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Research Progress Report

BROWN BEAR HABITAT PREFERENCES AND BROWN BEAR LOGGING AND MINING RELATIONSHIPS IN SOUTHEAST ALASKA

by
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Project W-22-6
Job 4.17
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Job No.: 4.17 Job Title: Brown Bear Habitat Preferences and Brown Bear Logging and Mining Relationships in Southeast Alaska

Period Covered: 1 July 1986-30 June 1987

SUMMARY

Nineteen brown bears (Ursus arctos) were captured or recaptured on Admiralty Island during this report period. No additional bears were captured on Chichagof Island because this was the last year of intensive field work at that site. To date, we have captured 94 brown bears on Admiralty (67) and Chichagof (27) Islands. From fall 1981 to fall 1986, we accumulated 3135 relocations. In 1986 we collected 837 relocations from Admiralty (624) and Chichagof (213) Islands. At the end of the 1986 field season, 11 males and 12 females on Admiralty Islands had active transmitters, while on Chichagof Island, 1 male and 9 females had them.

Our telemetry work on Chichagof Island during 1986 focussed primarily on bears whose home ranges overlapped clearcuts. Intensive 24-hr observations of clearcuts indicated that aerial-telemetry surveys during daylight hours provided a representative sample of bear use of clearcuts. To date, we have collected 866 relocations of radio-collared brown bears on Chichagof Island. Only 20 of those relocations (2%) occurred in clearcuts. Thus brown bears appear to be avoiding clearcuts at this study site.

On Admiralty Island, much of our effort was designed to monitor the response of bears to the Greens Creek road development. Eleven radio-collared bears inhabited the lower

Greens Creek drainage in relatively close proximity to active road construction. Though bears remained in the general vicinity, they avoided areas close to active construction during the day. The number of active day beds along 1.6 km of stream in the road corridor declined from 57 prior to development in 1985 to 17 during construction activity in 1986.

Four replicate surveys were completed as part of our mark-recapture density estimate of brown bears at our Admiralty study site. The mean number of bears in the study site was 144 (95% confidence limits of 115 and 169). This represents a density of 0.42 bears per km^2 (1.02 bears/mi^2).

Key words: Admiralty Island, Chichagof Island, brown bear, habitat use, density estimates, reproduction, forestry, clearcutting, old-growth forest, mining, roading, radio telemetry, Southeast Alaska, Ursus arctos.

CONTENTS

BACKGROUND

Once widely distributed across western North America, brown/grizzly bears (Ursus arctos) currently range over a significantly reduced portion of the continent. This is particularly true in the contiguous United States where the species was declared threatened in 1975. In North America today, the largest population of brown/grizzly bears (hereafter called brown bears) occurs in Alaska. In Southeast Alaska, logging, mining, and outdoor recreational activities are rapidly expanding throughout the range of the brown bear. To avoid or minimize population declines of this valuable resource (identified as a management indicator species by the U. S. Forest Service and Alaska Department of Fish and Game), it is imperative that managers develop (1) techniques to monitor bear population trends and (2) management guidelines for habitat protection and human activity in brown bear country.

This study, which began in 1981 (Schoen 1982), was designed to provide baseline ecological data on the seasonal movements and habitat utilization, den site selection, home range characteristics, food habits, and reproductive rates of brown bears. Particular emphasis was placed on developing an understanding of the relationships of mining and logging to bear populations. Preliminary data have been presented in Schoen and Beier (1983, 1985, 1986, 1987) and Schoen et al. (in press a, in press b). Additional literature review and problem analysis are provided in Schoen (1986).

OBJECTIVES

To determine weekly and seasonal movement patterns and habitat utilization by brown bears in Southeast Alaska, particularly with respect to mining and/or logging activities.

To locate and describe denning sites.

To determine reproductive rates and their relationship to habitat and harvest levels.

STUDY AREA

The study area is located in the Alexander Archipelago of Southeast Alaska. Specific sites have been selected on Admiralty and Chichagof Islands. On northern Admiralty Island, our specific objectives relate to monitoring relationships of radio-collared bears to the Greens Creek mining development. On southeastern Chichagof Island, we are assessing bear-logging relationships. Additional study site description is included in Schoen (1982) and Schoen and Beier (1983).

METHODS

Detailed methodology was described in Schoen (1982, 1986). Bears were captured in the alpine areas by shooting them with darts from a helicopter; along beaches and salmon streams, Aldrich leg-hold snares were used. Etorphine hydrochloride (M99, Lemmon Co., Sellersville, Pa.) and its antagonist, diprenorphine hydrochloride (M50-50, Lemmon Co., Sellersville, Pa.), were used to immobilize most bears. Sernylan (phencyclidine hydrochloride, Bioceutic Laboratories, St. Joseph, Mo. [no longer manufactured]) was used in a few cases.

Movements, home range patterns, and habitat use were determined by relocating instrumented bears through aerial radiotelemetry. Because all of our telemetry surveys were conducted from aircraft during daylight hours, we were concerned that bears may have been using clearcuts during hours of darkness. To answer this question, the use of clearcuts by bears was monitored for several 24-hr periods by a team of volunteers along the Corner Bay road system on Chichagof Island. These observations were conducted during 10-13 June and 15-18 July 1986. Volunteers continuously monitored several large clearcuts with spotting scopes and a starlight scope; they also drove the road system several times during the day.

During the first half of July 1986, we conducted a mark-recapture density estimate of brown bears within a 344-km^2 study area on northern Admiralty Island (Fig. 1). Early July was selected as the optimum time for alpine bear surveys because (based on past telemetry work) most bears use the alpine areas at that time of the year. Our surveys, generally conducted during evening hours, also included wetland areas; however, few bears were observed there. The Greens Creek Mine

facilities are located in the middle of this area. We anticipate using our density estimate as a baseline of the brown bear population prior to major development.

