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Population and Habitat Ecology of Brown Bears on Admiralty and Chichagof Islands

by

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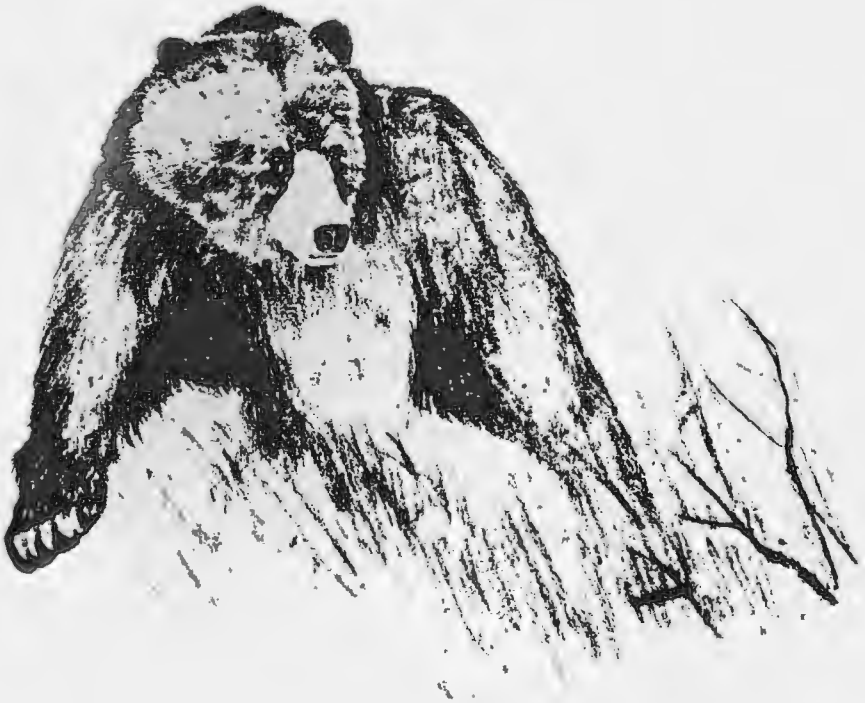

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SUMMARY

Brown bears were monitored in association with the Greens Creek Mine, Admiralty Island, Alaska, during this report period. In April 1993, Greens Creek Mine suspended mining operations. A mark-resight density estimation field study was initiated in June 1993 to determine brown bear density near the mine. Eight replicate mark-resight fixed-wing surveys were conducted and a mean daily Lincoln-Petersen estimate of 158 brown bears was found on the 344 km^2 study area. The density of 461 brown bears/1,000 km^2 of all ages was within the 95% confidence interval of densities obtained in 1986 and 1987. We conclude that the brown bear management program instituted by Greens Creek Mining Company was successful in maintaining bear populations over the study period.

During summer 1992 we conducted a mark-resight brown bear density estimate on a 1,112 km^2 study area that included the northeast portion of Chichagof Island. This area is highly roaded and intensively managed for timber harvest. Six successful mark-resight replicates were obtained. A population of 354 brown bears of all ages was estimated with a density of 318 brown bears/1,000 km^2. The density of brown bears on the northeast portion of Chichagof Island was 31% lower than that for the northern Admiralty Island study area. A total of 97 brown bears have been radio-collared from 1981 through 30 June 1993 on Admiralty Island. During the summer of 1993, 34 active radio-collars were on bears and being monitored. In the last report period the first mine-related death of a problem brown bear occurred. During this report period, two additional brown bears were killed as the result of mining activities.

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INTRODUCTION

The size of a wildlife population is one ultimate factor that may be affected by resource development activities that change a species habitat. Wildlife associated with pristine landscapes can be negatively affected by changes to that landscape even though only a small portion of their habitat is altered. Brown bears (*Ursus arctos*) are one species that have been studied in some locations relative to resource development (e.g., Archibald 1987, Ballard et al. 1990, McLellan 1990, Schoen and Beier 1990, Titus and Beier 1992). These studies may have taken place over >5 years and are lengthy for wildlife studies, yet they are often too short to document population changes for long-lived brown bears. Because population turnover rates are low for brown bears, only overt population changes caused by high mortality rates and/or low recruitment will result in a noticeable short-term population decline. Therefore, a variety of natural history attributes require monitoring to detect short-term proximate responses that can result in longer-term population changes.

