THE ALASKA DEPARTMENT OF FISH AND GAME,

THE NATIONAL PARK SERVICE,

AND THE

UNITED STATES FISH AND WILDLIFE SERVICE

DENSITY AND STRUCTURE OF A HUNTED POPULATION OF BROWN BEARS AT BLACK LAKE, ALASKA:

A COOPERATIVE INTERAGENCY STUDY

FIRST ANNUAL PROGRESS REPORT COVERING PERIOD FROM

JULY 1987 to DECEMBER 1988

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SUMMARY

This report summarizes the results of the first year of a proposed 10 year cooperative interagency study of brown bears (Ursus arctos) at Black Lake on the Alaska Peninsula. Six subprojects have been outlined as part of these studies: 1. Estimating brown bear density, 2. Monitoring radio-marked bears to estimate reproductive rates and movements, 3. Conducting and evaluating aerial stream survey, 4. Monitoring and analyzing harvests, 5. Further analyzing data from earlier studies, and 6. Analyzing new data and writing reports. The density estimation subproject is the primary objective of the first 2 years of this study. Activities necessary to conduct the density estimate in spring 1989 was the focus of work accomplished during this reporting period.

During early June, 59 brown bears were captured using Telezol. Two of 12 radio-collared female adults and 0 of 4 male adults died of natural causes during the course of study. One unmarked bear, presumed to be an adult female, died of natural causes. It is possible, based on these early data, that natural mortality rates in adults may be relatively high in this study area compared to elsewhere in Alaska. Five of 8 cubs-of-the-year (COY) disappeared from litters during June through October. Natural mortality of yearlings was 2 out of 10 in this period.

Radio transmitters were placed on 39 bears, and they were relocated 313 times thru early December for a total of 352 point locations counting initial capture location.

Four replicate aerial surveys of bears in the Black/Chignik Lakes area were completed between 8-10 August 1988. The average number of bears seen per survey (171, SD = 26) and bears seen per hour of survey (51) were similar to results since 1982. These recent results are significantly higher than counts from the 1960s and 1970s. Initial evaluation of the technique suggests sightability is less than 50%, but insufficient data are available to detect sightability biases in any particular sex/age group.

INTRODUCTION

Effective bear management depends on good information on bear population status, trends, and harvests. This is true in harvested as well as in unharvested populations. On the Alaska Peninsula, as elsewhere, accurate information on population size and trend is seldom available because of the expense and technical difficulties in obtaining it. The lack of direct information has forced managers to rely largely on indirect indices derived from numbers, location, and sex/age composition of harvested bears, and stream surveys of uncertain utility and precision to indicate population status and trend. Many studies have suggested that harvest statistics can frequently be inadequate indicators of status and trend (Harris 1984 and 1986; Bunnell and Tait 1980 and 1981; Caughley 1977, Miller and Miller 1989, Miller 1989, Miller in press). They are especially unreliable in detecting changes due to factors other than harvest.

Bear populations are susceptible to overexploitation due to their low reproductive rates, low densities, and strong hunter demand. Because of poor ability to detect trends through direct measurements, managers have been generally conservative in their management of bear harvests. However, even with conservative harvest guidelines it is possible that bear populations in some areas are overexploited. Where bear populations are heavily harvested, accurate population information is essential to understand and regulate the effects of harvest. The broad objective of this study is to develop an information base for a brown bear population which can be used as a baseline from which to measure future changes and which will permit evaluation of changes which have occurred in the past. Capture-recapture techniques have successfully been used to document changes in density caused by hunting in Alaska (Miller in press).

Development on the Alaska Peninsula is increasing with proposals for oil and gas development, increased commercial fishing, recreational facility development, and increased settlement and human presence in formerly remote areas. These developments are thought likely to adversely affect populations of brown bears. Similar developments have contributed to the reduction of grizzly bears to remnant levels in the lower 48 states. Baseline information on the density, composition, movements, habitat use, and reproductive rates need to be collected in a systematic, repeatable way so that changes resulting from human activities can be identified. When changes are documented, corrective measures can be implemented and guidelines for avoiding similar effects in other areas can be developed.

Information is needed for several areas on the Alaska Peninsula because of differences in harvest and developmental patterns, and because productivity of bear populations in different areas may vary. Also, by comparing

areas with different levels of human impact, insights on the potential effects of changes in human impacts can be gained. Because data on bear populations are expensive to obtain, pooling of resources of several agencies into one study area at a time will be more effective than several inadequately-funded studies. Selection of study areas needs to be approached systematically, concentrating first on areas where the information gained will be most informative and useful.

STUDY AREA

The Black Lake study area is located about midway down the Alaskan Peninsula in south-western Alaska (Fig. 1). The area was described by Erickson and Siniff (1963) and Glenn and Miller (1980). The Black Lake area has been selected for Phase 1 of this study because:

1. It is representative of areas that have been subjected to moderately heavy harvests for a number of years. Harvest data dating back to 1961 show some variation in harvest intensity, with initially low harvest followed by very high harvest during the early 1970's, significantly lower exploitation rates in the mid to late 1970's and relatively moderate but increasing rates in the 1980's. The population has most likely responded to these harvests. Also these harvests have produced an adequate base of data to permit comparison with data on the living population obtained from captured animals in this study.

2. From 1970-75 intensive marking studies provided data on population composition, reproductive rates, morphometrics, exploitation rates and, less precisely, on population density (Glenn et al. 1976, Glenn and Miller 1980, Glenn 1980, Miller and Ballard 1982, Modafferi 1984). A large body of raw data, especially dealing with exploitation rates of marked bears and population composition, remains incompletely analyzed (see Modafferi 1984). This baseline data will provide valuable comparisons with data obtained in this study and will provide a better understanding of population trend and response to harvest in the intervening years. Comparable baseline data are not available from any other portion of the Alaska Peninsula.

