As was determined in this study area, which represents approximately 30% of the island, muskeg bog and mixed muskeg bog and timber composed 16.9% and 17.6% of the total study area, respectively. These habitat types appear to be heavily used by black bears and the mixed timber classification appears to have low commercial value, at least in the context of today's judgement of value. Accordingly, I believe that

the large amount of attractive bear habitat perennially available, coupled with the availability of other attractive habitat areas whether temporary or permanent, essentially ensures that Mitkof Island will always have significant amounts of attractive black bear habitat as regards the food sustenance needs of the species.

The second aspect of forest management practice affecting the welfare of the black bear on Mitkof Island is the denning habitat needs of the animals. It naturally follows that the clear cut removal of old age stands results in the elimination of the existing tree dens. Without doubt, these dens have a limited natural life before the trees die or are blown down. It is unlikely, however, that their life would be as short as that of the trunks if cut and left on the ground as potential dens. Furthermore, in old age forests there is a continual renewal of decadent trees suitable as potential dens. There can be little doubt, therefore, that the assured providing of suitable dens for black bears is a serious concern if the near-elimination of old forests on Mitkof is a management objective.

The providing of dens for periods of 15 to 20 years following timber removal does not appear to be a problem, as shown by the common use of cut logs for dens during the current study. The effective life of these logs as suitable denning sites is not likely to extend beyond 20 years. This, and the fact that preservation of old age stands will not by predilection be a management objective, points up a need to develop management strategies that will assure the continued existence of enough old age trees to meet not only the denning needs of black bears but

also the needs of other animals requiring old age forest stands for their existence.

This objective can be met of course by any number of actions, such as preserving a certain portion of the Mitkof forest as old age stands, using other cutting practices than clear cuts, or leaving uncut suitable trees or small blocks of trees for den sites.

The big question, however, is how much denning habitat should be left to satisfy the denning needs of the bears? In my opinion, the amount of habitat needed is probably not extensive, simply because the population levels attained by bears should not require a large amount of denning habitat. I suspect, in fact, that the natural tree stands left after logging as currently practiced might still result in sufficient dens to satisfy the requirements of the bears. Several of the den sites identified in the current study were trees situated in circumstances that would not have resulted in their removal either because of cost, engineering problems, or similar considerations. These conditions can be expected to prevail to some degree, although the prospect of increased future value of forest products will undoubtedly lessen the amount of such areas left undisturbed.

I have suggested that actual or potential denning trees or blocks of trees might be left for the continued denning use by bears. Such leave trees would likely have low survivability as standing trees due to windthrow and other considerations. However, they would still offer the prospect of serving as den trees even if they fell. A similar consideration is the use of felled hollow trees. To a certain extent,

consideration should be given to leaving suitable numbers of such felled stems as denning sites for bears.

In concluding this report, I feel it appropriate to identify several informational voids that the U.S. Forest Service might wish to develop information on, relative to their future forest management practices. A major consideration concerns the population and behavioral characteristics of bears existing in those forested areas of Mitkof Island that have not been subjected to timber cutting, as contrasted with the bears included in this study which reside in an area that has already been subjected to significant timber harvest. A key area to be investigated would be the proposed Cabin Creek sale area. A study of that area would have the advantage of assessing the status of the Cabin Creek bear population before timber harvest and lay the groundwork for an evaluation of the impact of timber removal on that bear population. The information developed would be extremely useful in assessing the impact of timber harvest in other areas of the Tongass National Forest.

Additional desired studies include an assessment of the availability of denning sites for bears in the various habitat areas on Mitkof Island, a detailed study of the feeding habits of black bears on Mitkof Island, and an assessment of the availability of suitable food for bears in the various habitat types. An in-depth study is also required of the population characteristics of Mitkof Island black bears--e.g., population numbers, population structure, productivity, survival. However, this study is more within the purview of the Alaska Department of Fish and Game. Nonetheless, the Forest Service might encourage the Department of Fish and Game to develop more information in this area, particularly in

view of the growing interest of sport hunters in the black bears on Mitkof Island. During the current study, three of the radio-marked bears were known to have been taken by sport hunters and another is suspected to have been so taken. Surprisingly, and fortuitously, none of the seven bears radio-monitored in 1980 were killed. Equally surprisingly, two of these same bears were known to have been killed, and another suspected of being killed, during the 1981 season, as well as one of the six bears first marked in 1981. It is improbable that this mortality rate was sustained by the total island population, but it does point up the potential for the black bears of Mitkof Island to be exploited in excess of sustainable harvest levels.

A further interesting observation was the apparent low reproductivity of the black bears on Mitkof Island. During our study we saw few cubs, and none of the four adult females that we had radio-marked gave birth to cubs and only one of the four was accompanied by cubs when captured.

Fig. 3a. 1980 den of adult female #960 and accompanying cubs.

Fig. 3b. Adult female #960 in 1980 den.

Fig. 3c. Capture site, den sites, and seasonal and composite home ranges of adult female #960.

Fig. 3d. Consecutive day movements of adult female #960.

Fig. 3e. View north from 1980 den of adult female #960.

Fig. 3f. View east from 1980 den of adult female #960.

Fig. 3g. View south from 1980 den of adult female #960.

Fig. 3h. View west from 1980 den of adult female #960.

Fig. 3i. 1981 den of adult female #960.

Fig. 3j. View north from 1981 den of adult female #960.

Fig. 3k. View east from 1981 den of adult female #960.

Fig. 3ℓ. View south from 1981 den of adult female #960.

Fig. 3m. View north from 1981 den of adult female #960.

Fig. 4a. Radio-marked adult female #152.

Fig. 4b. Capture location, den site, and home range of adult female #152.

Fig. 4c. Den tree of adult female #152. Den entrance is in exact center of picture.

Fig. 4d. View north from den tree of adult female #152.

Fig. 4e. View east from den tree of adult female #152.

Fig. 4f. View south from den tree of adult female #152.

Fig. 4g. View west from den tree of adult female #152.

Fig. 5a. Radio-marked adult female #91.

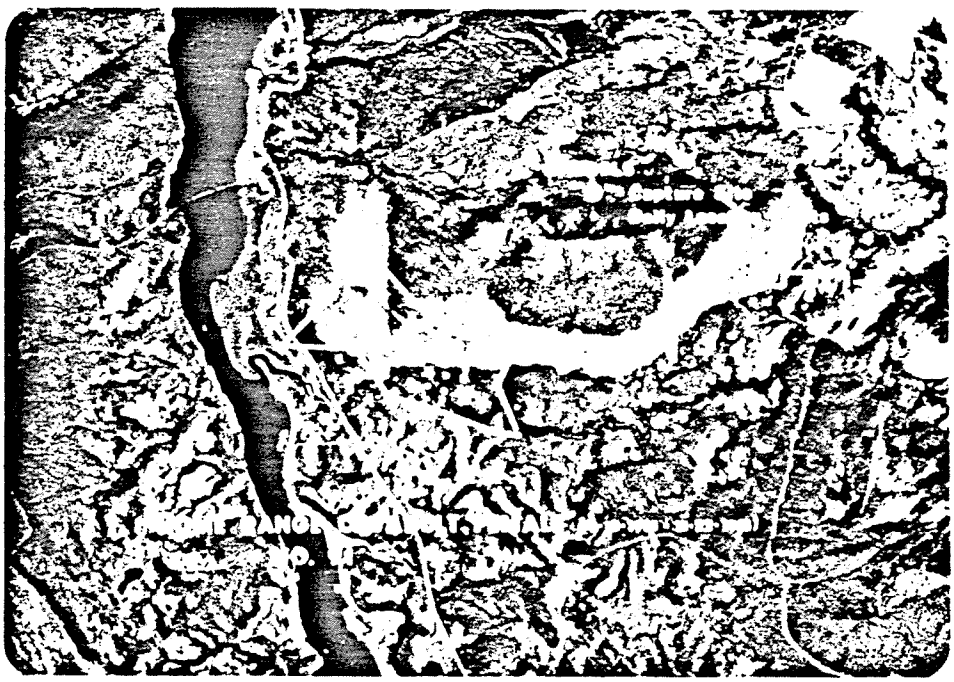


Fig. 5b. Capture site, den site, and home range of adult female #91.

Fig. 6a. Radio-marked adult female #811.

Fig. 6b. Capture site, den site, and home range of adult female #811.

Fig. 6c. Log den site of adult female #811.

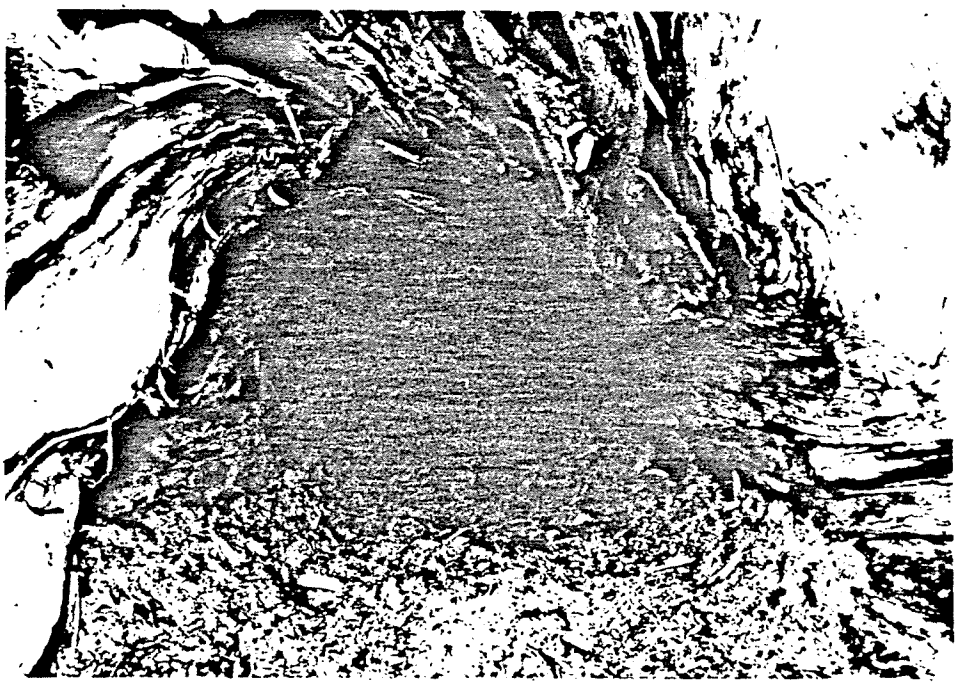


Fig. 6d. Interior of log den site of adult female #811.

Fig. 6e. View north from log den of adult female #811.

Fig. 6f. View east from log den of adult female #811.

Fig. 6g. View south from log den of adult female #811.