Brown bears occur in high densities in portions of coastal Alaska (e.g., Schoen and Beier 1990, Barnes et al. 1988). It is believed that brown bear dependence on spawning salmon as part of their annual nutritional pattern is responsible for this high density (McCarthy 1989, Barnes 1990). Resource development that alters access to salmon may reduce survival and

cub production and result in a lower population size. Resource development that provides easier access to remote areas increases hunting opportunity and can lead to increased defense of life and property deaths and illegal taking of brown bears. Therefore, it is useful to estimate population size at periodic intervals to determine the success of management programs that seek to maintain healthy brown bear populations.

The mountainous landscape and temperate rainforest of coastal southeast Alaska present problems in monitoring bear populations. Brown bears inhabit remote areas, and like many other forest wildlife they are not easily counted on an annual basis to develop a population index and time-trend (Kendall et al. 1992). Reynolds and Hechtel (1988) McLellan (1989) and others estimated density by intensive marking efforts and subsequent density estimation using telemetry data and home range over a study area.

High bear densities make it impractical to capture a significant portion of the brown bear population on our study areas. We used radio-telemetry and replicated capture-mark-resight (CMR) techniques to estimate density and correct for population closure. Miller and Ballard (1982) were among the first to use CMR techniques for brown bear population estimate and these methods have been used to estimate other large mammal populations such as deer (Rice and Harder 1977), and mountain sheep (Neal et al. 1993).

We estimated brown bear densities on two study areas in southeast Alaska. On the northeast portion of Chichagof Island we estimated density because of a belief that brown bear populations had declined due to high legal hunting levels, defense of life-and-property deaths, and illegal harvests during the 1980s. The increase in brown bear mortality was correlated with easy road access associated with logging activity (Titus and Beier 1992). Brown bear density on the northeast portion of Chichagof Island prior to road building and logging is unknown. We hypothesize that the brown bear density on the northeast portion of Chichagof Island should not differ from the northern portion of Admiralty Island.

The density estimates are a basis for meeting other study objectives such as validating the brown bear habitat capability model, population projection modeling, and establishing a baseline upon which future population changes can be monitored. The density estimate also provides a basis for re-evaluating the current brown bear hunting restrictions on the northeast portion of Chichagof Island.

Brown/grizzly bears have been studied in various North American locations relative to resource development (e.g., Archibald et al. 1987, Ballard et al. 1990, McLellan 1990, Schoen and Beier 1990, Titus and Beier 1992). Most of these studies were conducted on lower density bear populations, or they were of short duration. The high densities of brown bears in southeast Alaska and their seasonal concentrations in low elevation riparian forests (Schoen and Beier 1990) increases the probability of bear-human encounters. The combination of high-density brown bear populations, easily accessed public road system created by intensive forest management, and long-term changes in forest cover are unique aspects of our study.

OBJECTIVES

The scope of our project remained similar to that of the previous reporting period (Titus and Beier 1992). The main emphasis was to evaluate and predict short- and long-term changes in brown bear populations as influenced by man-induced changes to their habitat and demography. Specific objectives include:

1. Evaluate long-term changes in the home range and centers of activity of selected brown bears in the vicinity of Greens Creek, Admiralty Island.

2. Evaluate the degree of site tenacity by female brown bears and their offspring to developed areas of Greens Creek.

3. Determine trends in numbers of brown bears on a 344 km^2 study area centered on Greens Creek.

4. Determine the extent to which brown bears exhibit short-term changes in home ranges or centers of activity as a result of logging activity on northeast Chichagof Island.

5. Determine seasonal and annual home ranges of selected brown bears, particularly in areas where data can be acquired both before and after roadbuilding and intensive logging activities.