3. Stream survey techniques were tested in the Black Lake area in 1962 (Erickson and Siniff 1963). Variables and problems with these techniques were identified and recommendations for standardization have been followed since that time in stream surveys conducted intermittently during the 1960's and early 1970's and annually since 1982. Changes in total number of bears seen, number of bears seen per hour and

the population composition have been noted and possible explanations offered (Sellers and McNay 1984, Sellers 1986). If stream surveys are to be used as a routine bear population trend indicator, it is important that potential biases in the data are identified (Barnes 1986).

4. The Black Lake area is ecologically comparable in many ways with a largely unexploited population of bears in Katmai National Monument. In Katmai, studies to compare the hunted Black Lake population with the unhunted Katmai population are under consideration as Phase 2 of Alaska Peninsula brown bear studies.

OBJECTIVES

1. Estimate spring density of brown bears in a 500 square mile study area in the Black Lake vicinity.

2. Estimate sex and age composition of brown bear inhabiting the study area.

3. Estimate productivity of Black Lake bears including: litter size, age at first reproduction, breeding interval, and offspring mortality rates.

4. Estimate mortality rates with special emphasis on mortality resulting from exploitation by hunters. When possible, determine causes of natural mortalities.

5. Compare and evaluate changes in density, population composition, reproductive rates, recruitment rates, and mortality rates that have occurred in the study area since the early 1970s.

6. Document the timing and intensity of use by bears of habitats of special importance such as denning areas, salmon fishing areas, berry and vegetation foraging areas, ungulate calving areas, and others that may become evident through monitoring. Determine if different subpopulations of bears use these areas.

7. Evaluate the efficacy of aerial stream surveys in estimating trends in bear population numbers and composition.

8. Estimate bear numbers (with probable upper and lower bounds) for Game Management Subunits 9E and 9D, by extrapolating from the study density estimate.

These objectives will be met through 6 jobs which have been identified, justified, and described in the project proposal and are listed below:

1. Estimation of brown bear density using modified capture-recapture techniques (Miller et al. 1987).

2.1. Monitor radio-marked bears to assist in defining borders of the density estimation area.

2.2. Monitor reproductive rates of radio-marked females and survival of cubs.

2.3. Monitor radio-marked bears to determine movements and causes of natural mortalities.

3.1 Conduct annual stream surveys.

3.2 Evaluate biases in stream survey data.

4. Monitor human harvest and analyze harvest data.

5. Recompilation and reanalysis of raw data collected during other studies.

6. Data analysis and report writing.

The primary objectives of the first 2 years of this project is to accomplish Job 1, estimation of brown bear density and population structure. Work accomplished in the first year of study was designed to prepare to accomplish this job in the second year of study. A secondary objective of the first year of study was to begin to mark the animals needed to ultimately accomplish the remaining jobs.

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METHODS

Standard techniques were used to capture and mark 59 bears in the period 1 June 1988 through 5 June 1988. Good weather during the capture period permitted completion of the capture and marking effort in less time than anticipated. Bears were immobilized with Telezol (Taylor et al. in press).

In brief, our marking techniques involve spotting bears from a fixed-wing aircraft (PA 18); immobilizing bears with a dart shot from a helicopter (Bell Jet Ranger); collecting morphological measurements, a premolar tooth for age determination, and blood samples from immobilized bears; marking all bears with eartags and all bears except cubs-of-the-year with lip tattoos; and putting radio transmitter on most adult bears and selected subadults. Standard transmitters affixed to neck collars were used for adult bears estimated to have completed at least 80% of their final size; transmitters affixed to collars with a spacer designed to weather and drop off or transmitters glued to a bear's fur anterior to the shoulder hump were affixed to bears considered likely to grow enough that neck collars would cause injury or discomfort. Following a sufficient period to permit bears to recover from the effects of the drug, the site where each bear was marked was checked by aircraft to assure that the bear had recovered and moved off.

Movements, Mortality and Habitat Use

Radio telemetry flights were made periodically from June-December to monitor movements, mortality, and habitat use. An effort was made to visually spot each bear whose signal was heard; however, weather conditions sometimes allowed only general locations to be plotted. When bears were relocated precisely, information on activity, association with other bears, and type of habitat occupied were recorded on standard forms. Habitat classification followed Viereck and Dyrness (1980).

Stream Surveys

Aerial surveys of brown bears concentrated along salmon spawning streams draining into Black Lake and the Chignik River have been conducted annually since 1982 following standardized techniques suggested by Erickson and Siniff (1963) to minimize biases and maximize consistency between counts. A Piper Super Cub (PA 18) with an experienced pilot and the same observer (Sellers, except in 1983) covered the same route during morning (0700-1000) and evening (1730-2030) surveys. Surveys were timed to coincide with peak bear concentrations (3-12 August). All bears seen were recorded by location and family status or by relative size for single bears. Litters of cubs older than 1 year were difficult to classify by age and consequently were lumped as

">COY".

During 1988 stream survey flights and subsequent high altitude flights, frequencies of marked bears were monitored to determine which were within the survey area. Because of the large number of both marked and unmarked bears concentrated on short stretches of several streams, it was impractical to identify individual marked bears by radio frequency and simultaneously conduct normal stream survey counts as has been done on Kodiak Island (V. Barnes, per comun.). Instead, visual collar flags were noted during routine stream surveys for later comparison with the number of marked bears (radio with collar flag) documented through telemetry to be within the area.

Two heavily used streams (Fan and Boulevard Creeks) were selected for further evaluation after the standard stream surveys were completed. On the mornings of 11 and 12 August 1988 these two streams were surveyed using the technique of Barnes (1986).

RESULTS AND DISCUSSION

Captures. Fifty-nine bears were captured including 38 females and 21 males. There were 2 capture mortalities, one from drowning and one from probable drug complications. Records of bears captured are presented in Table 1. Teeth extracted from bears are in the process of being sectioned and aged by counting cementum annuli; only estimated ages are given in Table 1.

Transmitters were placed on 39 animals: 23 with standard collars, 9 with collars equipped with spacers designed to rot through within several years, 5 glued on to fur that were designed to be shed during mid-summer molt, and 2 with surgical rubber spacers designed to weather and drop off within 2 years.