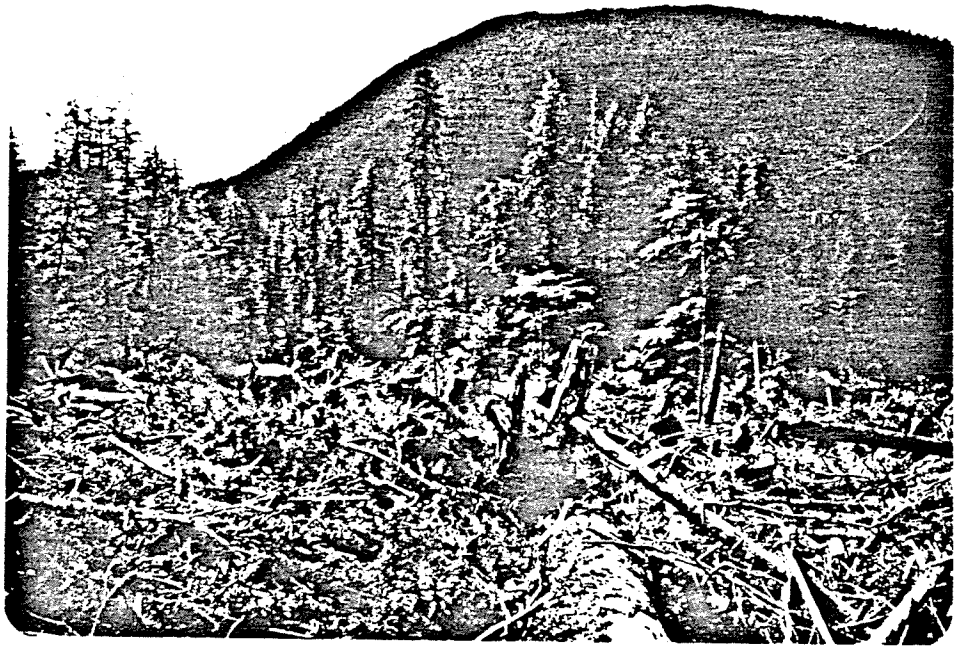


Fig. 6h. View west from log den of adult female #811.

Fig. 7a. Radio-marked yearling female #71.

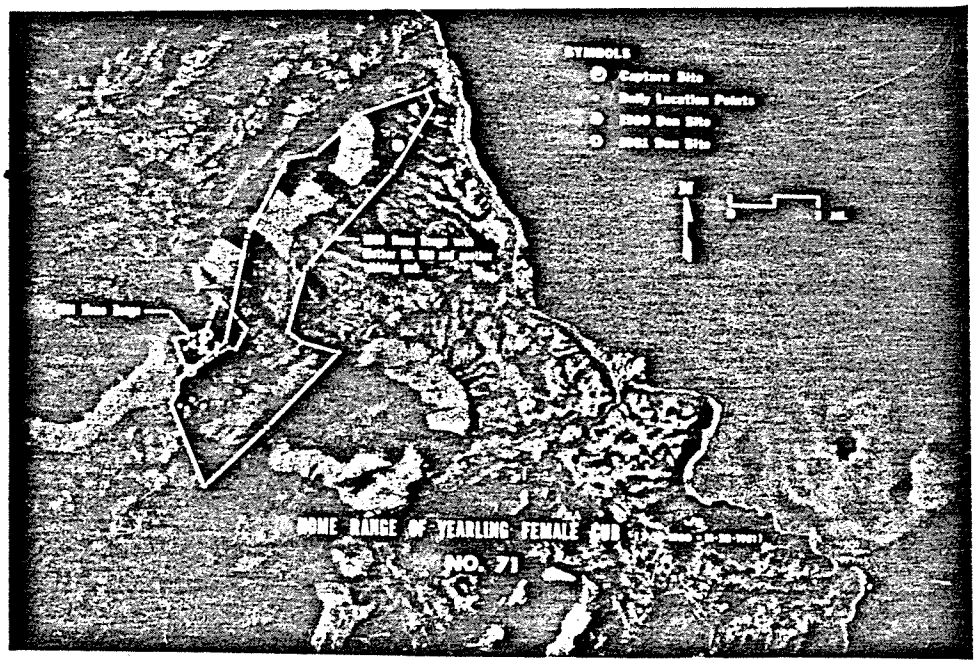


Fig. 7b. Capture site, den site, and seasonal and composite home range of yearling female #71.

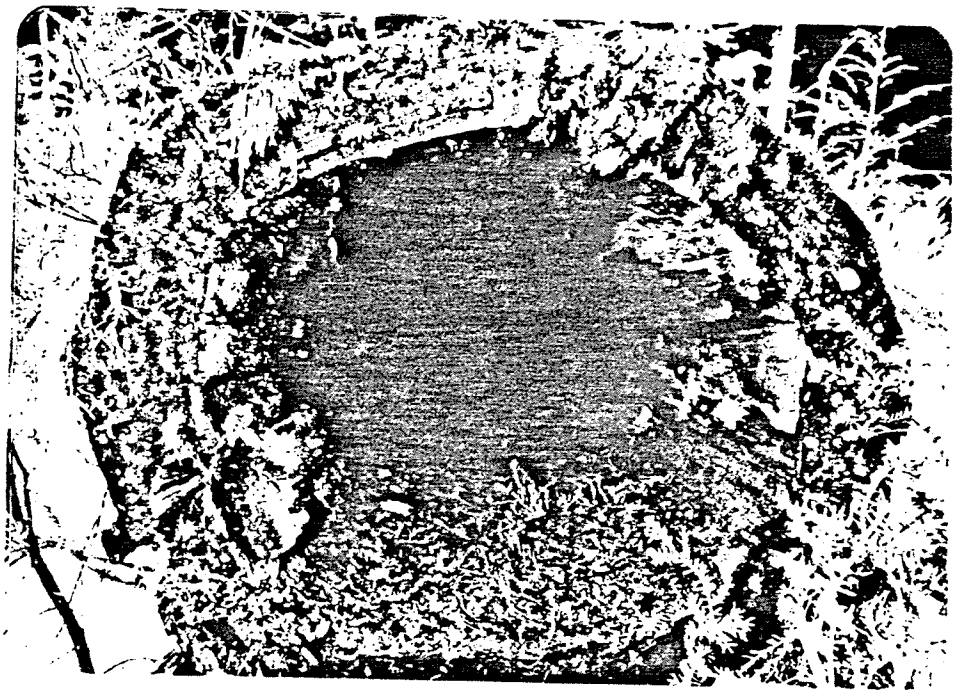


Fig. 7c. Log den of yearling female #71.

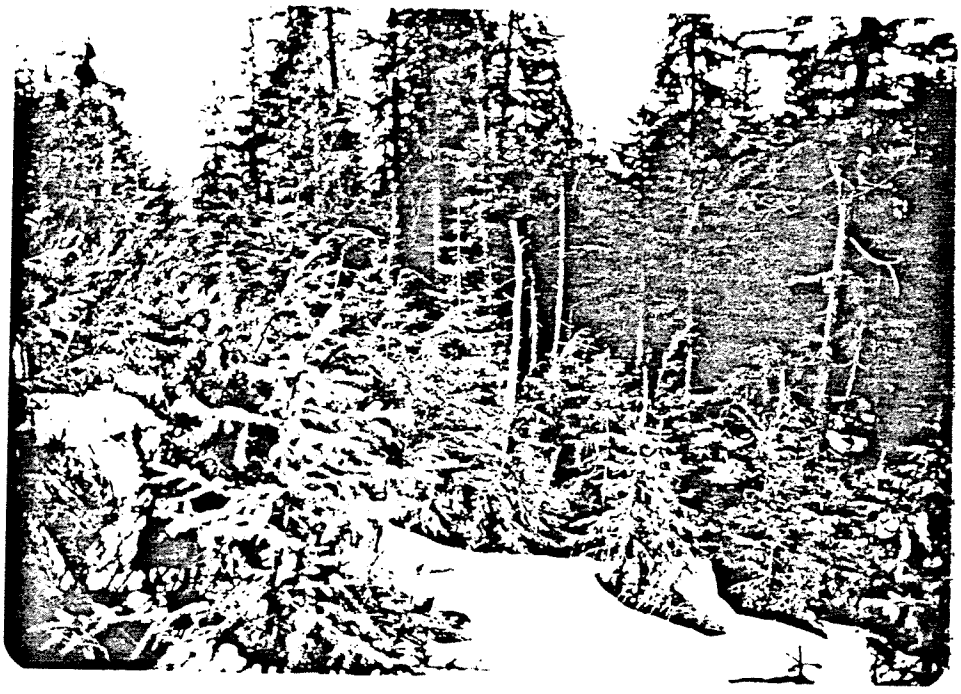


Fig. 7d. View north from log den of yearling female #71.

Fig. 7e. View east from log den of yearling female #71.

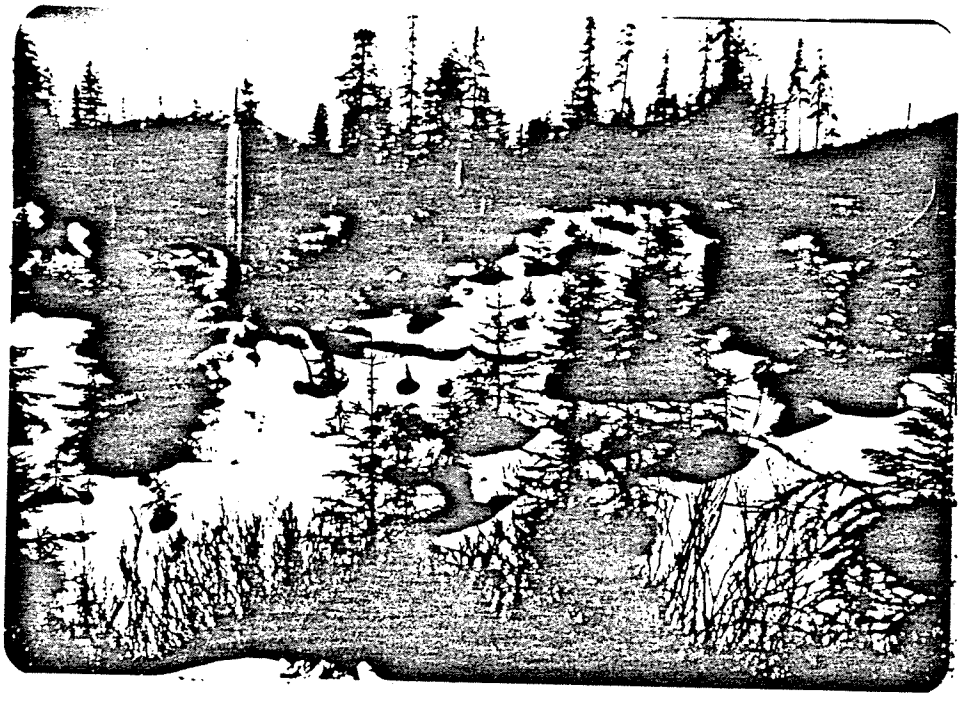


Fig. 7f. View south from log den of yearling female #71.

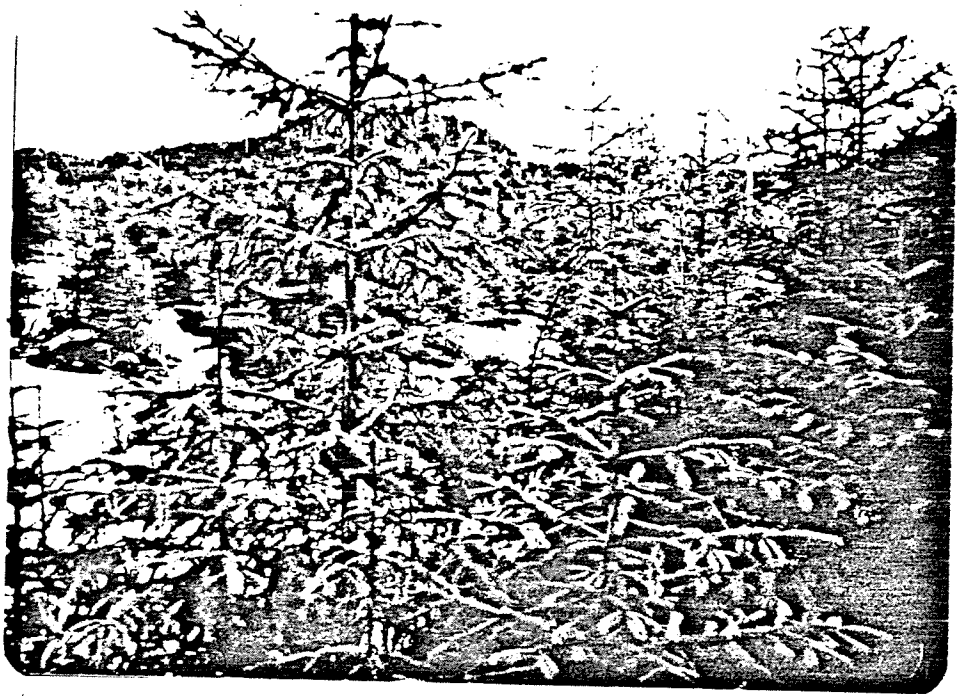


Fig. 7g. View west from log den of yearling female #71.