We used the modified Petersen estimate:

$$\underline{N} = \frac{(n_1 + 1)(n_2 + 1)}{(m_2 + 1)} - 1$$

where N is the population estimated, n_1 is the number of marked bears in the population, m_2 is the number of marked bears observed, and n_1 is the total number of bears observed (Seber 1982). We followed the procedure of Miller et al. (1987) and conducted a series of replicate surveys from which we calculated total cumulative bear days to derive our population estimate. Marked bears were, by definition, bears with transmitting radio collars. By determining which bears were inside or outside our study area, we were able to meet the assumption of population closure.

RESULTS AND DISCUSSION

This report summarizes data collected during the 1986 field season, which encompasses spring den emergence to fall denning. Also summarized are capture and status of instrumented bears and reproductive data from fall 1981 through June 1987 (Tables 1 and 2). At the completion of this reporting period, 11 males and 12 females on Admiralty Island and 1 male and 9 females on Chichagof Island had functional radios. During this period, we recorded 837 relocations: 621 and 213 from Admiralty and Chichagof Islands, respectively. This brings the total number of relocations for the study to 3135. Because of budget reductions, our telemetry work at our Chichagof Island study site will not be continued. Instead, our efforts will be directed exclusively toward our Admiralty Island study site where we will be monitoring the effects of the development of the Greens Creek Mine on brown bears.

Since fall 1981, 7 radio-collared bears have been harvested by hunters, 3 bears have been killed in defense of life or property, 4 bears have died during capture, 1 female bear was killed and eaten by a male bear before she had recovered from immobilization, 4 bears have died from unknown causes, the radio collars of 33 bears have been transmitting, and 37 bears have been unaccounted for (probably because the batteries have run down down or the transmitters have failed).

Habitat Use and Movements

The primary objective of our research on Chichagof Island was to assess the effect of logging activities on brown bear movements and habitat use. During the 1986 field season, we collected 213 relocations of radio-collared bears on Chichagof Island. The proportional habitat use by these bears was (1) old growth forest, 38%; (2) avalanche slopes, 20%; (3) riparian old growth, 18%; (4) tidal wetlands, 11%; (5) alpine/subalpine areas, 6%; (6) fish streams, 4%; (7) clearcuts, 2%; and (8) miscellaneous habitats, 2%. Since the 1983 field season, we have collected 866 relocations of radio-collared brown bears on Chichagof Island. During that period, only 20 relocations (2%) occurred in clearcuts; 4 relocations, in second-growth forests. Clearcuts make up approximately 6% of the Chichagof study area. During the next year, we will evaluate the habitat preferences of individual bears by comparing habitat use with availability of habitat types within their home ranges. The data collected thus far, however, indicate that bears are avoiding clearcuts.

Twenty-four hour ground observations of clearcuts in the Corner Bay drainage of Chichagof Island revealed no nocturnal habitat preference for clearcuts by bears. During 131 hours of ground observation, four out of 15 bear sightings (27%) occurred in clearcuts, and none of those were during hours of darkness, a time when survey flights are impractical (Table 3). From these data, we have concluded that our aerial telemetry surveys (conducted between 0600 and 2100 hrs) have provided a representative sample of bear habitat use.

In over 20 hours of roadside surveys conducted during this same time period, only 4 observations were made of bears in clearcuts (Table 4). An additional observation was made of a bear and her cubs walking several miles on a logging road to a garbage dump; another sighting of a single bear was made at the same dump. Throughout this period, we accounted for a minimum known adult population of 9 bears along the roads and clearcuts under observation.

At the same time that the intensive 24-hr observations were being conducted, telemetry surveys were conducted periodically during the day. Four radio-collared female bears (#'s 7, 15, 32, 53) were in the vicinity of our observation site and the adjacent clearcuts. Of 28 relocations, 14% occurred in clearcuts, while the rest occurred in old growth forests, avalanche slopes, or alpine/subalpine areas (Table 5). When a bear was located in a clearcut, we spent up to 20 min circling it with the power back to avoid disturbing the animal. On several occasions, the bears appeared to be simply travelling through the clearcut to the logging road, then following the

road out of the cut. In the other cases, the bears were again moving through the cut but were feeding on berries while travelling.

We suspect brown bears make limited use of clearcuts because the foraging habitat is not as good as that of the other sites (i.e., alpine/subalpine areas, wetlands, riparian old growth forests, avalanche slopes). Those habitats have more succulent herbaceous forage and more abundant berry crops than clearcuts. Second-growth forests with their impoverished understory have virtually no value as foraging sites for bears.

On Admiralty Island, major road building began in the lower Greens Creek drainage during late fall of 1985 after the bears had moved off the fish streams. Roadbuilding, including major blasting and operation of heavy equipment, continued throughout the spring, summer, and fall of 1986. During the 1986 field season, we monitored the movements of 11 radio-collared bears inhabiting the lower Greens Creek drainage during late summer when salmon were spawning in both Greens and Zinc Creeks. All 11 bears remained in this area; some, within several hundred meters of the development activity. However, intensive telemetry surveys conducted 3 times each day indicated bears shifted away from the immediate vicinity of construction activity and then moved in closer to the road when activity ceased during late evening hours. Several of the instrumented bears had been monitored along Zinc and Greens Creeks in previous years before development. Though we were at first surprised bears stayed in such close proximity to development activity, we recognized that they were attracted to abundant spawning salmon. The forest apparently provided sufficient cover for them to remain in the area.

In November 1985 we identified 57 day beds and recorded their locations along a 1.6-km strip (approximately 120 m in width) on both sides of lower Zinc Creek. We used this day bed survey as a relative index of bear use in this area prior to development activities. On 15 October 1986 following major road construction, we again conducted a day bed survey along that same section of Zinc Creek; however, we only counted 17 day beds (Table 6). Additionally, the proportion of day beds west of the creek increased substantially; more than half of the beds occurred there. Many of the day beds identified during the initial survey had been buried under broken rock and debris from road construction. Mean distance of day beds from the creek was 41 m (SE = 6.8). Because this distance was closer than that for the previous survey, it probably reflects the heavy disturbance on the east side of the creek caused by road-building activities. Seventy-six percent of day beds were associated with spruce or hemlock trees with a mean dbh

of 111 cm. Though our day bed survey suggested bears avoided the streamside area adjacent to road development, our telemetry data indicated they remained in the lower Greens and Zinc Creek drainages. We think the bears just shifted their movements away from active development.