Sex ratio and reproductive status of bears captured in 1988 was not representative of population composition. Biases were introduced against females accompanied by newborn cubs because these were frequently located at high-elevations where capture operations were more difficult or dangerous. Bears were very numerous; at one time a single spotter plane had located 9 separate family groups or individuals. This made it necessary to choose which bears to go after and this, in turn, likely made the captures non-representative of the population that was present.

An effort will be made to correct for this possible source of bias in composition of the population of marked bears during marking efforts in spring 1989. At this time bears will be immobilized in the order in which they are spotted unless this is deemed unwise based on safety considerations.

Movements and Status

Including capture sites, the 39 bears successfully outfitted with radios were located a total of 352 times. During 1988 relocation flights were made as follows: June-2. July-1, August-2, September-2, October-1, and December-1. As of December 1988, status of the 29 female brown bears outfitted with radios (excluding two capture mortalities) was as follows: two adults died of natural causes, three no longer have functioning radios (two glue-on radios had batteries die and one break-away radio was dropped), and 25 are alive with functioning radios. The status of 10 males outfitted with radios was as follows: one shed his collar, two shed glue-on radios, one glue-on radio went dead, one collar failed, one other either failed or the bear made a long distance movement, and four have functioning radios (one of these moved 110 km north of the study area). Table 2 shows the status of all 59 bears captured.

During 1988 16 maternal females and 14 of 28 total offspring were captured. One female with two yearlings ran into a pond and drowned before biologists could reach her. Neither of her yearlings were marked and their fate is unknown. Another bear with two 2.5-year old cubs died from drug complications. One of the young (#33) was marked but not fitted with a radio so the fate of these two bears is unknown. Two other maternal females died of natural causes as described below.

Bear #36 and her two cubs of the year were captured on 3 June. She was seen on 5 June alone near the capture site, and she was relocated (but not visually seen) the following day with her radio transmitting in the active mode, indicating she was alive. On 26 June she was found dead at the bottom of a cliff 8.5 km from the capture site. The carcass could not be checked until 19 July. Evidence at the site indicated she was involved in a rock/snow slide and had apparently suffered a broken neck. No sign of her cubs was found, and they were presumed dead. Bear #44 and her 2.4 year-old cub (#45) were both captured and radio collared on 3 June. They remained together and were relocated 8 times through 23 September. On 20 October she was found dead; her offspring was alive about 16 km away. We could not get to the carcass to determine the cause of death.

Two natural mortalities of unmarked bears were noted. During a stream survey flight on 8 August the carcass of a medium sized, well furred, unmarked bear was seen about 100 meters from Boulevard Creek. Two very small bears, judged to be yearlings, were seen along the stream near by. What we thought were these same two bears were seen on several subsequent flights, and on 12 August they were bedded down in contact with the carcass. There was no evidence that the carcass had been disturbed during these 5 days. Although it was not possible to examine the carcass, from the bear's size and appearance and the behavior of the two small bears, we assume it was a maternal female that died of natural causes. The other natural mortality was noted on the first

day of capture operations. Bear #5, an adult male, was captured as he was consuming a male yearling bear, presumed to be the offspring of bear #4 which was lactating and located less than 100 meters way from #5 and the dead yearling.

Although data are too few to draw conclusions from, the high incidence of natural mortalities observed during 1988 suggest that natural mortality in this population of bears may be higher than in other Alaskan populations. If true, this will be significant to estimation of sustainable exploitation rates as mortality of adult females was shown in simulation studies to be the most significant factor influencing population growth rate in polar bears (Taylor et al. 1987) and the same is probably true for brown bears.

Of the twelve maternal females that survived until fall only three (numbers 34,37 and 58) retained the original litter intact as late as September. One of three COY litters remained intact. Both other entire litters were lost to natural mortality. Two of six yearling litters remained intact into September. One entire litter of two yearlings was separated during capture. Two other yearling litters each lost one cub following capture. The other yearling litter lost one of three cubs to natural causes. None of the 5 litters with cubs older than yearlings remained intact until fall. Two of the separations may have been capture related, but the rest were caused either by natural weaning or natural mortality.

Analysis of movements and habitat use has not been made, however several trends were apparent. Most bears captured in the Alec River system remained in that drainage and actively sought red salmon (*Oncorhynchus nerka*) into early September. During late summer a few bears moved to the West Fork of the Chignik River where fishing activity continued into early December on a late run of coho salmon (*O. kisutch*).

Stream Surveys

Preliminary evaluation of stream surveys began during this reporting period. Four replicate aerial surveys of bears were conducted from 8-10 August 1988 (Table 3). The count of 217 bears on 9 August was the highest number of bears recorded since surveys began in 1958. However, the mean number of bears (171, SD = 26) and bears per hour (51) was not significantly different from 1982-86 surveys. The proportion of bears that were not in family groups (27%) was the lowest recorded since 1982. This low percentage of single bears could reflect the harvest of 32 single bears from the study area during the previous two hunting seasons (October 1987 and May 1988) and/or a highly productive population.

Erickson and Siniff (1963) identified several factors that lead to inconsistent results from aerial surveys of bears along streams. However, their most experienced observer had relatively consistent counts which averaged

91.5 (SD = 13, range 81-113) during four surveys of comparable timing to those done since 1982. Based on an average of 2.5 hours per flight, they counted an average of 36.6 bears per hour. From 1982-88 (excluding 1987 when weather prevented surveys during the peak concentration of bears) 21 complete surveys have been made with an average count of 164 bears (SD = 29.6) and an average of 54.2 bears (SD = 9) counted per hour. Erickson and Siniff (1963) were not able to test whether this technique has an application for detecting major changes in the size or composition of a bear population over time, as is suggested by the above comparison.