Fig. 8a. Radio-marked yearling male #885 at den site.

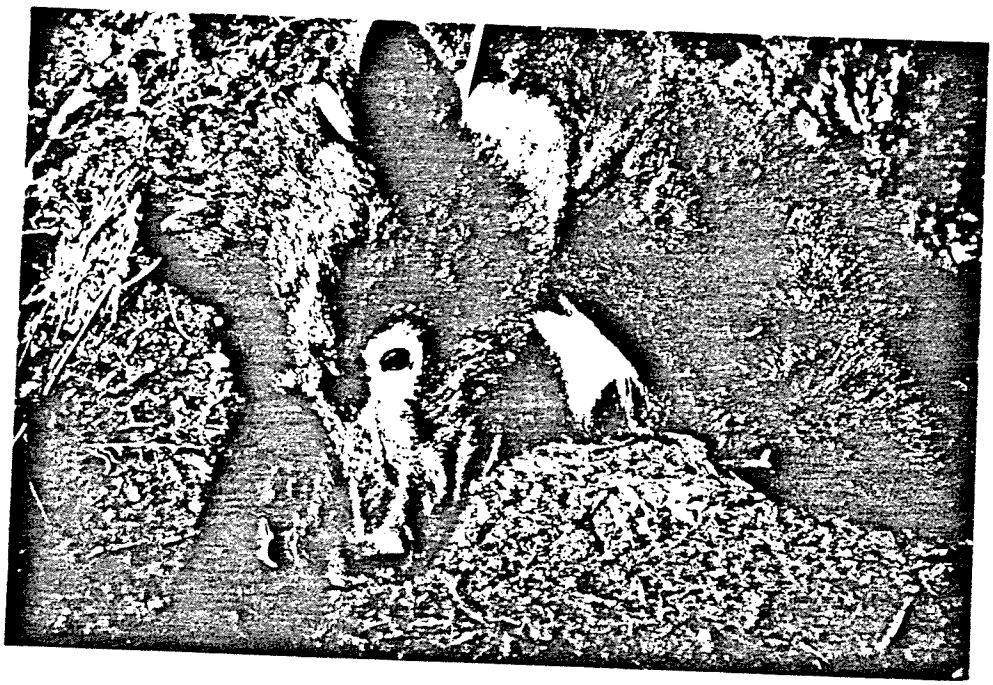


Fig. 8b. Yearling male #885.

Fig. 8c. Capture site, den site, and home range of yearling male #885.

Fig. 8d. Den site of yearling male #885.

Fig. 8e. View north from tree den of yearling male #885.

Fig. 8f. View east from tree den of yearling male #885.

Fig. 8g. View south from tree den of yearling male #885.

Fig. 8h. View west from tree den of yearling male #885.

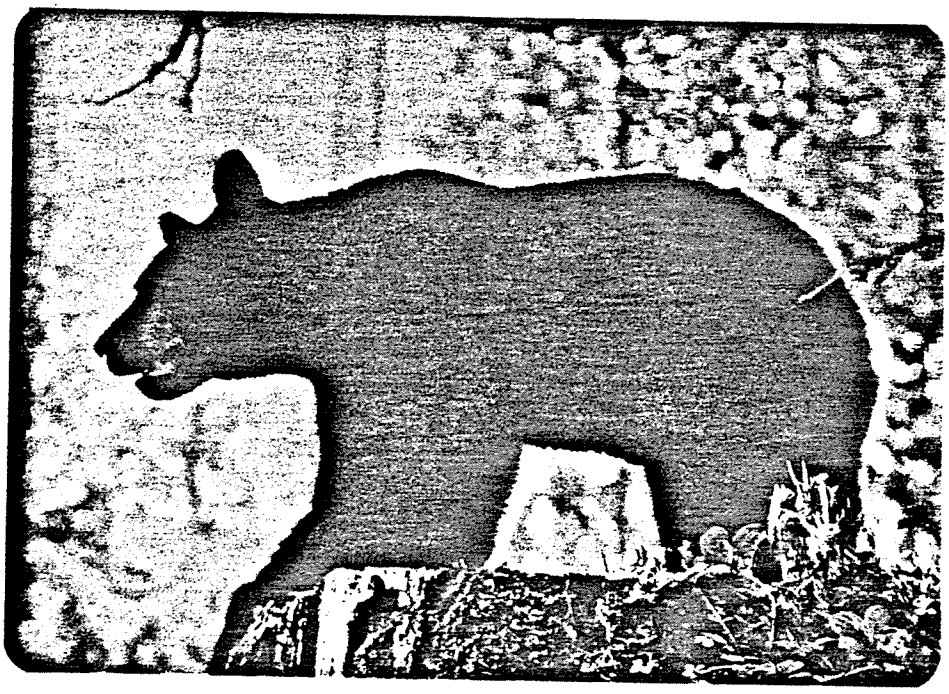


Fig. 9a. Radio-marked yearling male #736.

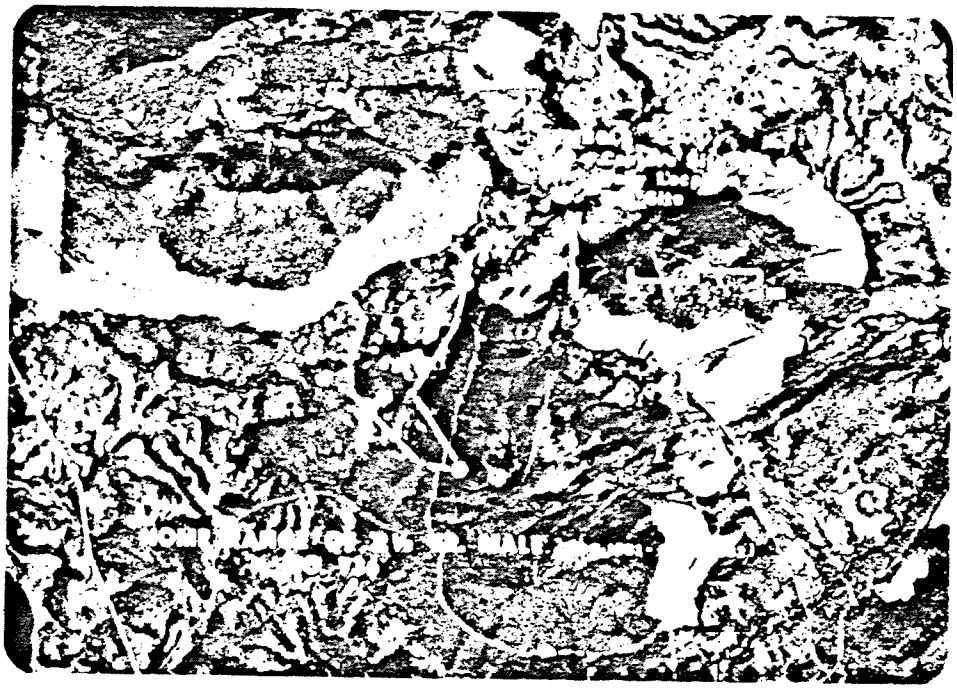


Fig. 9b. Capture site, den site, and home range of yearling male #736.

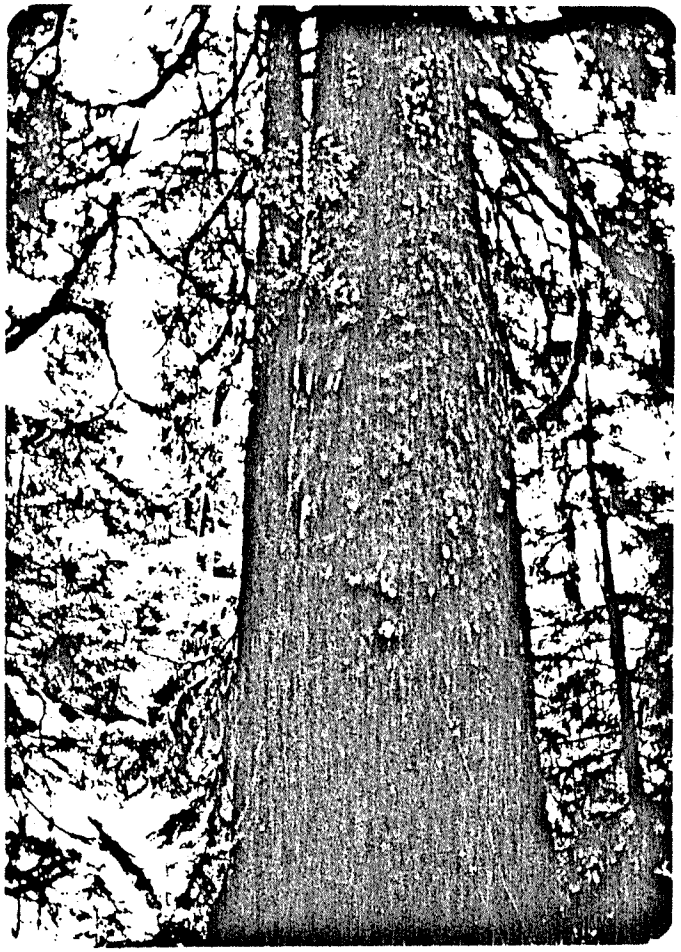


Fig. 9c. Den tree of yearling male #736.

Fig. 9d. View north from tree den of yearling male #736.

Fig. 9e. View east from tree den of yearling male #736.

Fig. 9f. View south from tree den of yearling male #736.

Fig. 9g. View west from tree den of yearling male #736.

Fig. 10a. Radio-marked 2-1/2-year-old female #936.

Fig. 10b. Capture location, den site and seasonal and composite home range of 2-1/2-year-old female #936.

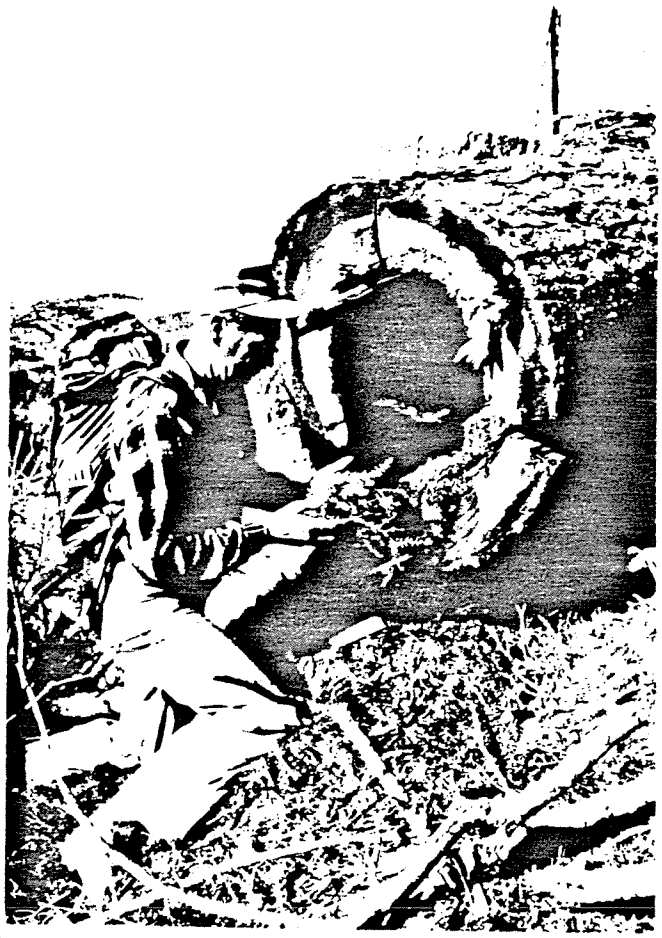


Fig. 10c. Initial and final den site of 2-1/2-year-old female #936.