Though there were 40 to 60 personnel involved in construction of the road, few people observed a bear from the ground, and there were no known bear-human encounters. We attribute the lack of "bear problems" to the camp's rigid garbage policy. All garbage is incinerated daily, and crew members are prohibited from throwing garbage or food stuffs away in the field. Additionally, the camp has a policy against recreational hiking on the site. The success of the Greens Creek Mine Company in minimizing "bear problems" is in direct contrast with the situation at the Corner Bay Logging Camp, which is using an open-pit garbage dump. This is even more significant when you consider that the density of bears in the Greens Creek area is higher than at Corner Bay.

Alpine Trend Counts and Density Estimates

We have conducted aerial alpine trend surveys on northern Admiralty since 1983 (Table 7). In 1986 these surveys were conducted as a second priority to our mark-recapture density estimates. Thus the length of survey and area covered differed slightly from previous surveys. This is reflected in a lower mean bear/hr sighting rate than in prior surveys. During our 1986 surveys, we observed more cubs of the year and a higher ratio of cubs:100 adults.

On the evening of 7 July 1986, we simultaneously conducted 4 separate aerial surveys of the alpine areas and tidal wetlands of Admiralty Island. We divided the island into 4 major sections and covered approximately 80% of them in about 12 hrs of flying time. During that survey, we counted 223 bears, including 176 adults and 47 cubs. This represented a ratio of 26.7 cubs:100 adults and 18.6 bears/hr of survey time. The bear/hr value compared closely to that of our intensive study area. However, the cub:100 adult ratio was much lower. If we assume an observability of about 20%, which is nearly the mean of 4 yrs of trend surveys, then we estimate a population of 1,115 bears over the survey area (80% of the island).

We conducted 4 replicate surveys as part of an intensive mark-recapture density estimate of brown bears on our northern Admiralty Island study area during July. Marginal weather prohibited us from completing additional surveys. Mean sightability of marked bears was 27%. Mean number of bears in the study site was 144 (Table 8). This represents a density

of 0.42 bears/km² (1.02 bears/mi²), with 95% confidence limits of 115 and 169 (Fig. 2). Mean number of adults (2 years of age) was 107, or 0.31 bears/km² (0.76 bears/mi²).

Compared with other areas of Alaska, the observability of bears in Southeast is very poor because of the dense forest canopy. The exceptions to this factor are high-elevation alpine areas and tidal wetlands. During the late-June to early July census period, all of our radio-collared bears (including bears captured in the alpine area by helicopter and on fish streams in snares) used upper alpine habitat extensively, while some used wetland habitat to a lesser degree. Observability was excellent in these areas, and this is where we concentrated our search effort. Search time varied from 1.5 to 2.5 hrs; the mean was 2.1 hrs. This is equivalent to 0.4 min/km² for the entire area or 1.4 min/km² when we consider just the open areas (alpine and wetlands). Fortunately, our survey techniques worked well at the Admiralty study site; however, the situation was not as good in our Chichagof study site where open alpine habitat is less abundant. Thus applicability of these techniques in Southeast will be limited to those areas with seasonal concentrations of bears in habitats with good observability.

For surveying high densities of bears, we think our techniques were efficient and cost-effective. In addition to previously marked bears in the area, we marked or re-marked 11 bears during the month prior to the census; an additional 11 bears were also marked over the census period. Our survey time for the small study area was relatively minimal (1.5-2.5 hr), and the ferry time from Juneau was only 8 min. Thus we were able to do all of the survey work with one aircraft. Our biggest problem was finding good flying weather. In order to survey the alpine areas, we needed ceilings of at least 1,200-1,500 m. This condition is uncommon in Southeast Alaska, and it is the major reason why we had only completed 4 survey flights from 2 through 18 July. After that time period, many bears start moving out of the alpine areas and become virtually invisible.

We would, of course, prefer a narrower confidence interval on our population estimate. We suspect precision would have increased with additional surveys but recognize that more surveys, though cost-effective in our study area, may not always be practical because of the marginal flying weather typical of Southeast.

In our census trial, we were confident that we satisfied the assumption of a closed population. The assumptions of independence and equal sightability could be achieved only by looking at bears older than 2 years (i.e., eliminating all cubs from the analysis). In our sample, we believe that all

the cubs of marked bears were 2-year-olds or younger. In our sample, cubs represented 36% of all bears observed. Using this value as a correction factor for the estimated mean number of bears older than 2 years ($\bar{N}$ = 107), the total population (including cubs) is estimated at 166 bears. If we include cubs in our original capture/recapture census (violating the assumptions of independence and equal sightability), our total population estimate is 144, which is 13% lower than the corrected estimate.

Other than cubs, the only obvious violation of equal sightability would be our "interior" bears, which do not use coastal areas. These bears, primarily females and their young, stay at higher elevations in less forested habitat throughout the year and would likely have a higher probability of being observed on any given survey. During our census, interior bears represented 11% of our sample. If we assume that a comparable proportion of the entire population consists of interior bears (a reasonable assumption), then this should not greatly affect the results of the census.

We do not believe tagging operations greatly influenced the survey results. Only 2 bears were actually captured on the same day as a census flight, and these were captured after completion of the flight. Survey flights were conducted on 2, 7, 9, and 18 July. No capturing was conducted within 2 days prior to a survey flight; however, we believe that any extensive fixed-wing or helicopter flying in the area less than 2 days before the census would reduce the number of bears observed.

We plan to repeat this mark-recapture density estimate next year and increase our individual surveys to 5 or 6. Additionally, a population estimate should be conducted in the study site after major development of the mine has been completed (10-20 yrs). In the interim, we plan to conduct replicate alpine counts in the area to monitor population trends. We believe this is a good potential tool for monitoring populations in Southeast Alaska where alpine habitat is abundant.