During stream surveys sightability of visually marked bears never exceeded 50%. The highest sightability was achieved on the two selected streams where a total of 7 of 15 marked bears was seen during 2 counts. This sightability was similar to that reported by Erickson and Siniff (47%). In recent capture-recapture census efforts in Game Management Unit 13 in southcentral Alaska, sightability of marked animals was 24-47% (Miller in press), and 32 or 39% in 2 areas on Kodiak Island (Barnes et al. 1988). During normal relocation flights when the exact location of a marked bear was known and several passes were made in an effort to see the bear, sightability was only about 67%. If less than half the bears present are actually seen during Black Lake stream surveys it is likely that over 400 bears are within the survey area during the peak of the salmon run. Additional data will be necessary to evaluate whether any specific sightability biases exist towards particular sex/age cohorts.

Schedule for Density Estimation

Capture operations in spring 1989 are scheduled to begin on May 18 and should be completed by May 23. During this time it is hoped that available funds will be adequate to deploy an additional 30 transmitters.

Following this marking phase, the study area will be undisturbed for several days and on approximately 26 May the density estimation phase will begin following the procedures outlined by Miller et al. (1987) except that unmarked bears spotted during this phase will not be captured and marked. In this regard, the density estimation procedure is more like that used in other high density brown bear studies on Kodiak (Barnes et al. 1988) and in southeastern Alaska (Schoen and Bier in prep). This procedure is designed to reduce disturbance to bears from helicopter operation and also to avoid the logistic difficulty of capturing all bears spotted in a study area with high bear density like Black Lake.

The most serious potential problem with completing the density estimate during spring 1989 will be weather. A long period of weather inadequate for flying during the period between emergence from dens and reduced visibility of bears caused by leaf-out could prevent completion of the planned

density estimate.

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Figure 1. Black Lake study area on the Alaska Peninsula.

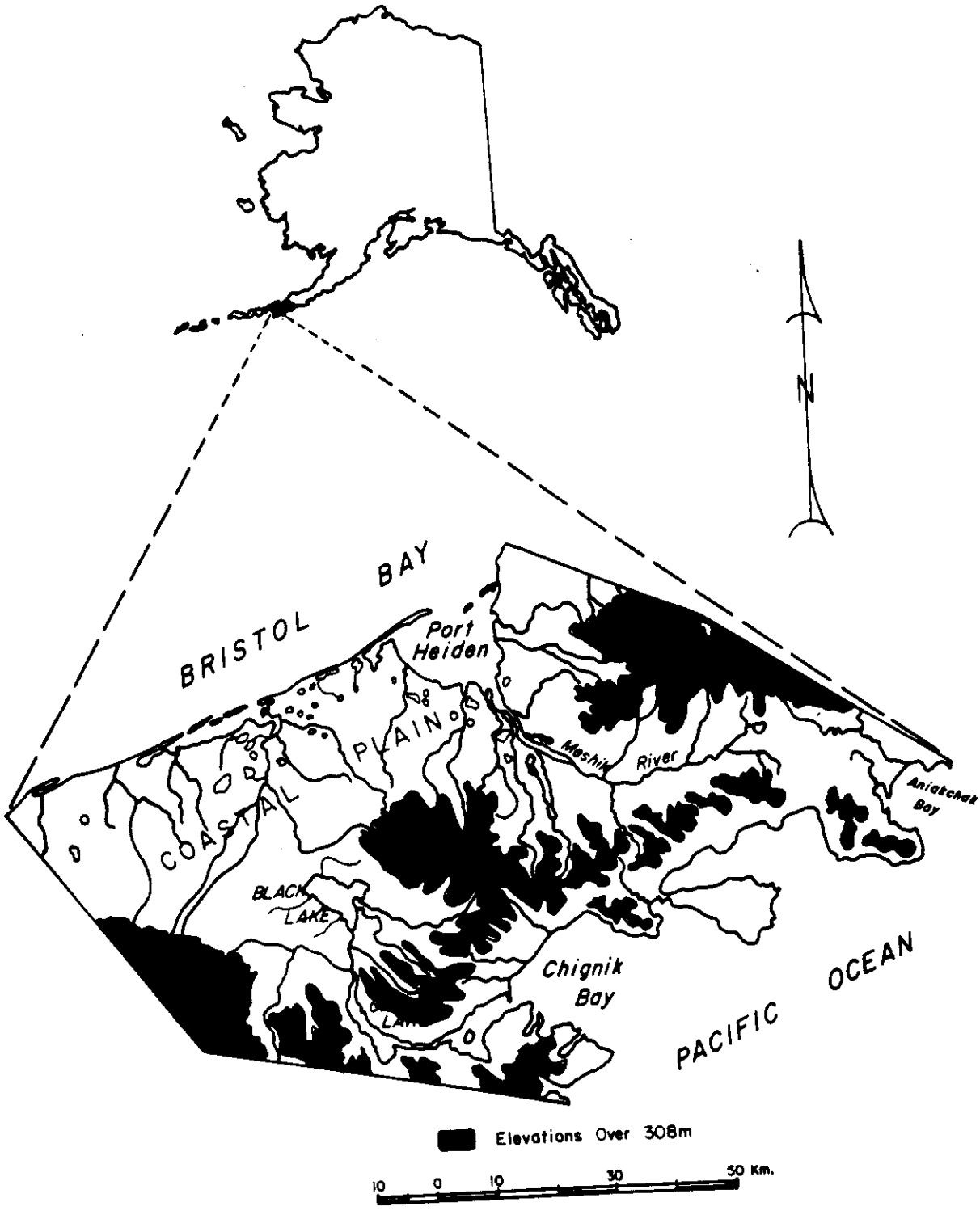
N
BRISTOL BAY
Port Heiden
COASTAL PLAIN
Meshik River
Aniakchak Bay
BLACK LAKE
Chignik Bay
PACIFIC OCEAN
Elevations Over 308m
10 0 10 30 50 Km.

Table 1. Brown bear capture records, cooperative Black Lake project.