6. Evaluate the interagency brown bear habitat capability model with independent data from northeast Chichagof Island.

7. Estimate brown bear density on northeast Chichagof Island.
8. Estimate annual survival and reproduction rates of brown bears on northeast Chichagof Island.

9. Determine the degree of population isolation of brown bears on northeast Chichagof Island.

10. Estimate the types of brown bear mortality on northeast Chichagof Island.

11. Use population projection models for evaluating the future status of brown bears on northeast Chichagof Island given differing demographic parameters.

12. Assess the seasonal distribution and habitat use patterns of brown bears on northeast Chichagof Island.

13. Evaluate survey methods for indexing brown bear populations by indirect methods.

14. Determine the association between logging roads, logging camps and associated development and attributes of annual brown bear harvest in southeast Alaska.

15. Develop management guidelines for intensive land development within southeast Alaska brown bear range.

STUDY AREAS

The Admiralty Island study area is centered on Hawk Inlet and the Greens Creek watershed. This area encompasses 344 km^2 and is described in Schoen (1982) and Schoen and Beier (1983, 1990). During this report period, bear tagging and telemetry flights focused on Greens Creek watershed, Robert Baron Mountain, Wheeler Mountain, and Admiralty Creek.

The northeast Chichagof Island study area is a 1,112 km^2 island-like area north of Tenakee Inlet and east of Port Frederick. A complete description of the study area is found in Titus and Beier (1992). We focused our research activities on portions of the study area during this report period. We targeted the Game and Seagull creeks watersheds (229 km^2) for study because of their high bear density and the roadbuilding and logging activity occurred during this report period.

METHODS

Bear capture, aerial telemetry, and data collection methods followed those of Schoen and Beier (1990) and Titus and Beier (1992). Methods specific to this report period follow.

Mark-resight density estimates

The brown bear mark-resight density estimation technique followed methods developed by S. Miller (e.g., Miller and Sellers 1992) that use a modified Lincoln-Peterson estimate (Seber 1982, Pollock et al. 1990). All brown bears were marked (radio-collared) prior to the resight flights.

Open habitats near the Hoonah dump were part of the northeast Chichagof Island search area. In order to meet the assumptions of the mark-resight technique (Eberhardt 1990, Pollock et al. 1990), we conducted aerial telemetry flights to assure population closure, and to determine if any bears had lost their radio collars during the survey period.

The boundary of the Admiralty Island search area was delineated by Schoen and Beier (1990) and encompassed representative proportions of the different types of bear habitat. This allowed for extrapolation of the density estimate across Admiralty Island. Boundaries of the 344 km^2 study area were determined by examining 10 years of home range data from radio-collared bears. The northern boundary of the Admiralty Island study area was lowland forest

and muskeg areas north of Robert Baron Mountain where radio-collared brown bears rarely travelled. A portion of one female brown bear's home range from 1992 and 1993 was north of this boundary; this bear was in the CMR study area during survey flights. To the east and west salt water formed the study area boundaries. A long, steep stream valley was arbitrarily chosen as the study area's southern boundary. No bears were premarked south of this boundary in the last 4 years.

The boundary of the 1,112 km^2 northeast Chichagof Island study area encompassed all of the peninsula that is connected to the rest of the Chichagof Island by a narrow isthmus. Two prior years of radio-telemetry relocation flights indicated a high, but not complete level of geographic closure. Telemetry flights before and after the CMR surveys indicated that closure was complete for the purposes of CMR.

Mark-Resight Survey Flights

Our density estimate was derived from a series of independent visual searches using a PA-18 fixed-winged aircraft. Predetermined survey routes were followed to ensure complete coverage of alpine, rock, and subalpine habitats while avoiding duplication. Logging roads and clearcut habitats were not targeted for observation.

Telemetry receiving equipment was turned off during searching. When a bear(s) was spotted the telemetry receiving equipment was activated to determine the marked or unmarked status of the individual(s). The visual presence of an eartag (color and left or right ear) aided in determining the status and recognition of an individual bear. This was especially important when >1 bear was spotted at once and a quick determination of each bear's status was necessary. Because some bears had radio-collars and no ear tags, or ear tags and no radio-collars, the presence of a radio-signal was the key factor in determining a bear's status.