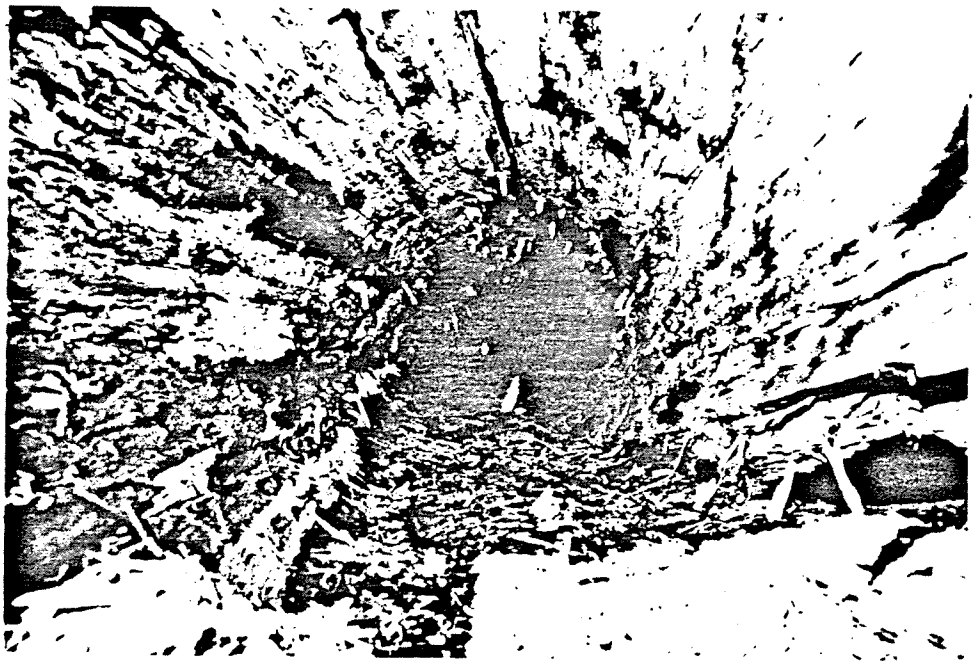


Fig. 10d. Interior of log den site of 2-1/2-year-old female #936.

Fig. 10e. View north from log den of 2-1/2-year-old female #936.

Fig. 10f. View east from log den of 2-1/2-year-old female #936.

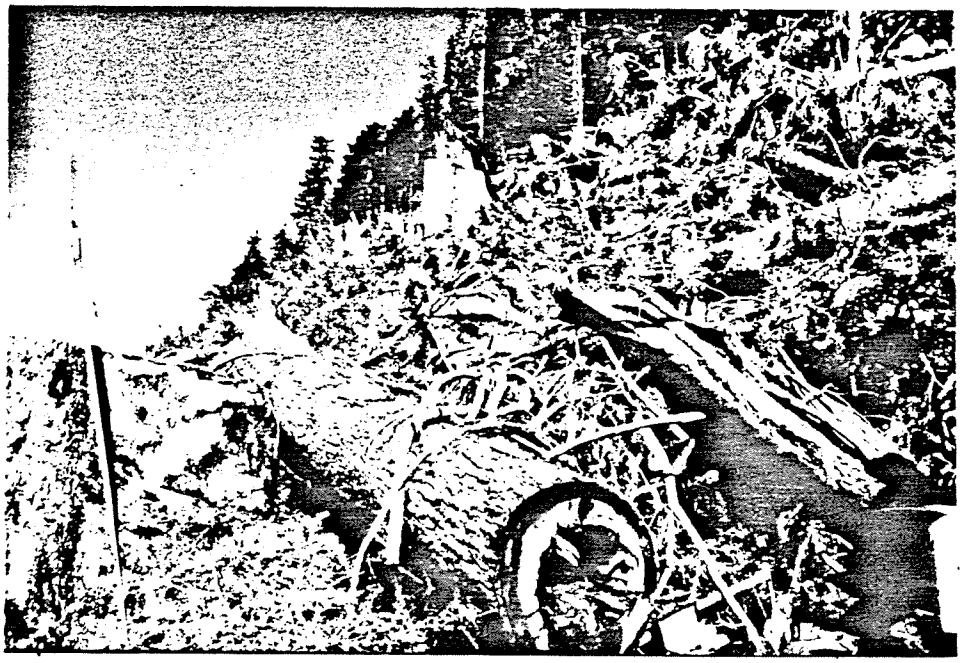


Fig. 10g. View south from log den site of 2-1/2-year-old female #936.

Fig. 10h. View west from log den site of 2-1/2-year-old female #936.

Fig. 10i. Secondary tree den of 2-1/2-year-old female #936, which was occupied after the bear was disturbed and deserted the initial den (Fig. 10c). Bear deserted this den when she was disturbed by the search for dens, and returned to the initial den.

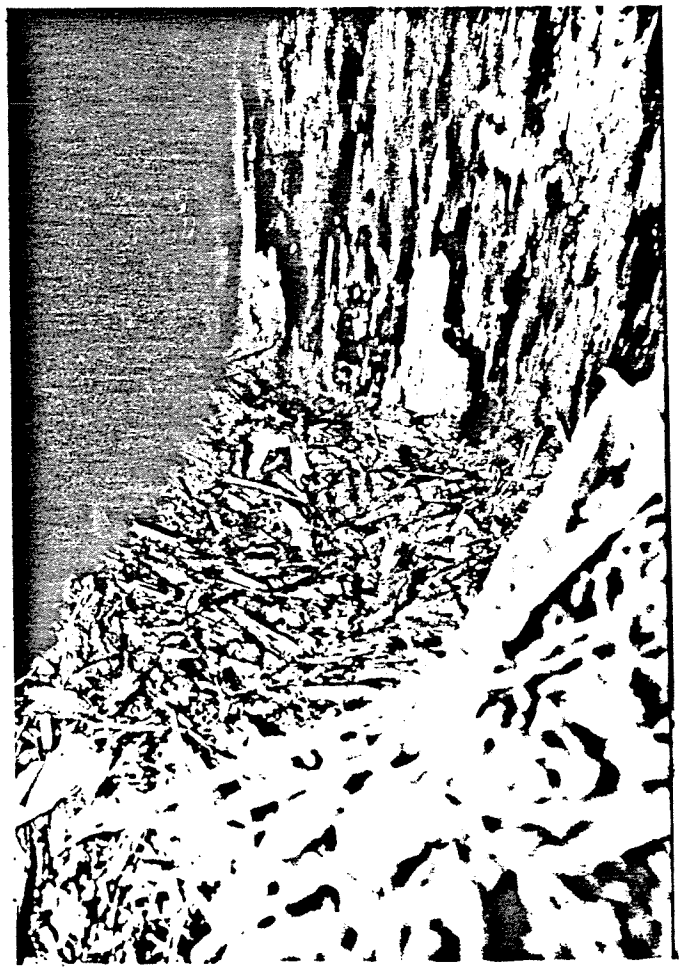


Fig. 10j. Interior of secondary tree den of 2-1/2-year-old female #936.

Fig. 10k. View north toward second tree den of 2-1/2-year-old female #936.

Fig. 10ℓ. View east from secondary tree den of 2-1/2-year-old female #936.

Fig. 10m. View south from secondary tree den of 2-1/2-year-old female #936.

Fig. 10n. View west from secondary tree den of 2-1/2-year-old female #936.

Fig. 11a. Radio-marked adult male #910.

Fig. 11b. Capture site, den site, and home range of adult male #910.

Fig. 11c. Den site of adult male #910.

Fig. 11d. Interior of tree den of adult male #910.

Fig. 11e. View north from tree den site of adult male #910.

Fig. 11f. View east from tree den site of adult male #910.

Fig. 11g. View south from tree den site of adult male #910.

Fig. 11h. View west from tree den site of adult male #910.

Fig. 11g. View south from tree den site of adult male #910.

Fig. 11h. View west from tree den site of adult male #910.

Fig. 12a. Radio-marked adult male #193.

Fig. 12b. Capture site and home range of adult male #193.

Fig. 13a. Radio-marked adult male #693.

Fig. 13b. Capture site and home range of adult male #693.

Fig. 14a. Radio-marked adult male #772.

Fig. 14b. Capture site and seasonal and composite home range of adult male #772.

Fig. 14c. Den site of adult male #772.

Fig. 14d. Adult male #772 in 1980 tree den.

Fig. 14e. View north from tree den of adult male #772.

Fig. 14f. View east from tree den of adult male #772.

Fig. 14g. View south from tree den of adult male #772.

Fig. 14h. View west from tree den of adult male #772.

Fig. 15a. Radio-marked adult male #786.

Fig. 15b. Capture site, den site, and seasonal and composite home range of adult male #786.

Fig. 15c. Tree den of adult male #786.

Fig. 15d. View north from tree den of adult male #786.

Fig. 15e. View east from tree den of adult male #786.

Fig. 15f. View south from tree den of adult male #786.

Fig. 15g. View west from tree den of adult male #786.

Fig. 16a. Radio-marked adult male #850.

Fig. 16b. Capture site, den site, and seasonal and composite home range of adult male #850.

Fig. 16c. Den site of adult male #850

Fig. 16d. Interior of log den of adult male #850.

Fig. 16e. View north from log den of adult male #850.

Fig. 16f. View east from log den of adult male #850.

Fig. 16g. View south from log den of adult male #850.

Fig. 16h. View west from log den of adult male #850.

Fig. 17. Radio-marked adult male #828. This bear was captured as a nuisance animal in the town of Petersburg, radio-marked, and released at the south end of Mitkof Island. The animal subsequently moved to the mainland and relocated in the vicinity of the Wrangell city dump.

Appendix 1

Required data forms, 1 through 17

Data Form No. 2

Den Characteristics

Date den entered Prior to 11/18/81 Date den observed 11/20/81 Observer and title A.W. Erickson Professor

Date den abandoned Approx. 5/2/82 Den number 960 B Location, Township and range SW¼, Sect 25 T59S, R80E

Map or aerial photo number 301 Width of opening 28" Height of opening 26"

Aspect NE Slope(%) 5° Elevation 50' Date of spring egress Approx. 5/2/82

Color slides: View to north (no.) 3j View to south (no.) 3ℓ

View to east (no.) 3k View to west (no.) 3m

View of den (no.) 3i

Black and white prints: View to north (no.) 3j View to south (no.) 3ℓ

View to east (no.) 3k View to west (no.) 3m

View of den (no.) 3i

Comments: Den located in a hollow log in an old clear cut adjacent to the Beach. The log lays slightly upslope with the den opening facing to the SE. Log 40' long and 90" in circumference. Log covered with moss and hemlock seedlings. Clear cut surrounding den now supporting a dense stand of spruce and hemlock 20 to 25' in heigh

Physical Data *

Date _____ Ear-tag no. (L) Metal 2325 (R) Plastic 54 Collar Number 960

Radio frequency _____ Sex _____ Age class _____ Body length _____

Height at shoulder _____ Body weight _____

Girth _____ Head length X width _____ X _____ Color anomalies _____

Blood sample no. _____ Hair sample no. _____

Condition (good, poor) _____ Pelage condition _____

Observers name _____ Title _____ Photo no. _____

Comments: * 1981 Den. See previous form for physical data on bear and for data on 1980 den.