ID	SEX	AGE	WT. (LBS)	CAPTURE DATE	EARTAGS LEFT	EARTAGS RIGHT	C.	RADIO TYPE	FLAGS	SKULL SIZE LENGTH (mm)	SKULL SIZE WIDTH (mm)	CONDIT.	BLOOD % Hb	BLOOD % PCV	ASSOC. & COMMENTS
001	F	17*	415	6/1/88	23	24	W	regular	Y CF	392	227	2	14.5	42.0	W/ 2@1, captured
002	F	1*	125	6/1/88	60	59	W	- -		271	147	NA	17.0	45.0	W/ #1 & sibling #3
003	M	1*	136	6/1/88	59	60	O	- -		282	151	NA	18.0	45.0	W/ #1 # sibling #2
004	F	20*	425	6/1/88	86	85	W	regular	W CF	370	222	4	16.0	45.0	W/ male #5 and dead ylg.
005	M	12*	850*	6/1/88	80	79	R	regular		444	259	4	17.0	44.5	W/ female #4 and dead ylg.
006	F	4*	340	6/1/88	58	57	W	w/ spacer	W CF	375	206	3	16.0	45.5	W/ male #7
007	M	4*	385	6/1/88	31	32	R	- -		371	197	3	15.0	43.5	W/ female #6
008	F	3*	300*	6/1/88	1	2	W	regular	Y CF	351	186	4	17.5	49.0	Alone
009	M	7*	475*	6/2/88	21	22	R	w/spacer	R CF	384	209	3	14.6	42.0	W?/ male #10
010	M	4*	290	6/2/88	69	70	R	glue-on	R RtE	374	201	NA	14.0	38.5	W?/ male #9
011	F	22*	580	6/2/88	92	91	W	regular	Y CF	406	242	4	14.3	41.0	Alone
012	F	9*	370	6/2/88	74	73	W	regular	W CF	371	208	NA	15.5	47.0	W/ 1@2 (#13)
013	F	2*	150	6/2/88	83	84	W	- -		299	166	NA	15.0	39.0	W/ mom #12
014	M	8*	485	6/2/88	17	18	R	- -		436	240	4	14.5	43.0	W/ male #15
015	M	14*	1100*	6/2/88	75	76	R	glue on	R Bk	419	300	5	NA	NA	W/ male #14
016	F	4*	275*	6/2/88	20	19	W	w/spacer		350	196	NA	14.8	44.0	Alone
017	F	19*	500*	6/2/88	13	14	W	regular	W CF	373	246	5	14.4	47.0	W/ big male, not captured
018	F	15*	400*	6/2/88	82	81	W	regular	Y CF	394	238	2	16.3	45.0	W/ 2@1 (#19 & 20)
019	F	1*	110*	6/2/88	89	90	W	- -		249	148	3	14.2	43.0	W/ mom #18
020	F	1*	90*	6/2/88	65	66	W	- -		261	154	2	13.5	41.0	W/ mom #18 & sib (#19)
021	F	3*	175*	6/2/88	51	52	W	glue-on	W RtE	300	170	4	14.5	40.0	Alone
022	F	10*	375*	6/2/88	NA	NA		- -		379	239	NA	NA	NA	Capture mortality, drowned
A	?	1*	100*	6/2/88	NA	NA		- -				NA	NA	NA	Darted but not handled, recovered
B	?	1*	100*	6/2/88	NA	NA		- -				NA	NA	NA	Darted but not handled, recovered
025	M	15*	1000*	6/2/88	7	NA	R	- -		446	296	4	NA	NA	Alone, Rt. ear missing
026	F	13*	380	6/2/88	5	6	W	regular	Y CF	386	231	3	14.4	38.0	W/ 3@2 (#27-29)
027	F	2*	170	6/2/88	67	68	W	glue-on	W LfE	300	167	NA	15.0	40.0	W/ #26 & sibs
028	M	2*	160	6/2/88	16	15	R	- -		307	170	NA	13.8	43.0	W/ #26 & sibs
029	M	2*	155	6/2/88	97	98	R	- -	R LfE	295	165	NA	13.9	41.0	W/ #26 & sibs
030	F	12*	385	6/3/88	9	10	W	regular	W CF	377	226	3	16.0	43.0	W/ 1@2* (#31)

Continued...