When sows with cubs were encountered we visually estimated cub age. Bear locations were plotted on maps but these locations were not provided to the survey team for the next survey. These plots assisted in resolving confusing situations about the status of a particular bear.

All but one of the survey flights were conducted during the evening. Through habitat analysis and direct observation Schoen and Beier (1990) established that during late June and early July southeast Alaska brown bears make extensive use of alpine and subalpine habitats.

Data Analysis

We derived 3 types of brown bear population estimates including 1) bears of all ages, 2) bears > age 2, and 3) independent bears. For the bears of all ages estimate we had to treat all bears seen in groups as independent sightings that have an equal chance of being observed. The bears > age 2 estimate does not include cubs-of-the-year or yearlings in the estimate. The independent bears estimate excludes all cubs with their mother but includes

paired adults and paired siblings. This protocol follows that developed by S. Miller and allows for direct comparison with other estimates that used the same methods.

Population size was estimated using the mean of individual Peterson estimates based on the Chapman single replication estimator (Seber 1982, Eberhardt 1990). Confidence intervals followed Miller et al. (1987) and Seber (1982). Mark-resight analysis software originally developed by S. Miller in LOTUS (Lotus Development Co.) was modified for Microsoft EXCEL for Windows (Microsoft Corp.).

We also conducted the joint hypergeometric maximum likelihood estimator (MLE) based on Bartmann et al. (1987) and White and Garrott (1990). Asymmetric confidence intervals are provided as a part of the MLE analysis and this analysis was provided by S. Miller.

We tested for differences in bear density between Admiralty and Chichagof islands using t-tests for each type of population estimate. We used a two-tailed test under the null hypothesis that there would be no difference in bear density between the two study areas. Each replicate was considered a sampling unit for the analysis.

RESULTS AND DISCUSSION

Admiralty Island/Hawk Inlet Study Area

Greens Creek Mine - Admiralty Island Study. Fourteen brown bears were captured and radio-collared during this report period as part of the long-term study on northern Admiralty Island associated with the Greens Creek Mine. One bear fell to his presumed death over a cliff after darting. One brown bear captured was previously marked in the mid-1980s. As of 30 June 1993, 97 brown bears were radio-collared on this study area beginning in 1981. We monitored 34 active radio-collars during summer 1993 for their location in association with the Greens Creek Mine and on Robert Baron Mountain. Spatial patterns were similar to previous years with the exception of one radio-collared sow (#56) that moved away from a traditionally used portion of her home range where mine development occurred. Bear #12 that was habituated to humans was killed in summer 1992 by an ore truck or other vehicle (Table 1). Bear #12 was the likely son of one of the two radio-collared sows killed during the spring 1992 hunting season. Another brown bear was shot by mine personnel in defense of life and property. A total of 3 brown bears are known to have been killed in association with Greens Creek mining activities. No changes in cub production were noted during this period (Table 2).

1993 Admiralty Island Density Estimate. Premarking of brown bears on the northern Admiralty Island study area began in 1981. One sow first radio-collared in 1982 was sighted during the mark resight survey flights of 1993. A total of 117 brown bears were radio-collared on the northern portion of Admiralty Island from 1981-1993 and 30 brown bears with active radio-collars were present within the study area during the mark-resight period.

This represented 32 bears age >2.0 and 41 bears of all ages that formed family groups (Table 3). To estimate the total number of marked bears in the population we had to guess that bear #53 had 2 cubs in 1993. Despite having an active radio-collar we were unable to observe this bear in the forest.

We conducted 8 aerial mark-resight surveys in July 1993. Weather during this period was unusually dry, clear and hot for southeast Alaska. Sightability of marked individuals was double that for the Chichagof Island surveys. Eighteen of 30 individual marked brown bears were observed on the 8 survey flights. Twelve of these individuals were boars and 6 were sows.