BEAR DENNING STUDY

Appendix 1

Data Form No. 3

Den Characteristics

Date den entered 10/20/80* Date den observed 10/22/80 Observer and title A.W. Erickson Professor

Date den abandoned 3/19/81 Den number 936-A Location, Township and range T60S, R80E Sect, 27, SW

Map or aerial photo number 185 Width of opening 17½" Height of opening 19"

Aspect WSW Slope(%) 45% Elevation 1,035 Date of spring egress 3/19/81

Color slides: View to north (no.) 10e View to south (no.) 10g

View to east (no.) 10f View to west (no.) 10h

View of den (no.) 10c

Black and white prints: View to north (no.) 10e View to south (no.) 10g

View to east (no.) 10f View to west (no.) 10h

View of den (no.) 10c

Comments: Bear located in den 10/22/80. Denned at least since 10/20/80, possibly earlier. Den hollow log, lined with ferns and hemlock fronds. Bear disturbed on 3 occasions and redenned in a hollow hemlock tree base (see 2nd den report attache

Physical Data

Caputre Date 7/31/80 Ear-tag no. (L) Metal 2308 (R) Plastic 55 Collar Number 936

Radio frequency 165.936 mHz Sex F Age class 2½ Body length 45½"

Height at shoulder 29½" Body weight 105 pounds

Girth 30" Head length X width 10-5/8" X 6-3/8" Color anomalies None

Blood sample no. _____ Hair sample no. 934

Condition (good, poor) good Pelage condition excellent

Observers name A.W. Erickson Title Professor Photo no. 10a

Comments: Immature female. Teats indicate that she has not given birth to cubs

Capture location: T60S, R80E, Section 27, NE¼

BEAR DENNING STUDY

Appendix 1

Data Form No. 4

Den Characteristics

Date den entered 11/2/80 Date den observed 1/21/81 Observer and title A.W. Erickson Professor

Date den abandoned 1/21/81 *Den number 936-B Location, Township and range SW¼, Sect. 27 T60S, R80E

Map or aerial photo number 185 Width of opening 11" Height of opening 3'

Aspect WSW Slope(%) 55 Elevation 800 Date of spring egress See Comment

Color slides: View to north (no.) 10h View to south (no.) 10m

View to east (no.) 10ℓ View to west (no.) 10n

View of den (no.) 10i

Black and white prints: View to north (no.) 10k View to south (no.) 10m

View to east (no.) 10ℓ View to west (no.) 10n

View of den (no.) 10i

Comments: *This den entered when bear deserted its first Den when disturbed. It subsequently returned to its first Den when disturbed on 1/21/81. This den in the base of a standing hemlock, 50' upslope from a clear cut. No Den material in Den.

Physical Data *

Date _____ Ear-tag no. (L) Metal 2308 (R) Plastic 55 Collar Number 936

Radio frequency _____ Sex _____ Age class _____ Body length _____

Height at shoulder _____ Body weight _____

Girth _____ Head length X width _____ X _____ Color anomalies _____

Blood sample no. _____ Hair sample no. _____

Condition (good, poor) _____ Pelage condition _____

Observers name _____ Title _____ Photo no. _____

Comments: *See data form for bear's first Den.

BEAR DENNING STUDY

Appendix 1

Data Form No. 5

Den Characteristics

Date den entered 11/18/80 Approx. Date den observed 11/18/80 Observer and title A.W. Erickson Professor

Date den abandoned 3/20/81 Den number 850 Location, Township and range 60S, 80E, Sect. 4, SE¼

Map or aerial photo number 208 Width of opening 37½" Height of opening 30"

Aspect WSW Slope(%) 30° Elevation 150' Date of spring egress 3/20/81

Color slides: View to north (no.) 16e View to south (no.) 10g

View to east (no.) 16f View to west (no.) 10h

View of den (no.) 16c

Black and white prints: View to north (no.) 16e View to south (no.) 16g

View to east (no.) 16f View to west (no.) 16h

View of den (no.) 16c

Comments: Bear denned in a large hollow log located in a clear cut. Some moss and ferns lining den. Bear left den when disturbed upon discovery of the den and once when the den was examined.

Physical Data

Date 8/1/80 Ear-tag no. (L) Metal 2309 (R) Plastic 56 Collar Number 850

Radio frequency 164.850 mHz Sex M Age class Adult Body length 55½"

Height at shoulder 33-1/8" Body weight 182 lbs.

Girth 37½" Head length X width 11-3/8" X 8-3/8" Color anomalies _____

Blood sample no. _____ Hair sample no. 850

Condition (good, poor) fat Pelage condition excellent

Observers name A.W. Erickson Title Professor Photo no. 16a

Comments: Capture location: T60S, R80E, Sect 4, NW¼

BEAR DENNING STUDY

Appendix 1

Data Form No. 6

Den Characteristics

Date den entered 10/23/80 Date den observed 11/23/80 Observer and title A.W. Erickson Professor

Date den abandoned 4/17/81 Den number 885 Location, Township and range T60S, R80E, Sect. 9, SW¼

Map or aerial photo number 208 Width of opening 9½" Height of opening 20"

Aspect SW Slope(%) 40% Elevation 750' Date of spring egress 4/17/81

Color slides: View to north (no.) 8e View to south (no.) 8g

View to east (no.) 8f View to west (no.) 8h

View of den (no.) 8d

Black and white prints: View to north (no.) 8e View to south (no.) 8g

View to east (no.) 8f View to west (no.) 8h

View of den (no.) 8d

Comments: Bear denned in a hollow hemlock tree base. Several entrances. Den lined with ferns and moss.

Physical Data

Capture Date 8/1/80 Ear-tag no. (L) Metal 2310 (R) Plastic 57 Collar Number 885

Radio frequency 164.885 mHz Sex M Age class 1½ yrs Body length 39½"

Height at shoulder 24½" Body weight 63 lbs.

Girth 23½" Head length X width 9-1/8" X 6-1/8" Color anomalies Large white chest patch

Blood sample no. ____ Hair sample no. 885

Condition (good, poor) excell. Pelage condition excellent

Observers name A.W. Erickson Title Professon Photo no. 8b

Comments: Yearling male

Capture location: T60S, R80E, Sect. 4, SE¼

BEAR DENNING STUDY

Appendix 1

Data Form No. 7

Den Characteristics

Date den entered 11/24/80 Date den observed 11/24/80 Observer and title A.W. Erickson Professor

Date den abandoned Approx. 3/15/81 Den number 910 Location, Township and range T61S, R82E Sect. 15, SW¼

Map or aerial photo number 123 Width of opening 13½" Height of opening 14½"

Aspect NW Slope(%) 50° Elevation 1275' Date of spring egress approx. 3/15/81

Color slides: View to north (no.) 11e View to south (no.) 11g

View to east (no.) 11f View to west (no.) 11h

View of den (no.) 11c

Black and white prints: View to north (no.) 11e View to south (no.) 11g

View to east (no.) 11f View to west (no.) 11h

View of den (no.) 11c

Comments: Bear denned in base of a mt. hemlock tree located on a shale slope. Den lined with moss and ferns. Bear deserted den when discovered and once when checked.

Physical Data

Date 8/1/80 Ear-tag no. (L) Metal 2311 (R) Plastic 58 Collar Number 910

Radio frequency 164.910 mHz Sex M Age class Adult Body length 55-3/4"

Height at shoulder 33¼" Body weight 178

Girth 37½" Head length X width 12½" X 8-1/8" Color anomalies Large white chest patch

Blood sample no. ____ Hair sample no. 910

Condition (good, poor) excell. Pelage condition excellent

Observers name A.W. Erickson Title Professor Photo no. 11a

Comments: Capture location: T60S, R80E, Sect. 15, NW¼

BEAR DENNING STUDY

Appendix 1

Data Form No. 8

Den Characteristics

Date den entered approx. 11/24/80 Date den observed 12/18/80 Observer and title A.W. Erickson Professor

Date den abandoned Post 3/23/81 Den number 772 Location, Township and range T59S, R80E Sect. 8, NW¼

Map or aerial photo number 194 Width of opening 11" Height of opening 33"

Aspect NE Slope(%) 20% Elevation 1500' Date of spring egress 3/23/81

Color slides: View to north (no.) 14e View to south (no.) 14g

View to east (no.) 14f View to west (no.) 14h

View of den (no.) 14c

Black and white prints: View to north (no.) 14e View to south (no.) 14g

View to east (no.) 14f View to west (no.) 14h

View of den (no.) 14c

Comments: Bear denned 13' up in the bole of a hollow hemlock tree

Physical Data

Capture Date 8/3/80 Ear-tag no. (L) Metal 2312 (R) Plastic 59 Collar Number 772

Radio frequency 164.772 mHz Sex M Age class Young adult Body length 53½"

Height at shoulder 33-1/8" Body weight 156 lbs.

Girth 34" Head length X width 12-3/4" X 7½" Color anomalies sparse light chest patch

Blood sample no. n Hair sample no. 765

Condition (good, poor) excell. Pelage condition excellent

Observers name A.W. Erickson Title Professor Photo no. 14a

Comments: Capture location: T60S, R80E, Sect. 7, NW¼

BEAR DENNING STUDY

Appendix 1

Data Form No. 9

Den Characteristics *

Date den entered Approx. 12/1/81 Date den observed 6/10/82 Observer and title Brad Hanson Grad student

Date den abandoned Approx 5/2/82 Den number 786 Location, Township and range SW¼, Sect. 3 T60S, R80E

Map or aerial photo number 208 Width of opening 12" Height of opening 19"

Aspect SW Slope(%) 50° Elevation 1100 Date of spring egress Approx 5/2/82

Color slides: View to north (no.) 15d View to south (no.) 15f

View to east (no.) 15e View to west (no.) 15g

View of den (no.) 15c

Black and white prints: View to north (no.) 15d View to south (no.) 15f

View to east (no.) 15e View to west (no.) 15g

View of den (no.) 15c

Comments: During winter of 1981 bear denned on slope opposite state fish hatchery, but den not located. The location of the Den indicated that it was in a tree. The 1982 Den (above) was located in the base of a large (9'10" circumference) hemlock, minor Den linings with Hemlock fronds.

Physical Data

Capture Date 8/3/80 Ear-tag no. Metal (L) 2315 Plastic (R) 61 Collar Number 786

Radio frequency 164.786 mHz Sex M Age class medium adult Body length 49-3/4"

Height at shoulder 30-5/8" Body weight 142 lbs.