Table 1. Continued

ID	SEX	AGE	WT. (LBS)	CAPTURE DATE	EARTAGS LEFT	EARTAGS RIGHT	C.	RADIO TYPE	FLAGS	SKULL SIZE LENGTH (mm)	SKULL SIZE WIDTH (mm)	CONDIT.	BLOOD % Hb	BLOOD % PCV	ASSOC. & COMMENTS
031	M	2*	140	6/3/88	100	99	R	- -		289	157	3	19.0	45.0	W/ mom #30
023	F	17*	380	6/3/88	76	75	W	regular		375	228	4	16/0	44.0	W/ 3#1 (only #24 captured)
024	M	1*	40*	6/3/88	86	85	R	- -		239	128	2	13.0	39.5	w/ mom #23 & 2 siblings
032	F	12*	400*	6/3/88	61	62	W	regular		377	239	3	NA	NA	Capture mort., w/ 2@3* (#33 captured)
033	M	3*	230	6/3/88	35	36	R	- -		330	180	3	14.0	42.0	W/ mom #32 & 2 siblings
034	F	17*	475*	6/3/88	95	96	W		W CF	405	245	4	20.0	47.0	W/ 3@0, not captured
036	F	15*	285	6/3/88	45	46	W		W CF	360	235	2	17.0	45.6	W/ 2@0, captured
A	F	0*	24	6/3/88	B208	B218	R	- -		NA	NA	NA	NA	NA	Rototags, w/mom #36, drugged by hand
B	F	0*	22.5	6/3/88	B194	B213	R	- -		NA	NA	NA	NA	NA	Rototags, w/mom #36, drugged by hand
037	F	8*	340	6/3/88	98	18	W		W CF	363	200	4	16.0	44.0	W/1@1* (°75lbs), not captured
038	F	16*	450*	6/3/88	22	50	W		W CF	373	234	3	13.0	40.0	W/1@2* (#39)
039	M	2*	215	6/3/88	43	44	R	glue-on		350	192	3	16.0	40.5	W/mom #38
040	F	6*	340	6/3/88	71	72	W		W CF	364	189	1	15.0	42.5	Weighed wet, w/ male #41
041	M	14*	850*	6/3/88	34	33	R		R RtE	410	269	NA	16.5	44.5	W/ female #40
042	M	5*	425*	6/3/88	25	26	R	w/spacer	O CF	387	209	3	18.5	45.5	W/ female #43
043	F	5*	275*	6/3/88	79	80	W	w/spacer	Y CF	352	199	2	13.5	37.0	W/ male #42
044	F	20*	425*	6/3/88	97	70	W		W CF	411	231	3	17.5	41.0	W/ 1@2 (#45)
045	F	3*	225*	6/3/88	77	78	W	w/spacer		340	181	3	14.0	42.0	W/ #44 (mom)
046	F	16*	320*	6/4/88	7	8	W		W CF	384	225	2	16.3	44.0	W/ 3@0, not captured
047	M	4*	250*	6/4/88	96	5	O	surg. rubber		364	195	5	16.0	45.0	Alone
048	M	4*	340*	6/4/88	23	24	R	w/spacer	R CF	359	192	3	15.5	43.0	Alone
049	M	10*	800*	6/4/88	11	12	O			475	260	3	NA	NA	W/ female #50
050	F	8*	270*	6/4/88	29	30	R	w/spacer		371	212	1	17.3	46.0	W/ male #49
051	F	14*	400	6/4/88	56	55	W		W CF	381	242	3	14.6	41.0	W/ 3@1 (not captured, age certain)
052	F	4*	345	6/4/88	35	36	W			360	189	3	15.0	43.0	Alone
053	F	3*	250*	6/5/88	63	64	W	w/spacer	W CF	336	175	2	13.0	37.5	Alone
054	M	3*	265	6/5/88	37	38	R	surg. rubber	R CF	334	193	2	15.0	48.0	Alone

Continued...

Table 1. continued

ID	SEX	AGE	WT. (LBS)	CAPTURE DATE	EARTAGS LEFT	EARTAGS RIGHT	C.	RADIO TYPE	FLAGS	SKULL SIZE LENGTH (mm)	SKULL SIZE WIDTH (mm)	CONDIT.	BLOOD % Hb	BLOOD % PCV	ASSOC. & COMMENTS
055	F	8*	450*	6/5/88	26	99	W		W CF	372	211	3	15.5	42.0	W/ adult male(?)
056	M	3*	187	6/5/88	88	87	R			312	163	2	13.5	38.5	W/ larger adult (mom?)
057	F	7*	365	6/5/88	27	28	W		Y CF	377	217	3	14.0	43.0	W/ large male(?)
058	F	15*	450*	6/5/88	92	93	W		W CF	378	241	3	14.5	41.0	W/ 2@1, not captured

* Estimated value

Table 1. Brown bear capture records, cooperative Black Lake project.

ID	SEX	AGE	WT. (LBS)	CAPTURE DATE	EARTAGS LEFT	EARTAGS RIGHT	C.	RADIO TYPE	FLAGS	SKULL SIZE LENGTH (mm)	SKULL SIZE WIDTH (mm)	CONDIT.	BLOOD % Hb	BLOOD % PCV	ASSOC. & COMMENTS
001	F	17*	415	6/1/88	23	24	W	regular	Y CF	392	227	2	14.5	42.0	W/ 2@1, captured
002	F	1*	125	6/1/88	60	59	W	- -		271	147	NA	17.0	45.0	W/ #1 & sibling #3
003	M	1*	136	6/1/88	59	60	O	- -		282	151	NA	18.0	45.0	W/ #1 # sibling #2
004	F	20*	425	6/1/88	86	85	W	regular	W CF	370	222	4	16.0	45.0	W/ male #5 and dead ylg.
005	M	12*	850*	6/1/88	80	79	R	regular		444	259	4	17.0	44.5	W/ female #4 and dead ylg.
006	F	4*	340	6/1/88	58	57	W	w/ spacer	W CF	375	206	3	16.0	45.5	W/ male #7
007	M	4*	385	6/1/88	31	32	R	- -		371	197	3	15.0	43.5	W/ female #6
008	F	3*	300*	6/1/88	1	2	W	regular	Y CF	351	186	4	17.5	49.0	Alone
009	M	7*	475*	6/2/88	21	22	R	w/spacer	R CF	384	209	3	14.6	42.0	W?/ male #10
010	M	4*	290	6/2/88	69	70	R	glue-on	R RtE	374	201	NA	14.0	38.5	W?/ male #9
011	F	22*	580	6/2/88	92	91	W	regular	Y CF	406	242	4	14.3	41.0	Alone
012	F	9*	370	6/2/88	74	73	W	regular	W CF	371	208	NA	15.5	47.0	W/ 1@2 (#13)
013	F	2*	150	6/2/88	83	84	W	- -		299	166	NA	15.0	39.0	W/ mom #12
014	M	8*	485	6/2/88	17	18	R	- -		436	240	4	14.5	43.0	W/ male #15
015	M	14*	1100*	6/2/88	75	76	R	glue on	R Bk	419	300	5	NA	NA	W/ male #14
016	F	4*	275*	6/2/88	20	19	W	w/spacer		350	196	NA	14.8	44.0	Alone
017	F	19*	500*	6/2/88	13	14	W	regular	W CF	373	246	5	14.4	47.0	W/ big male, not captured
018	F	15*	400*	6/2/88	82	81	W	regular	Y CF	394	238	2	16.3	45.0	W/ 2@1 (#19 & 20)
019	F	1*	110*	6/2/88	89	90	W	- -		249	148	3	14.2	43.0	W/ mom #18
020	F	1*	90*	6/2/88	65	66	W	- -		261	154	2	13.5	41.0	W/ mom #18 & sib (#19)
021	F	3*	175*	6/2/88	51	52	W	glue-on	W RtE	300	170	4	14.5	40.0	Alone
022	F	10*	375*	6/2/88	NA	NA		- -		379	239	NA	NA	NA	Capture mortality, drowned
A	?	1*	100*	6/2/88	NA	NA		- -				NA	NA	NA	Darted but not handled, recovered
B	?	1*	100*	6/2/88	NA	NA		- -				NA	NA	NA	Darted but not handled, recovered
025	M	15*	1000*	6/2/88	7	NA	R	- -		446	296	4	NA	NA	Alone, Rt. ear missing
026	F	13*	380	6/2/88	5	6	W	regular	Y CF	386	231	3	14.4	38.0	W/ 3@2 (#27-29)
027	F	2*	170	6/2/88	67	68	W	glue-on	W LfE	300	167	NA	15.0	40.0	W/ #26 & sibs
028	M	2*	160	6/2/88	16	15	R	- -		307	170	NA	13.8	43.0	W/ #26 & sibs
029	M	2*	155	6/2/88	97	98	R	- -	R LfE	295	165	NA	13.9	41.0	W/ #26 & sibs
030	F	12*	385	6/3/88	9	10	W	regular	W CF	377	226	3	16.0	43.0	W/ 1@2* (#31)