We spotted from 27 to 57 individual bears of all ages in the 8 survey flights and 5 to 12 of these bears were marked (Table 3). Our mean Lincoln-Petersen density estimate of 461 bears of all ages/1000 km^2 was similar to the 491 bears/1000 km^2 for the joint hypergeometric maximum likelihood estimate.

Our density estimate in 1993 repeats those made by Schoen and Beier (1990) in 1986 and 1987. Confidence intervals at the 95% level overlapped among the 3 estimates, although the mean MLE density for 1993 was 23% higher than the 1986 estimate of 399 brown bears/1000 km^2. The impact of the mine did not result in short-term changes in the density of brown bears across the study area. We believe that the established bear management program and employee policies were instrumental in our inability to detect a population change. The study area was much larger than the Greens Creek valley where the mining development occurred. The population may have changed at a smaller scale and we were unable to detect the change.

Northeast Chichagof Island Study Area

No brown bears were captured on the northeast Chichagof Island study area in spring or summer 1993. Five bears were darted and tagged at the Hoonah dump in 1993 and two cubs of sow #180 died (Table 4). Eighty-three bears were captured on this study area from October 1989 through October 1993. The highly forested northeast Chichagof Island study area hampers our ability to observe female bears and determine their reproductive status on an annual basis (Table 5).

Two radio-collared boars were killed outside of the hunting season during this report period. Bear #173 was killed in defense of life by loggers during tree falling operations. Bear #102 was an intermittent visitor to the Hoonah dump over the past three years but in 1993 he was not visiting the dump. Bear #102 was killed illegally 24 km from the dump in Freshwater Bay. His radio-collar was found under tree roots and his body was found floating in Freshwater Bay.

Chichagof Island Density Estimate. We premarked 79 individual brown bears from 1989-1992 and 46 individual radio-collars were active and on brown bears at the beginning

of the mark-resight capture period. Some bears shed their collars, some were killed and at least one bear moved off the study area during the premarking period. The 46 individual brown bears radio-collared represented 50 bears > age 2.0 and 69 bears of all ages that formed family groups (Table 6).

We conducted 8 aerial mark-resight surveys in July 1992. Two surveys were eliminated from analysis because they were incomplete.

Sightability of marked bears was low and varied from 4-17% for the independent bears estimate. Mean sightability varied from 10.5-12.3% indicating that either many bears were not spotted while in alpine and subalpine habitats or that many bears were in forested habitats where they could not be seen. We suspect the latter reason for our low sightability. From 33 to 53 bears of all ages were spotted on the 6 valid surveys.

Combining the survey data on marks present, marks seen, and total number of bears seen, we estimated a mean daily Lincoln-Petersen estimate of 369 brown bears of all ages as the population size. This indicates that 19% of the study area brown bear population was marked representing 17% of the independent (subadult and adults) bears.

Our density estimate of 332 bears of all ages/1,000 km^2 for the mean Lincoln-Petersen estimate was close to the joint hypergeometric maximum likelihood estimate (Bartmann et al. 1987) of 318 bears of all ages/1,000 km^2.

Comparing Admiralty and Chichagof island density estimates. The 1992 MLE density estimate of brown bears on the northeast Chichagof Island study area was 31% lower than that for the 1993 Admiralty Island study area. Eighty percent confidence intervals between MLE estimates did not overlap (Figure 1). Results of t-tests using the daily mean Petersen density estimates indicated that population size differed ($P<0.15$ as a minimum) for each of the 3 density measures (Table 7).

Alternative explanations for the lower density estimate on the northeast portion of Chichagof Island include: 1) bias and heterogeneity in the Chichagof Island mark-resight data set; 2) study areas with naturally differing bear densities; and 3) increased access, logging activity, and habitat change that contribute to a lower bear density on the northeast portion of Chichagof Island.