Girth 33¼" Head length X width 12" X 7½" Color anomalies 4" x 2" chest patch with 1" spot above patch

Blood sample no. _____ Hair sample no. 786

Condition (good, poor) excell. Pelage condition excellent

Observers name A.W. Erickson Title Professor Photo no. 15a

Comments: Capture location: T60S, R79E, Section 12, NW¼

BEAR DENNING STUDY

Appendix 1

Data Form No. 10

Den Characteristics

Date den entered Approx. 10/21/81 Date den observed 10/23/81 Observer and title A.W. Erickson Professor

Date den abandoned Approx. 4/28/82 Den number 736 Location, Township and range NW¼, Sect. 16 T60S, R80E

Map or aerial photo number 208 Width of opening Approx. 10" Height of opening Long slit in trunk

Aspect NW Slope(%) 20° Elevation 600 Date of spring egress Approx. 4/28/81

Color slides: View to north (no.) 9d View to south (no.) 9f

View to east (no.) 9e View to west (no.) 9g

View of den (no.) 9c

Black and white prints: View to north (no.) 9d View to south (no.) 9f

View to east (no.) 9e View to west (no.) 9g

View of den (no.) 9c

Comments: Den located in hollow standing Hemlock. Entrance approximately 18' above the ground. Tracks of bear in snow at the base of the tree. Basal diameter of tree 47".

Physical Data

Date 8/6/81 Ear-tag no. (L) Metal 2320 (R) Plastic 52 Collar Number 736

Radio frequency 164.736 mHz Sex M Age class 2½ Body length 46"

Height at shoulder 29-3/4" Body weight 125 lbs.

Girth 30" Head length X width 11½" X 6-3/4" Color anomalies None

Blood sample no. _____ Hair sample no. _____

Condition (good, poor) good Pelage condition excellent

Observers name A.W. Erickson Title Professor Photo no. 9a

Comments: Capture location: NW¼, Sect. 9, T60S, R80E

BEAR DENNING STUDY

Appendix 1

Data Form No. 11

Den Characteristics

Date den entered Prior to 11/18/81 Approx. Date den observed 11/21/81 Observer and title A.W. Erickson Professor

Date den abandoned 5/2/82 Den number 152 Location, Township and range NE¼, Sect. 32 T59S, R80E

Map or aerial photo number 188 Width of opening Est. 12" Height of opening Est. 20"

Aspect NW Slope(%) 30° Elevation 1400 Date of spring egress Approx.

Color slides: View to north (no.) 4d View to south (no.) 4f

View to east (no.) 4e View to west (no.) 4g

View of den (no.) 4c

Black and white prints: View to north (no.) 4d View to south (no.) 4f

View to east (no.) 4e View to west (no.) 4g

View of den (no.) 4c

Comments: Bear Denned in a large Hemlock approximately 25' above ground. Poked head out of opening. Den on a moderate slope in a mature stand of Hemlock and Spruce.

Physical Data

Date 8/7/81 Ear-tag no. (L) Plastic 63 (R) Metal 2322 Collar Number 152

Radio frequency 164.152 mHz Sex F Age class Adult Body length 53½"

Height at shoulder 32" Body weight 145 lbs.

Girth 32" Head length X width 11¼" X 7-3/8" Color anomalies none

Blood sample no. _____ Hair sample no. _____

Condition (good, poor) good Pelage condition excellent

Observers name A.W. Erickson Title Professor Photo no. 4a

Comments: Capture location: T60S, R80E, Sect. 5, SW¼

BEAR DENNING STUDY

Appendix 1

Data Form No. 12

Den Characteristics

Date den entered Approx. 10/20/81 Date den observed 10/24/81 Observer and title A.W. Erickson Professor

Date den abandoned Approx 5/2/82 Den number 071 Location, Township and range NW¼, Sect. 4 T60S, R80E

Map or aerial photo number 188 Width of opening 19½" Height of opening 17¼"

Aspect NE Slope(%) 5° Elevation 300' Date of spring egress Approx. 5/2/82

Color slides: View to north (no.) 7d View to south (no.) 7f

View to east (no.) 7e View to west (no.) 7g

View of den (no.) 7c

Black and white prints: View to north (no.) 7d View to south (no.) 7f

View to east (no.) 7e View to west (no.) 7g

View of den (no.) 7c

Comments: Den in clear cut. Den opening facing west. Dense clump of spruce in front of den. Den in a hollow log, 27" DBH.

Physical Data*

Date 8/7/81 Plastic #64 Ear-tag no. (L) Metal 2317 (R) Metal 2318 Collar Number 071

Radio frequency 164.071 mHz Sex F Age class 1½ Body length 39½"

Height at shoulder 21-3/4" Body weight 66lbs.

Girth 25-3/4" Head length X width 9½" X 5-5/8" Color anomalies None

Blood sample no. ____ Hair sample no. ____

Condition (good, poor) good Pelage condition excellent

Observers name A.W. Erickson Title Professor Photo no. 7a

Comments: Yearling cub of female 960 - Marked in winter Den

Capture locations: 3/21/81 - T59S, R80E, Sect. 23, NE¼

8/7/81 - T60S, R80E, Sect. 5, SE¼

BEAR DENNING STUDY

Appendix 1

Data Form No. 13

Den Characteristics

Date den entered 11/16/81 Approx. Date den observed 11/17/81 Observer and title A.W. Erickson Professor

Date den abandoned 5/2/82 Den number 811 Location, Township and range NE¼, Sect. 26 T60S, R80E.

Map or aerial photo number 185 Width of opening 26" Height of opening 33"

Aspect NW Slope(%) 15° Elevation 600' Date of spring egress 5/2/82 Approx.

Color slides: View to north (no.) 6e View to south (no.) 6g

View to east (no.) 6f View to west (no.) 6h

View of den (no.) 6c

Black and white prints: View to north (no.) 6e View to south (no.) 6g

View to east (no.) 6f View to west (no.) 6h

View of den (no.) 6c

Comments: Den located in a recent clear cut. Den in a 31' hollow log, open only at lower end. Butt 45" DBH. Den 15'6" in from opening. Den lined with grass and ferns.

Physical Data

Date 8/7/81 Ear-tag no. (L) Metal 2323 (R) Plastic 65 Collar Number 811

Radio frequency 164.811 Sex F Age class Adult Body length 50½"

Height at shoulder 30-3/4" Body weight 150 lbs.

Girth 36" Head length X width 12" X 7-3/4" Color anomalies None

Blood sample no. _____ Hair sample no. _____

Condition (good, poor) good Pelage condition excellent

Observers name A.W. Erickson Title Professor Photo no. 6a

Comments: Has had cubs previously. Capture location: T60S, R80E, Sect 27, NE¼

BEAR DENNING STUDY

Appendix 1
Data Form No. 14

Den Characteristics

Date den entered _____ Date den observed _____ Observer and title _____

Date den abandoned _____ Den number ____ Location, Township and range _____

Map or aerial photo number _____ Width of opening _____ Height of opening _____

Aspect _____ Slope(%) _____ Elevation _____ Date of spring egress _____

Color slides: View to north (no.) _____ View to south (no.) _____

View to east (no.) _____ View to west (no.) _____

View of den (no.) _____

Black and white prints: View to north (no.) _____ View to south (no.) _____

View to east (no.) _____ View to west (no.) _____

View of den (no.) _____

Comments: Moved mainland -- den not searched for.

Physical Data

Capture Date 8/3/80 Ear-tag no. Metal (L) 2314 Plastic (R) 60 Collar Number 828

Radio frequency 164.828 mHz Sex M Age class Adult Body length 65"

Height at shoulder 37-7/8" Body weight 286 lbs.

Girth 43½" Head length X width 14-3/8" X 9-3/4" Color anomalies two separated chest spots

Blood sample no. _____ Hair sample no. 828

Condition (good, poor) excell. Pelage condition excellent

Observers name A.W.Erickson Title Professor Photo no. 16a

Comments: Captured as a nuisance animal by Butch Young. Transported and released at the end of the road at south end of island at Pt. Balquiore

Capture location: Magill's trailer court

BEAR DENNING STUDY

Appendix 1

Data Form No. 15

Den Characteristics

A.W. Erickson

Date den entered _____ Date den observed _____ Observer and title Professor

Date den abandoned _____ Den number _____ Location, Township and range _____

Map or aerial photo number _____ Width of opening _____ Height of opening _____

Aspect _____ Slope(%) _____ Elevation _____ Date of spring egress _____

Color slides: View to north (no.) _____ View to south (no.) _____

View to east (no.) _____ View to west (no.) _____

View of den (no.) _____

Black and white prints: View to north (no.) _____ View to south (no.) _____

View to east (no.) _____ View to west (no.) _____

View of den (no.) _____

Comments: Den not located

Physical Data

Date 8/5/81 Ear-tag no. (L) Plastic 51 (R) Metal 2319 Collar Number 193

Radio frequency 164.193 mHz Sex M Age class Adult Body length 60-3/4"

Height at shoulder 36½ Body weight 218 lbs.

Girth 41-3/4" Head length X width 13¼" X 7½" Color anomalies None

Blood sample no. r Hair sample no. 193

Condition (good, poor) good Pelage condition good

Observers name A.W. Erickson Title Professor Photo no. 12a

Comments: Capture location: T60S, R80E, Sect. 5, SE¼, .5 miles up the north spur of Falls Creek Road.

Den Characteristics

Date den entered _____ Date den observed _____ Observer and title _____

Date den abandoned _____ Den number _____ Location, Township and range _____

Map or aerial photo number _____ Width of opening _____ Height of opening _____

Aspect _____ Slope(%) _____ Elevation _____ Date of spring egress _____

Color slides: View to north (no.) _____ View to south (no.) _____

View to east (no.) _____ View to west (no.) _____

View of den (no.) _____

Black and white prints: View to north (no.) _____ View to south (no.) _____

View to east (no.) _____ View to west (no.) _____

View of den (no.) _____

Comments: _____

Physical Data

Date 8/6/81 Ear-tag no. (L) Plastic 62 (R) Metal 2321 Collar Number 693

Radio frequency 164.693 mHz Sex M Age class Adult Body length 61"

Height at shoulder 42" Body weight 230 lbs.

Girth 43¼" Head length X width 14½" X 8-3/4" Color anomalies None

Blood sample no. _____ Hair sample no. _____

Condition (good, poor) good Pelage condition excellent

Observers name A.W. Erickson Title Professor Photo no. 13a

Comments: Capture Location: SE¼, Sect. 4, T60S, R80E.

BEAR DENNING STUDY

Appendix 1

Data Form No. 17

Den Characteristics *

Date den entered _____ Date den observed _____ Observer and title _____

Date den abandoned _____ Den number ____ Location, Township and range _____

Map or aerial photo number _____ Width of opening _____ Height of opening _____

Aspect _____ Slope(%) _____ Elevation _____ Date of spring egress _____

Color slides: View to north (no.) _____ View to south (no.) _____

View to east (no.) _____ View to west (no.) _____

View of den (no.) _____

Black and white prints: View to north (no.) _____ View to south (no.) _____

View to east (no.) _____ View to west (no.) _____

View of den (no.) _____

Comments: Bear's den not located

Physical Data

Date 8/10/81 Ear-tag no. (L) Plastic 67 (R) Metal 2453 Collar Number 91

Radio frequency 164.091 Sex F Age class Adult Body length 55½"

Height at shoulder 32¼" Body weight 162 lbs.