We also believe there is good potential for monitoring brown bears with an infrared scanner, which we tested during August 1986. These devices can be used at night or early morning in alpine areas, on tidal wetlands, or along anadromous salmon streams. To gain maximum effectiveness along fish streams, however, the scanner should be mounted on a helicopter (rather than a fixed-wing aircraft) in order to follow a stream course. It would also help to have the scanner mounted on a gyro to keep it pointed down during turns.

Another census technique previously used in Southeast is the counting of bear tracks along salmon streams. Although Klein's (1958) evaluation of this technique indicated there were problems distinguishing tracks of different bears, it is interesting to compare previous work using this technique with our estimates. Dufresne and Williams (1932) surveyed all the major salmon streams in the Admiralty, Baranof, and Chichagof Islands. They counted 149 bears on northern Admiralty Island in the general vicinity of our study site. This compares reasonably well with our estimate of 144 bears and suggests that the population density has not changed significantly in 50 years. Their estimate for all of Admiralty was 900 bears. If we were to directly extrapolate our study site density (0.42 bears/km^2) to the entire island, the result would be about 1700 bears. Though the density probably varies significantly over the island, an island population of 1200 to 1500 bears may be a reasonable estimate.

Reproduction

During spring 1987, we monitored 12 different family groups on Admiralty Island. Intensive field work was discontinued on Chichagof Island, so our data there are incomplete. From data collected on marked females over a 6-yr period (Tables 9 and 10), it is apparent that cub mortality is high (about 40%) during the 1st year of life. Age at first breeding is variable, but it generally exceeds 5 years. During the winter of 1986-87, 2 females denned with 2-year-old cubs. Thus it appears that some litters may stay with their mothers longer than previously expected for coastal brown bears. There appears to be much variability in maternal behavior and frequency of litter production in brown bears from Southeast Alaska.

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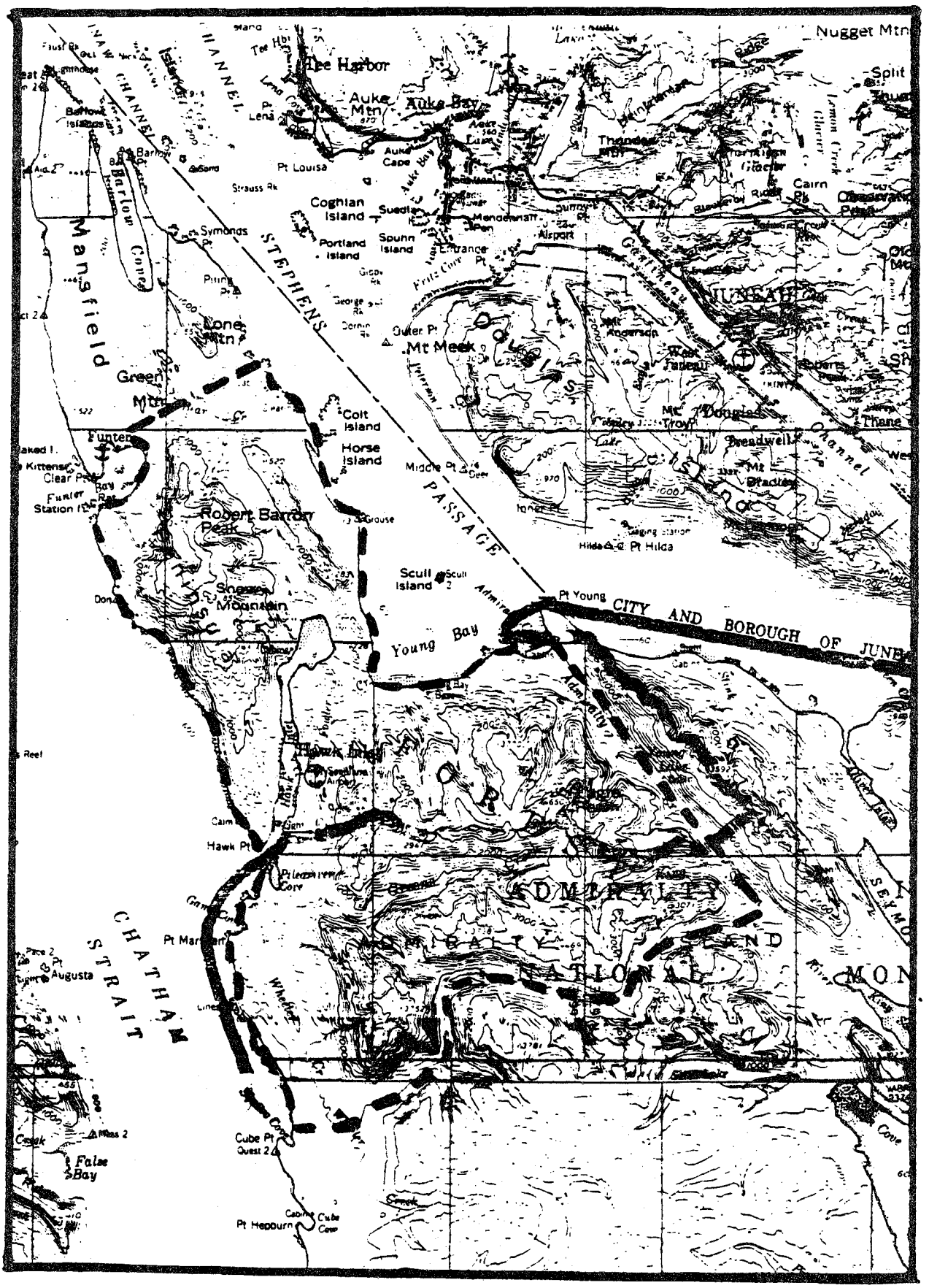
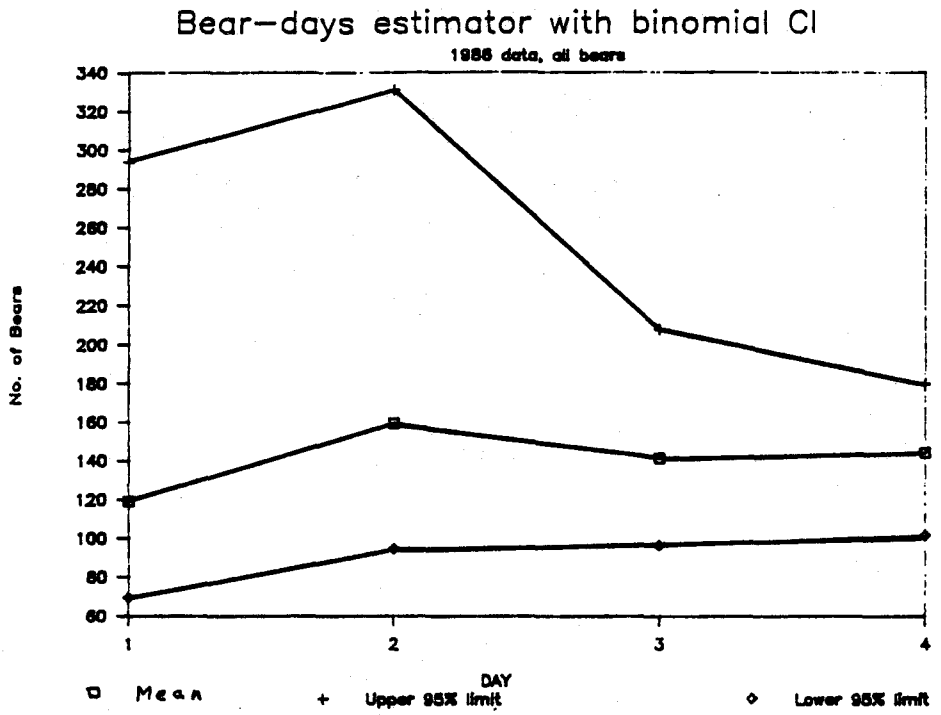