Continued...

Table 1. Continued

ID	SEX	AGE	WT. (LBS)	CAPTURE DATE	EARTAGS LEFT	EARTAGS RIGHT	C.	RADIO TYPE	FLAGS	SKULL SIZE LENGTH (mm)	SKULL SIZE WIDTH (mm)	CONDIT.	BLOOD % Hb	BLOOD % PCV	ASSOC. & COMMENTS
031	M	2*	140	6/3/88	100	99	R	- -		289	157	3	19.0	45.0	W/ mom #30
023	F	17*	380	6/3/88	76	75	W	regular		375	228	4	16/0	44.0	W/ 3#1 (only #24 captured)
024	M	1*	40*	6/3/88	86	85	R	- -		239	128	2	13.0	39.5	w/ mom #23 & 2 siblings
032	F	12*	400*	6/3/88	61	62	W	regular		377	239	3	NA	NA	Capture mort., w/ 2@3* (#33 captured)
033	M	3*	230	6/3/88	35	36	R	- -		330	180	3	14.0	42.0	W/ mom #32 & 2 siblings
034	F	17*	475*	6/3/88	95	96	W		W CF	405	245	4	20.0	47.0	W/ 3@0, not captured
036	F	15*	285	6/3/88	45	46	W		W CF	360	235	2	17.0	45.6	W/ 2@0, captured
A	F	0*	24	6/3/88	B208	B218	R	- -		NA	NA	NA	NA	NA	Rototags, w/mom #36, drugged by hand
B	F	0*	22.5	6/3/88	B194	B213	R	- -		NA	NA	NA	NA	NA	Rototags, w/mom #36, drugged by hand
037	F	8*	340	6/3/88	98	18	W		W CF	363	200	4	16.0	44.0	W/1@1* (°751bs), not captured
038	F	16*	450*	6/3/88	22	50	W		W CF	373	234	3	13.0	40.0	W/1@2* (#39)
039	M	2*	215	6/3/88	43	44	R	glue-on		350	192	3	16.0	40.5	W/mom #38
040	F	6*	340	6/3/88	71	72	W		W CF	364	189	1	15.0	42.5	Weighed wet, w/ male #41
041	M	14*	850*	6/3/88	34	33	R		R RtE	410	269	NA	16.5	44.5	W/ female #40
042	M	5*	425*	6/3/88	25	26	R	w/spacer	O CF	387	209	3	18.5	45.5	W/ female #43
043	F	5*	275*	6/3/88	79	80	W	w/spacer	Y CF	352	199	2	13.5	37.0	W/ male #42
044	F	20*	425*	6/3/88	97	70	W		W CF	411	231	3	17.5	41.0	W/ 1@2 (#45)
045	F	3*	225*	6/3/88	77	78	W	w/spacer		340	181	3	14.0	42.0	W/ #44 (mom)
046	F	16*	320*	6/4/88	7	8	W		W CF	384	225	2	16.3	44.0	W/ 3@0, not captured
047	M	4*	250*	6/4/88	96	5	O	surg. rubber		364	195	5	16.0	45.0	Alone
048	M	4*	340*	6/4/88	23	24	R	w/spacer	R CF	359	192	3	15.5	43.0	Alone
049	M	10*	800*	6/4/88	11	12	O			475	260	3	NA	NA	W/ female #50
050	F	8*	270*	6/4/88	29	30	R	w/spacer		371	212	1	17.3	46.0	W/ male #49
051	F	14*	400	6/4/88	56	55	W		W CF	381	242	3	14.6	41.0	W/ 3@1 (not captured, age certain)
052	F	4*	345	6/4/88	35	36	W			360	189	3	15.0	43.0	Alone
053	F	3*	250*	6/5/88	63	64	W	w/spacer	W CF	336	175	2	13.0	37.5	Alone
054	M	3*	265	6/5/88	37	38	R	surg. rubber	R CF	334	193	2	15.0	48.0	Alone

Continued...

Table 1. continued

ID	SEX	AGE	WT. (LBS)	CAPTURE DATE	EARTAGS LEFT	EARTAGS RIGHT	C.	RADIO TYPE	FLAGS	SKULL SIZE LENGTH (mm)	SKULL SIZE WIDTH (mm)	CONDIT.	BLOOD % Hb	BLOOD % PCV	ASSOC. & COMMENTS
055	F	8*	450*	6/5/88	26	99	W		W CF	372	211	3	15.5	42.0	W/ adult male(?)
056	M	3*	187	6/5/88	88	87	R			312	163	2	13.5	38.5	W/ larger adult (mom?)
057	F	7*	365	6/5/88	27	28	W		Y CF	377	217	3	14.0	43.0	W/ large male(?)
058	F	15*	450*	6/5/88	92	93	W		W CF	378	241	3	14.5	41.0	W/ 2@1, not captured

* Estimated value

Table 2. Current status of bears marked near Black Lake in June, 1988.