Girth 35-3/8" Head length X width 12½" X 7¼" Color anomalies None

Blood sample no. _____ Hair sample no. _____

Condition (good, poor) good Pelage condition excellent

Observers name A.W. Erickson Title Professor Photo no. 4a

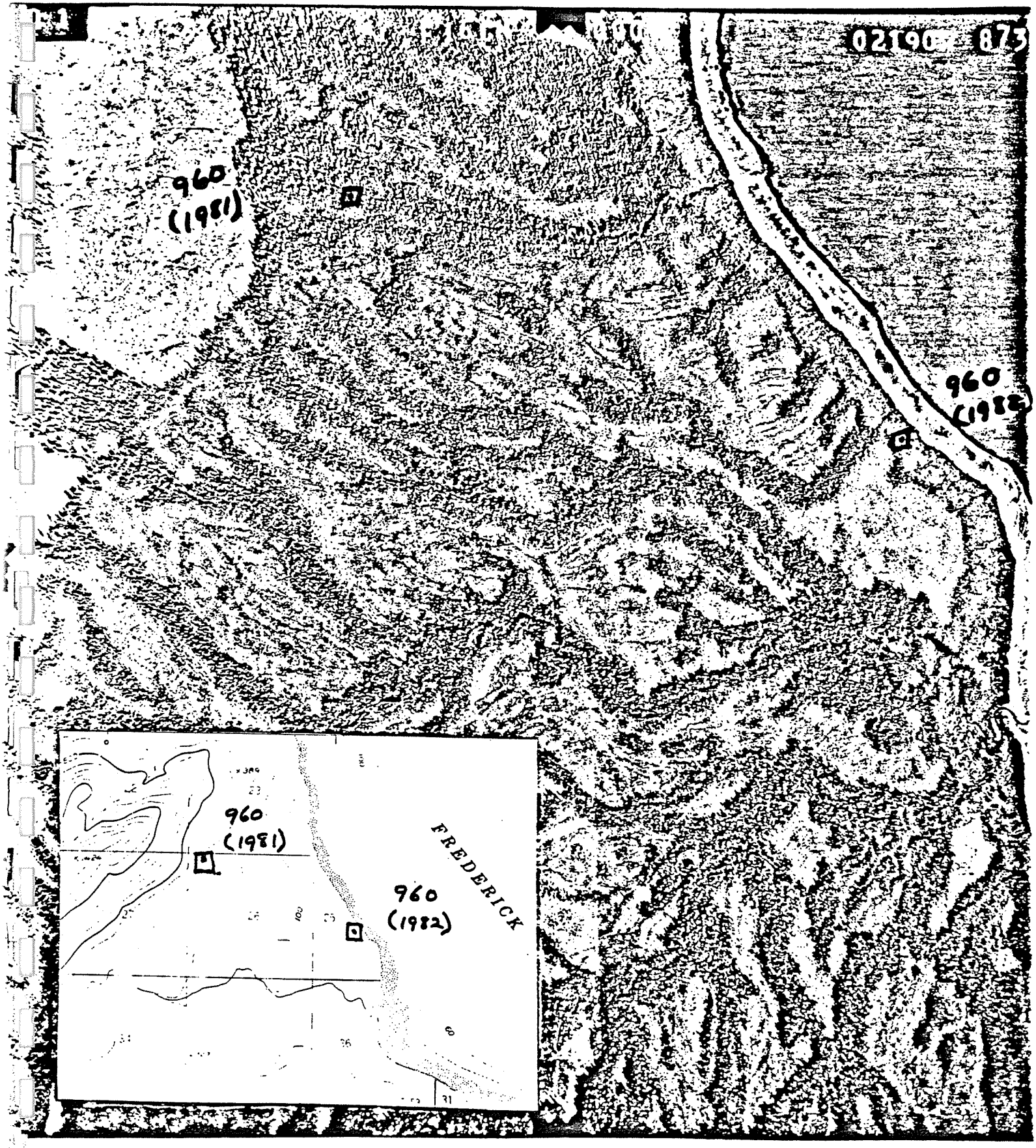
Comments: Location: T60S, R79E, Sect. 12, NW¼

Appendix 2

Study area habitat map
(separate attachment)