Figure 1. Brown bear study site on northern Admiralty Island with census area outlined by dashed lines.



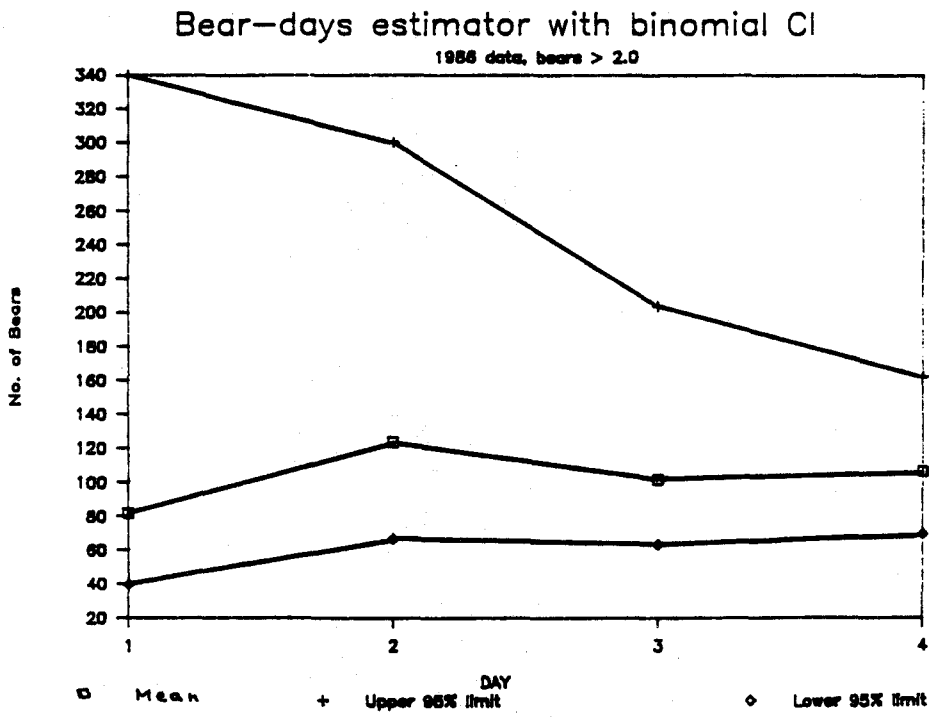


Figure 2. Estimated mean number of total bears and adult bears including 95 percent confidence intervals by survey day.

Table 1. Summary and status of brown bears captured on Admiralty Island, fall 1981 through 30 June, 1987.

Bear No.	Location	Sex	Capture (recapture) Age[a]	Weight (kg)[b]	Date	Capture techniques[c]	Current status (30 June 1987)
51	Greens Cr.	M	1	60	8-28-81	s	radio lost 9-81
60	Greens Cr.	F	20	160(135)[d] (125)[d]	9-21-81(7-2-82) (7-8-85)(7-3-86) (6-28-87)	h	transmitting
59	Greens Cr.	M	3	80(113)[d]	9-21-81(8-8-82)	h	mortality (5-1-83)
58	Eagle Peak	M	4	180(194)	9-21-81(8-8-82)	h	last located 9-84 Hood Bay
36	Mansfield Pen.	F	14	230	9-26-81	h	radio lost 5-82
50	Greens Cr.	M	3	120(146)	9-26-85(6-17-83)	h	radio lost 5-85
14	Greens Cr.	F	7	120(90) (95)[d]	9-26-81(7-2-82) (7-5-85)	h	transmitting
43	King Salmon	F	15	250(114)	9-27-81(7-3-86)	h	transmitting
6	King Salmon	F	8	150(153)	9-27-81(6-14-83)	h	radio lost 5-86
62	Admiralty Cove	F	14	150	6-16-82	s	? last located 9-86
B-14	King Salmon	F	2	100	9-26-81	h	mortality
10	Greens Cr.	M	11	280[d] (288)[d] (315)	7-2-82(7-8-85) (6-9-86)	h	? last located 5-87
38	Greens Cr.	F	23	280(180)[d]	7-2-82(7-8-85)	h	mortality 5-86
99	Greens Cr.	F	17	200(158)	7-8-82(6-21-84)	h	radio lost 9-85
95	Mansfield Pen.	F	8	170	7-8-82	h	radio dead 6-86
72	Eagle Peak	M	6	200	7-8-82	h	? last located 9-86
34	Mansfield Pen.	F	2	70	7-8-82	h	hunter kill 9-83
63	Greens Cr.	F	17	160	7-8-82	h	? last located 10-84
20	Greens Cr.	F	5	100(135)[d]	7-30-85(5-1-83)	s/h	mortality 5-1-83
56	Greens Cr.	F	13(14)	170(158)[d]	7-30-82(7-8-85)	s	transmitting
48	Greens Cr.	M	adult	300	8-3-82	s	radio lost 6-83
39	Mansfield Pen.	F	9(9)	270(171)[d]	8-7-82(7-9-85)	s/h	transmitting
37	Mansfield Pen.	F	10	270	8-3-82	s	hunter kill 10-83
67	Greens Cr.	F	2	60	81-2-82	s	no radio; sighed 9-28 Lake Florence, 6-85 Pack Cr.