Bear #	Sex	Estimated Age	Date last Location	Current Status
001	F	17	10/19/88	Alive, lost 1 of 2 yearlings from capture
002	F	1		Unk, this or sibling (#3) still with mother (#1)
003	M	1		Unk, this or sibling (#2) still with mother (#1)
004	F	20	12/05/88	Alive, denned
005	M	12	06/03/88	Unk, either radio or long emigration
006	F	4	12/05/88	Alive, denned
007	M	4		Unk, no radio
008	F	3	12/05/88	Alive, not denned yet
009	M	7	09/23/88	Alive
010	M	4	09/08/88	Glue-on radio shed as of 9/8/88
011	F	22	09/08/88	Alive
012	F	9	12/06/88	Alive, presummed to be denned
013	F	2		Unk, no radio
014	M	8		Unk, no radio
015	M	14	06/06/88	Glue-on radio shed
016	F	4	12/05/88	Radio shed or bear denned
017	F	19	12/05/88	Alive, denned
018	F	15	09/22/88	Alive
019	F	1		Separated from mother (#18) at capture, presumed dead
020	F	1		Separated from mother (#18) at capture, presumed dead
021	F	3	09/22/88	Alive, but glue-on radio now presumed nonfunctional
022	F	10		Capture mortality
023	F	17	12/05/88	Denned
024	M	1	10/19/88	Presummed denned with mother(#23)
025	M	15		Unk, no radio
026	F	13	10/19/88	Alive
027	F	2	06/06/88	Unk, glue-on radio nonfunctional
028	M	2		Unk, no radio
029	M	2		Unk, no radio
030	F	12	12/05/88	Alive
031	M	2		Unk, no radio
032	F	12		Capture mortality
033	M	3		Unk, no radio
034	F	17	12/05/88	Alive, denned w/3 COY
036	F	15	06/26/88	Natural mortality
A	F	0		Mother (#36) dead, presummed dead
B	F	0		Mother (#36) dead, presummed dead
037	F	8	12/05/88	Alive

Continued...

Table 2. Continued

Bear #	Sex	Estimated Age	Date last Location	Current Status
038	F	16	10/20/88	Alive
039	M	2	07/20/88	Unk, glue-on radio nonfunctional
040	F	6	12/05/88	Alive, denned
041	M	14	06/06/88	Unk, radio shed
042	M	5	11/26/88	Alive, bear moved 110 km north
043	F	5	12/05/88	Alive, presummed denned
044	F	20	10/20/88	Natural mortality
045	F	3	12/05/88	Alive, denned
046	F	16	12/05/88	Alive, lost 3 COY
047	M	4	12/05/88	Alive, denned
048	M	4	10/20/88	Alive
049	M	10		Unk, no radio
050	F	8	12/05/88	Alive, denned [3]
051	F	14	12/05/88	Alive, denned w/2 yearlings
052	F	4	12/05/88	Alive
053	F	3	10/19/88	Alive
054	M	3	09/08/88	Alive, but radio confirmed nonfunctional
055	F	8	10/20/88	Alive
056	M	3		Unk, no radio
057	F	7	12/05/88	Alive, denned
058	F	15	12/05/88	Alive, denned

Table 3. Black Lake stream survey results. 1982-88.

Date	Females w/young		COY		>COY		Single Bears		Total	Bears Per	Comments
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Sample	Hour	
1982											
8/8 am	26	19	25	19	25	19	58	43	134	40.20	
8/8 pm	27	18	37	25	29	20	55	37	148	50.74	
Mean	27	19	31	22	27	19	57	40	141	45.47	
1983											
8/9 pm	34	24	33	24	35	25	38	27	140	48.00	USFWS
8/10am	41	25	49	29	34	20	43	26	167	51.12	USFWS
8/10pm	29	19	42	28	24	16	56	37	151	61.22	USFWS
8/12am	35	20	47	27	29	17	62	36	173	55.81	USFWS
Mean	35	22	43	27	31	20	50	32	158	54.04	
1984											
8/7 am	28	25	32	29	22	20	28	25	110	33.85	
8/7 pm	37	22	32	19	47	27	55	32	171	64.04	
8/8 am	26	26	17	17	30	30	26	26	99	61.88	
8/8 pm	37	24	26	17	44	29	46	30	153	61.20	
Mean	32	24	27	20	36	27	39	29	133	55.24	
1985											
8/5 pm	47	23	35	17	60	29	64	31	206	68.70	
8/6 am	35	20	36	20	45	25	62	35	178	59.30	
8/8 am	47	22	37	17	65	30	66	31	215	67.90	
Mean	43	21	36	18	57	28	64	32	200	65.30	
1986											
8/6 pm	38	22	27	16	46	27	62	36	173	49.40	
8/7 am	25	15	17	10	36	22	85	52	163	51.40	
8/7 pm	41	20	29	14	44	22	88	44	202	61.60	
8/8 pm	34	20	21	13	40	24	71	43	166	47.40	
Mean	35	20	24	13	42	24	77	43	176	52.45	

Continued...

Table 3. Continued.

Date	Females w/young		COY		%COY		Single Bears		Total	Bears Per	Comments
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Sample	Hour	
1987											
8/7 pm	3	11	2	7	5	18	18	64	28		aborted, turbulence
8/12pm	27	18	34	23	28	19	58	39	147	51.88	Too late into salmon run
1988											
8/8 pm	40	25	34	22	47	30	37	23	158	45.14	
8/9 am	51	24	49	23	65	30	50	23	217	62.00	
8/10am	31	20	23	15	43	28	57	37	154	48.13	
8/10pm	38	24	31	20	50	32	38	24	157	49.58	
Mean	40	23	34	20	51	30	46	27	172	51.21	