Appendix 3

Map sections and aerial photographs identifying exact den sites geographically and within habitat types, 1-6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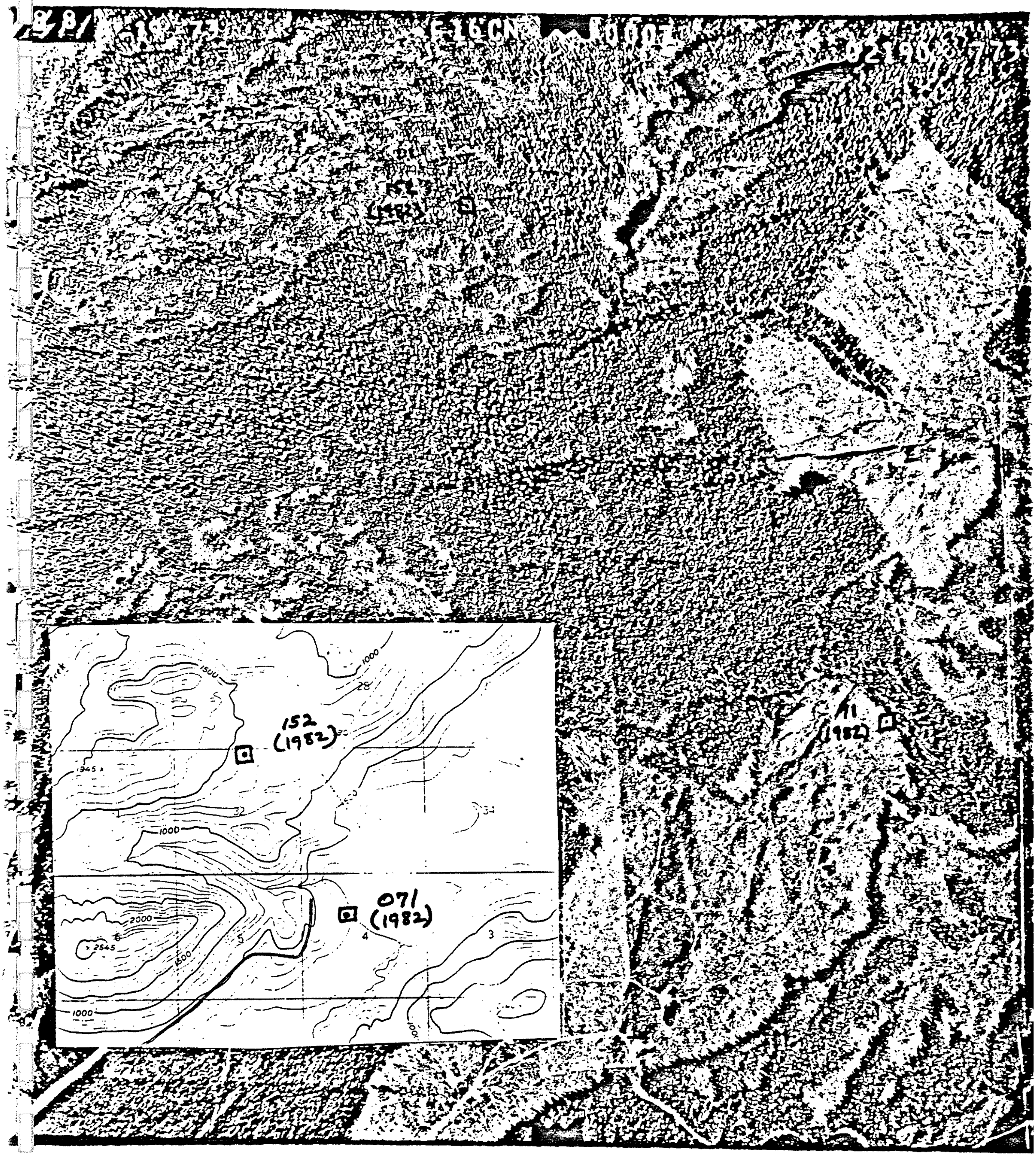
960
(1982)
FREDERICK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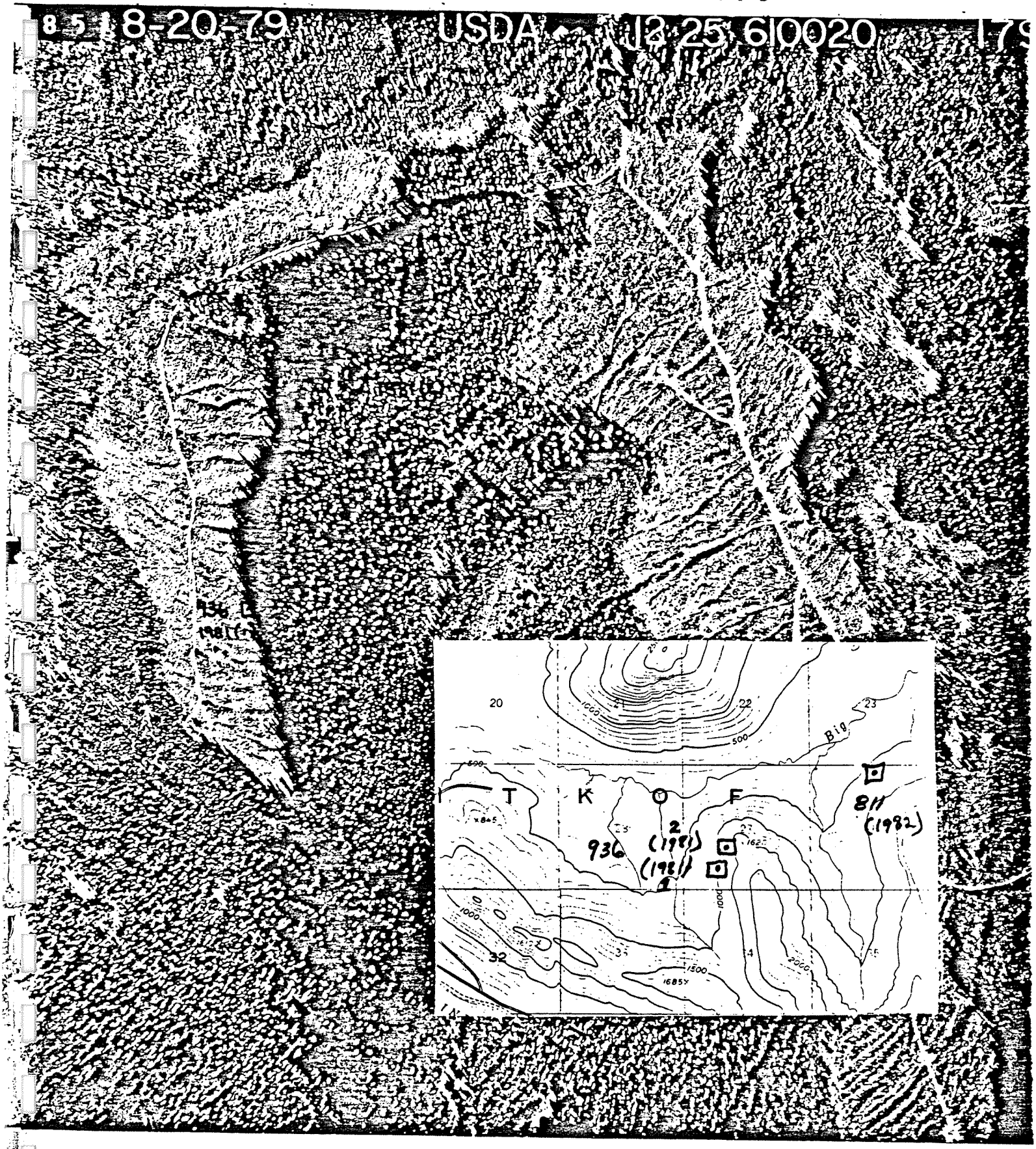
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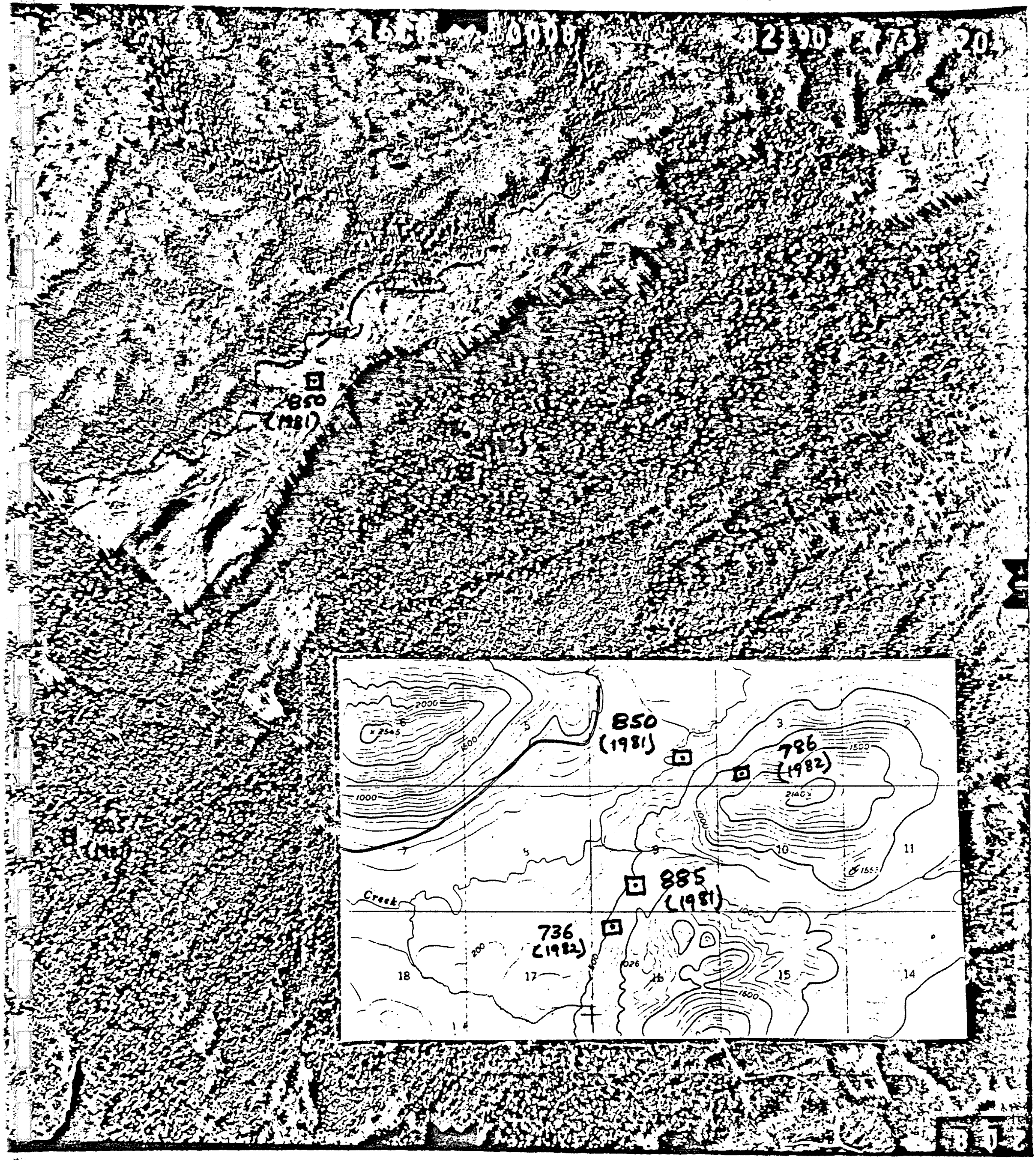
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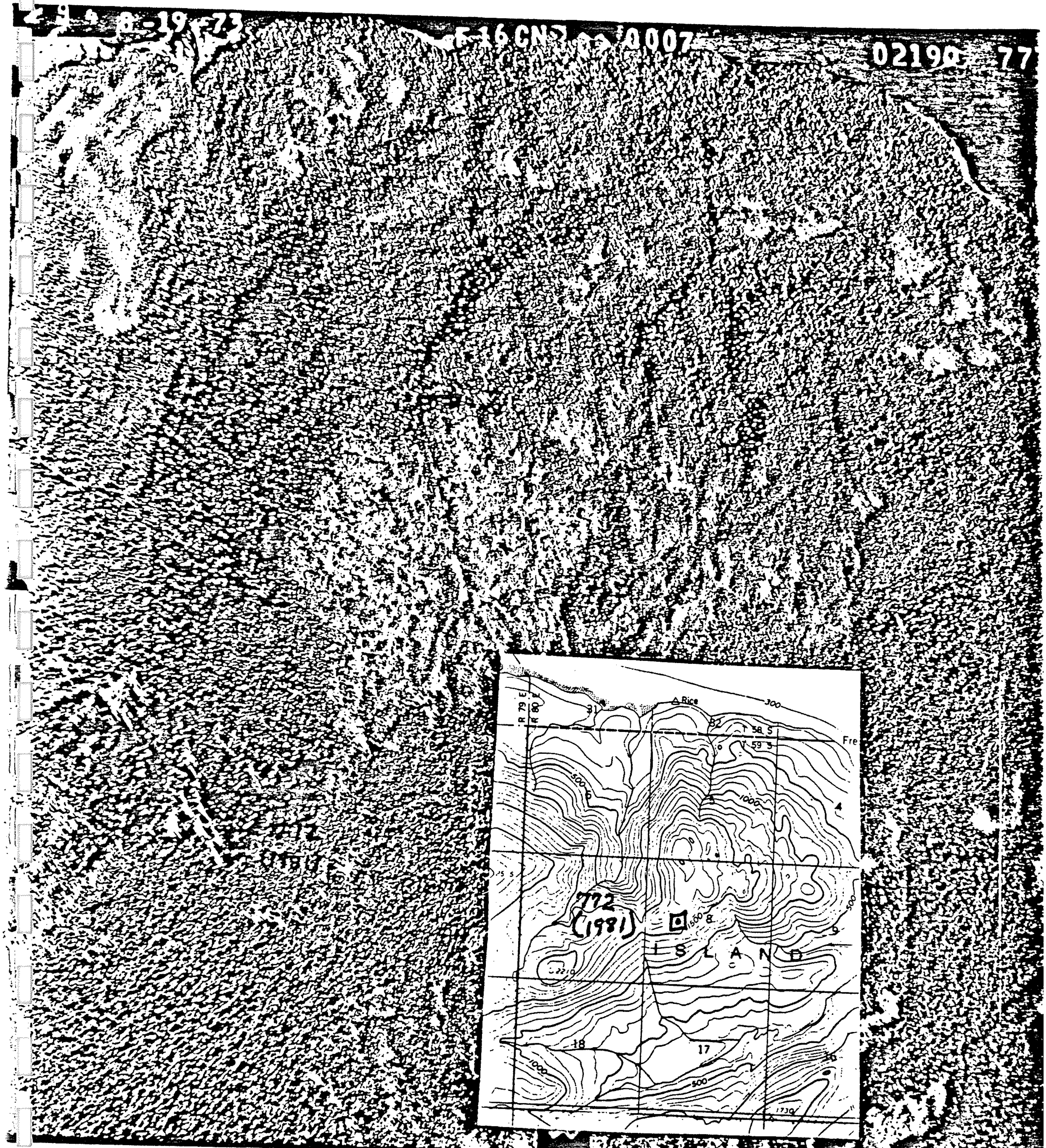
(1981)
786
(1982)
885
(1981)
736
(1982)
Creek
2000
1500
1000
1600
200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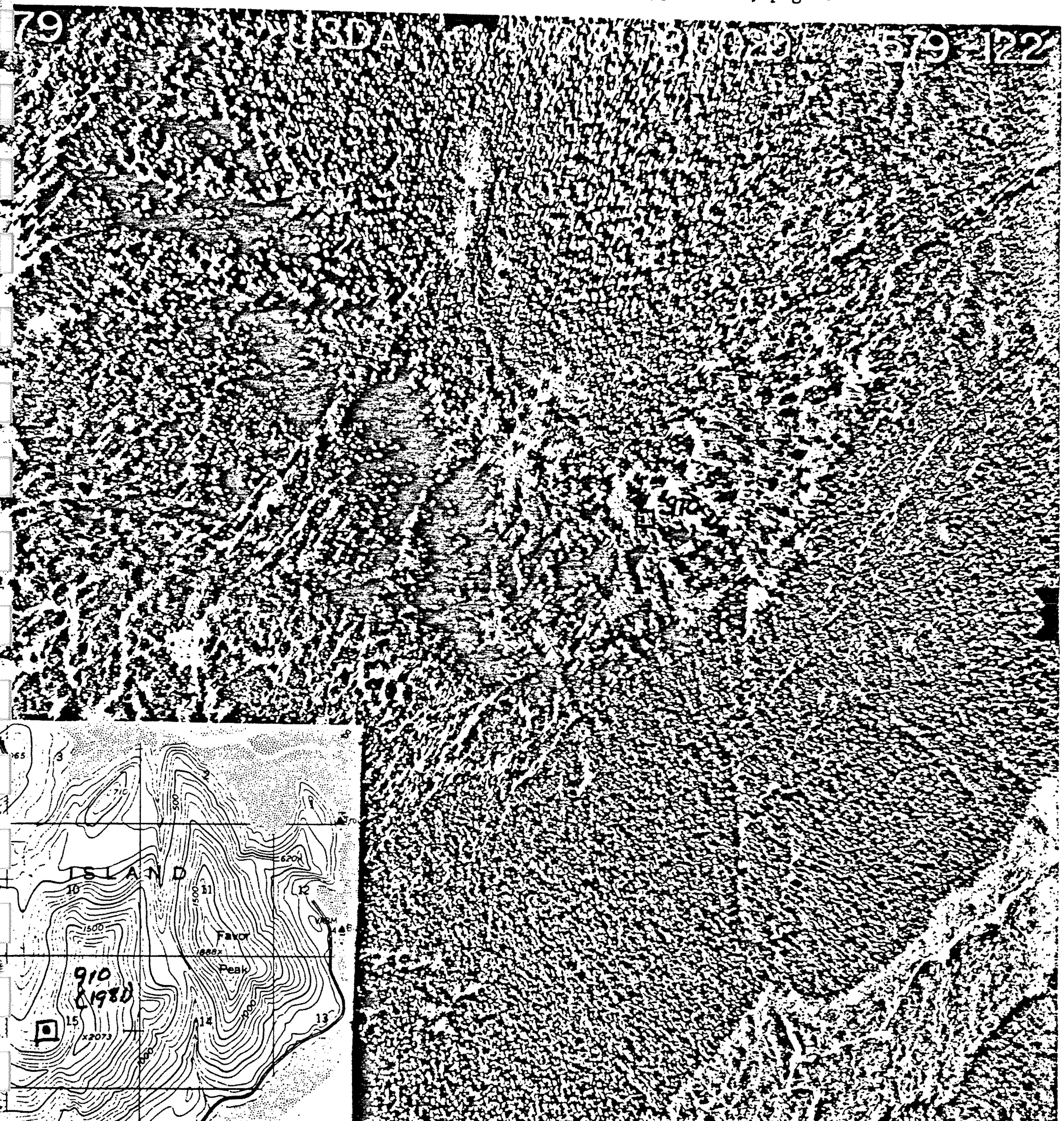
772
(1981)
Rice
ISLAND
R 79 E
R 80 E
T 58 S
T 59 S
300
500
1000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ISLAND
Favor
Peak
1888x
x2073
910
1980

Appendix 4

35mm photographs of captured bears, home ranges, dens, and den habitat surroundings. Photographs correspond to report Figures 3 through 17 (separate attachment).