Table 1. Continued.

Bear No.	Location	Sex	Capture (recapture) Age[a]	Weight (kg)[b]	Date	Capture techniques[c]	Current status (30 June 1987)
7	Pack Cr.	F	11	150	8-26-82	d	no radio, sighted 6-85 Pack Cr.
11	Pack Cr.	M	4	120	8-28-82	t	hunter kill 5-83
8	Pack Cr.	F	10	150	8-26-82	t	transmitting
9	Pack Cr.	F	1	54	8-26-82	d	no radio, sighted 6-85 Pack Cr.
91	Pack Cr.	F	19	162[d]	6-21-83	h	?
92	Pack Cr.	F	16	158[d]	6-21-83	h	radio lost 5-86
93	Pack Cr.	M	5	158[d]	6-21-83	h	transmitting
94	Pack Cr.	F	10	156[d]	7-13-83	t	? last located 8-87
40	Greens Cr.	M	10	180	6-21-83	h	? last located 8-85
13	Greens Cr.	M	15+	284[d] (270)[d] (270)	6-14-83(7-6-84) (6-11-86)	h	transmitting
55	Greens Cr.	F	7	124(155)[d]	6-21-83(7-10-86) (6-26-87)	h	transmitting
35	Wheeler Cr.	F	8	135[d]	6-17-83	h	mortality
18	Greens Cr.	M	6	214[d]	6-17-83	h	? last located 8-85
16	Greens Cr.	F	4	90[d] (170)[d]	6-17-83(6-28-87)	h	transmitting
66	Greens Cr.	M	4	180[d]	6-22-83	h	? last located 8-85
64	Eagle Peak	F	14	190[d] (159)	6-24-83(7-3-86	h	transmitting
57	Greens Cr.	F	11	203[d]	9-28-83	h	? last located 7-85
68	Greens Cr.	F	5	146[d]	9-28-83	h	radio lost -86
4	Greens Cr.	F	6	214[d]	9-29-83	h	? last located 10-84
19	King Salmon	F	13	191	9-29-83	h	mortality
41	Mansfield Pen.	M	2	135	6-21-84	h	hunter kill 9-86
49	Mansfield Pen.	M	3	100	6-16-84	h	no radio ?
81	Mansfield Pen.	F	14	200	6-21-84	h	? last located 9-85
29	Wheeler Cr.	F	12	158	7-5-84	h	? last located 11-84
69	Greens Cr.	M	(2)	59	7-9-85	h	radio lost 5-86

Table 1. Continued.

Bear No.	Location	Sex	Capture (recapture) Age[a]	Weight (kg)[b]	Date	Capture techniques[c]	Current status (30 June 1987)
79	Greens Cr.	F	(4)	124	6-11-86	s	hunter kill 9-87
27	Greens Cr.	M	(3)	77	6-11-86(6-28-87)	s/h	transmitting
28	Greens Cr.	M	adult	260	6-11-86(7-10-86)	s/h	hunter kill 5-87
61	Hawk Inlet	M	adult	215	6-12-86	s	transmitting
77	Greens Cr.	M	(3)	115	6-26-86	h	? last located 9-86
46	Greens Cr.	M	adult	248[d]	6-26-86	h	transmitting
52	Greens Cr.	M	adult	190	6-26-86	h	transmitting
98	Greens Cr.	M	adult	315[d]	6-26-86	h	transmitting
96	Mansfield Pen.	F	(7)	148	7-3-87	h	transmitting
89	Eagle Peak	F	(10)	150[d]	7-9-86	h	DLP[e] 8-87
84	Wheeler Mt.	F	(10)	148[d]	7-9-86	h	transmitting
97	Greens Cr.	M	(12)	293[d]	7-10-86	h	transmitting
76	Greens Cr.	M	(3)	130[d]	7-10-86	h	transmitting
78	Greens Cr.	F	(3)	91	7-10-86	h	mortality 8-86
85	Wheeler Mt.	F	(7)	150	7-11-86	h	transmitting
25	Greens Cr.	M	(2)	68	6-26-87	h	transmitting
71	Wheeler Mt.	F	(6)	148	6-29-87	h	? last located 8-87
54	Eagle Peak	M	(3)	73	6-26-87	h	transmitting

[a] Age determined by tooth section or (estimated).

[b] Weight estimated.

[c] h = helicopter
s = snare
t = trap
d = darted, free ranging.

[d] Actual weight.

[e] DLP = defense of life and property kill.

Table 2. Summary and status of brown bears captured on Chichagof Island, summer 1983 through 30 Sept., 1986.

Bear No.	Location	Sex	Capture (recapture) Age[a]	Weight (kg)[b]	Date	Capture techniques[c]	Current status (30 June 1987)
23	Kadashan	M	5	158[d]	6-23-83	h	last located 10-83
21	Corner Bay	F	adult	169[d]	6-23-83	h	radio lost 6-85
88	Kadashan	M	5	167[d] (190)	6-23-83(7-18-85)	h	DLP mortality[e]
24	Corner Bay	F	16	225[d]	6-23-83	h	radio lost 9-84
12	Kook Lake	F	3	100	6-24-83	h	radio lost 8-84
30	Kadashan	M	3	126[d] (136)	6-24-83(9-16-83)	h/s	DLP 11-86
2	Crab Bay	M	6	216[d]	6-24-83	h	last located 7-84
73	Kadashan	F	11	158(181)[d]	8-8-83(7-12-84)	s	transmitting
18	Kadashan	M	19	215	9-16-83	s	hunter kill 5-84
44	Kadashan	F	adult	272	9-17-83	s	found dead 9-84
90	Corner Bay	M	4	135	9-22-83	d	radio lost, sighted 5-84 Portage
32	Kadashan	F	5	136	7-10-84	s	transmitting
11	Kadashan	F	2(3)	118(100)[d]	7-10-84(6-20-85)	s/h	transmitting
82	Kadashan	F	4	145[d] (158)[d]	7-11-84(7-15-85)	s	transmitting
53	Kadashan	F	16	215	7-12-84	s	transmitting
65	Corner Bay	F	2	79	7-19-84	s	lost radio, last sighted 6-85 Corner Bay
33	Corner Bay	F	(3)	79	7-19-84	s	not transmitting, sighted 7-85 Kadashan trap
26	Kadashan	F	adult	200[d] (180)	7-21-84(8-1-85)	s	lost radio 5-86
9	Kadashan	F	adult	154[d]	7-21-84	s	radio lost 8-84, sighted 7-85 Kadashan
3	Kook Lake	M	3	136[d] (167)[d]	10-2-84(7-18-85)	s	last located 4-86, Lisianski R.
22	Kook Lake	F	3	91[d]	10-8-84	s	transmitting
17	Crab Bay	M	4	200[d]	6-18-85	h	transmitting

Table 2. continued.

Bear No.	Location	Sex	Capture (recapture) Age[a]	Weight (kg)[b]	Date	Capture techniques[c]	Current status (30 June 1987)
5	Crab Bay	F	4	118[d]	6-18-85	h	transmitting
70	Kadashan	M	4	163[d]	6-18-85	h	last located 7-86
15	Corner Bay	F	5	113[d]	6-18-85	h	transmitting
25	Crab Bay	F	15	159[d]	6-20-85	h	last located, 8-86
7	Kadashan	F	17	160	7-19-85	s	transmitting

[a] Age determined by tooth sectioning or (estimated).
[b] Weight estimated.
[c] h = helicopter
s = snare
t = trap
d = darted, free ranging.
[d] Actual weight.
[e] DLP = defense of life or property.

Table 3. Observations[a] of brown bears in the Corner Bay watershed, Chichagof Island, over 24-hour periods from 1645 hours on June 6 to 1100 hours on June 13 and from 1400 hours on July 15 to 1200 hours on July 18, 1986.

Date	Time	Habitat	No. bears	Marked bear
6/10	1645	clearcut	1F/3 cubs	--
6/11	0930	avalanche slope	1F/2 cubs	#53
6/11	1445	clearcut	1F/3 cubs	--
6/11	2150	avalanche slope	1F/2 cubs	#53
6/12	1355	avalanche slope	1F	#15
6/12	2200	avalanche slope	1F	#15
7/16	1603	alpine meadow	1F	#15
7/16	1702	alpine meadow	1F	#15
7/16	1838	alpine meadow	1F	#15
7/16	1908	alpine meadow	1F	#15
7/16	2005	avalanche slope	1F/2 cubs	#53
7/17	1648	alpine meadow	1F/2 cubs	--
7/17	2041	alpine meadow	1F/2 cubs	#53
7/18	0608	clearcut	1F/2 cubs	#53
7/18	0745	clearcut	1F/2 cubs	#53

[a] Total observation time was 131 hours (excluding a gap of 5 hours from 2300 (6/12) to 0400 (6/13).

Table 4. Observations of brown bears during surveys along the Corner Bay road system on Chichagof Island, 1986.

Date	Time	Habitat	No. bears	Approximate Survey Length (hours)
6/10	1930	clearcut	1	2.5
6/11	1700	road	1F/3 cubs	1.0
6/11	2000	clearcut	1	2.7
6/11	2240	clearcut	1	
6/12	0730		0	1.5
6/12	1900	dump	1	1.4
6/13	0700		0	2.1
7/15	1600		0	1.5
7/16	0730		0	1.5
7/16	1400		0	1.5
7/17	0800	clearcut	1	1.5
7/17	1700		0	1.5
7/18	1200		0	1.5

Table 5. Aerial relocations of radio-collared brown bears (Nos. 53, 15, 7, 32) located in vicinity of intensive 24-hour observations of the Corner Bay watershed during June and July 1986.

Date	Time	Relocations			
		Old growth	Clearcut	Avalanche slope	Alpine meadow
6/10	0900	1	0	3	0
6/10	2100	2	0	2	0
6/11	0630	3	0	1	0
6/11	1430	2	0	2	0
7/15	1030	2	1	0	0
7/15	1730	0	1	1	1
7/16	0600	0	0	1	2
7/16	1330	0	2	0	1
		% = 36	14	36	14

Table 6. Summary of brown bear day bed survey along 1.6 km of lower Zinc Creek, Admiralty Island, before road development in 1985 and during road development in 1986.

Date	Number of estimated day beds (%)		Total
	E[a]	W[b]	
1985	42 (82)	15 (36)	57
1986	8 (47)	9 (53)	17

[a] East of creek adjacent to road.

[b] West of creek away from road.

Table 7. Summary of alpine bear surveys conducted on northern Admiralty Island from 1983 through 1986.

	1983	1984[a]	1985	1986[b]
Survey time (hrs)	1.8	1.0	1.5	2.1
Bears observed:				
adults	28.0	18.0	30.0	24.5
cubs of year	7.0	2.5	5.0	8.0
total cubs	14.0	10.5	6.0	14.0
cubs:100 adults	50.0	36.2	20.0	57.1
Total	42.0	28.5	36.0	38.5
Bears/hour	23.3	28.6	24.0	18.3
area (km^2)	390	390	390	344
Sightability of marked bears	16%	23%	20%	27%
Estimated density based on mark-recapture (bear/km^2)	0.67	0.28	0.46	0.42

[a] mean of 2 surveys.

[b] mean of 4 surveys.

Table 8. Mark-recapture[a] density estimate for brown bears on northern Admiralty Island[b], 1986.

Date	n_1[c]	m_2[d]	n_2[e]	Sightability	Est. cumul. bear days	Avg. # bears $\underline{N}$	95% CI (binomial)	Bear density bear/km² (mi²)
All bears								
7/2	25	7	36	0.28	119.3	119.3		0.35 (0.85)
7/7	28	4	34	0.14	318.5	159.3		0.46 (1.13)
7/9	28	10	43	0.36	423.9	141.3		0.41 (1.0)
7/18	41	11	41	0.27	576.7	144.2	-29.5 to (+) 24.4	0.42 (1.02
Bears > 2 years of age								
7/2	17	4	22	0.24	81.8	81.8		0.24 (0.58)
7/7	19	2	24	0.11	247.4	123.7		0.36 (0.88)
7/9	19	6	24	0.32	304.8	101.6		0.30 (0.72)
7/18	26	6	28	0.23	426.3	106.6	-24.5 to (+) 52.0	0.31 (0.76)

[a] $\underline{N} = \frac{(n_1 + 1)\ (n_2 + 1)}{m_2 + 1} - 1$

[b] The study site is 344 km² (141 mi²).

[c] n_1 = # of marked bears in population.

[d] m_2 = # of marked bears observed.

[e] n_2 = total # of bears observed.

Table 9. Reproductive history of radio-collared female brown bears on Admiralty Island, 1981-87.

Bear No.	Age at capture (yrs)	Offspring[a] by year						
		1981	1982	1983	1984	1985	1986	1987
60	20	1 2-yr	0	2 Coy[b]	1 Coy	1 1-yr	1 2-yr	1 3-yr
36	14	2 Coy	--					
14	7	0	0	0	2 Coy	0[c]	0	2 Coy
43	15	0	2 Coy	2 1-yr	--	--	--	2 Coy
6	8	0	0	1 Coy[d]	0	0	--	
62	14		0	0	0	0	0	--
38	23		0	0	0	0	0	--
99	17		2 3-yr	2 Coy	2 1-yr	1 2-yr[d]	--	
63	17		2 cubs	0	0	2 Coy	--	
95	8		2 1-yr	2 2-yr	0	2 Coy	2 1-yr	--
34	2		0	0				
56	13		2 2-yr	2 3-yr	2 Coy	2 1-yr	2 2-yr[e]	1 Coy
67	2		0	--				
37	10		0	1 Coy	--			
39	9		0	0	2 Coy	0[d]	1 Coy	?
7	11		1 Coy	1 1-yr	1 2-yr	--		
8	10		0	0	2 Coy	2 1-yr	2 2-yr	2 3-yr[e]
9	Coy		0	0	0	0	0	0[g]
35	8		0	--				
16	4		0	0	--	--	0	
91	19		0	--				
92	16		0	2 Coy	--			
55	7			0	--	--	1 1-yr	1 2-yr
64	14			1-yr	1 2-yr[e]	2 Coy	2 1-yr	2 2-yr
94	10			0	2 Coy	2 1-yr	2 2-yr[e]	2 Coy
57	11			2 2-yr	2 3-yr	2 Coy	--	
68	5			0	0	0	0	--
4	6			0	2 Coy	2 1-yr	--	

Table 9. Continued.

Bear No.	Age at capture (yrs)	Offspring[a] by year						
		1981	1982	1983	1984	1985	1986	1987
19	13			1 2-yr	--			
81	14				0	0	--	
29	12				3 1-yr[f]	0	--	
79	4						0	0[g]
84	10						2 Coy	2 1-yr
85	7						1 Coy	1 1-yr[h]
89	10						2 Coy[f]	2 1-yr
96	7						3 Coy	2 1-yr
78	3							0
71	6							0

[a] Coy = cub of year
1-yr = yearling
2-yr = 2-year-old
cub = cub older than COY
0 = no cubs observed.
[b] Male killed cubs in June.
[c] Female ate cubs in den.
[d] Cubs disappeared over winter.
[e] Cubs left over summer.
[f] One cub disappeared over summer.
[g] Observed breeding.
[h] Female killed DLP 8-87.

Table 10. Reproductive history of radio-collared female brown bears on Chichagof Island, 1983-87.[a]

No.	(yrs)	1983	1984	1985	1986	1987
21	Adult	0	3 Coy	3 1-yr	--	--
24	16	0	2 Coy	--	--	--
12	3	0	0	0	--	--
73	11	0	2 2-yr	0	3 Coy	3 3-yr
44	Adult	0	3 Coy[b]	--	--	--
32	5		0	0	0[f]	--
11[c]	2	0	0[c]	0	0[f]	--[f]
82	4	0	0	0	0	0
53	16		0	2 Coy	2 1-yr	--
65	2		0	0	--	--
33	2		0	0	0	--
26	Adult		2 cubs[d]	1 2-yr[e]	--	--
9	5		0	0	--	--
22	3		0	0	0	--
5	4			0	0	--
15	4			0	2 yr	--
25	11			2 1-yr	2 yr	--
7	17			2 1-yr	2 2-yr	--

[a] Coy = cub of year
1-yr = yearling
2-yr = 2-year-old
cub = cub older than Coy
0 = no cubs observed.

[b] Female found dead by midsummer.
[c] Offspring of No. 73.
[d] Cubs different sizes.
[e] Cub gone by 7-85.
[f] Observed breeding.

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