Bias and heterogeneity may have existed in the northeast Chichagof Island data. Variation in sighting probabilities among marked individuals occurred in the Chichagof Island data set and heterogeneity occurred according to reproductive and sex-status class in the data set according to analysis performed by G. White. Adult males were conspicuously absent from alpine habitats on the northeast Chichagof Island study area during the 1992 survey period. Adult males were observed and captured in alpine habitats during previous years. Sightability of marked bears was also lower (11-12%, Table 6) on the northeast Chichagof Island study area as compared to CMR studies that have been conducted elsewhere.

Another possible bias in the CMR methods as employed in southeast Alaska is that only alpine, rock, subalpine, and avalanche chute habitats provide suitable areas for searching. Searching of quadrants or habitat blocks cannot be randomly assigned to avoid habitat bias resulting in sampling heterogeneity.

One assumption of mark-resight studies is that the observation of each animal is independent of all others. This is not the case for female brown bears with dependent offspring and for other groups such as sibling groups and paired adults. This problem occurs in surveys of other animals that are found in herds or family groups. Neal et al. (1993) explored this bias and found that it results in smaller variance estimates when each member of a group is treated as an independent observation. The number of bears observed within a group was sampled by Schoen and Beier (1990) for Admiralty Island in 1986 and 1987. We collected similar data during our mark-resight survey flights in 1992 and 1993. Single bear observations composed slightly more than half of our observations from the 1992 and 1993 mark-resight surveys (Table 8). To minimize variance estimation bias and have more precise confidence interval coverage, the independent bears estimate is most useful.

Natural differences in bear population densities might occur between the northeast Chichagof and northern Admiralty study areas under pristine conditions. Such population differences would probably be the result of habitat/food resource differences between areas. Under pristine conditions, both study areas had extensive tracts of old-growth forest. Both study areas have 15-20% of their land area in alpine, subalpine and rock habitat, although the Admiralty Island study area has more extensive alpine meadow habitat above 800 m. The importance of this habitat type to brown bear population regulation is unknown. Both study areas have numerous salmon spawning streams. We conclude that habitat/food resource differences between study areas are not sufficient to explain the differing bear densities.

The greatest qualitative difference between study areas were the established communities, recent roadbuilding, and logging on the northeast Chichagof Island study area. We believe that increased access, logging, and habitat change have contributed to the lower bear density on the northeast Chichagof Island study area.

The brown bear density estimate based on the habitat capability model for the Tongass Land Management Plan Revision was 324 bears for the national forest lands on northeast Chichagof Island (USDA Forest Service 1991) for 1990. This value would be ~10-15% higher if all lands were included in the habitat capability model, owing to the large tracts of private lands in two watersheds. The Tongass Land Management Plan Revision model includes only the effects of vegetation changes over time, with none of the long-term reductions in habitat capability attributable to human access (Schoen et al. in press). We conclude that the brown bear habitat capability model agrees with our independent density estimate over the short term. Our patterns of bear mortality associated with increased access after roadbuilding indicate that the long-term reductions in capability owing to both human access and vegetation changes need to be incorporated into the model for planning purposes.

Bears Seen Per Hour as a Trend Indicator. There is interest in finding wildlife survey methods and indexing population size while avoiding the costs of complete counts (e.g., Verner 1985). Sign surveys have been attempted for monitoring bear populations (e.g., Lindzey et al. 1977, Kendall et al. 1992) and where wildlife are visible, their numbers seen per unit of time might be useful for developing a ratio scale for assessing trend. Miller et al. (in review) found mixed results when relating bears/hour and density. For example, there was a negative relationship between bears/hour seen and the estimated density on Admiralty Island in 1986 and 1987. The number of bears seen/hour on Admiralty Island declined from the 1993 surveys (Table 9) compared with 1986 and 1987. We note high variability in daily bear counts despite standardized survey routes (Table 9). This variability was lower on Chichagof Island (Table 10). Owing to the variability, it is obvious that single surveys (i.e., no within year replication) would have little precision and they cannot be considered as a monitoring tool. Pooling data from replicate surveys to increase precision may have merit, but high variability will reduce the ability to detect trends. For example, the bears/hour counted on Admiralty Island declined from 19.5/hour on 9 July to 7.7/hour on 13 July (Table 9). We do not believe that there was any change in bear population size over this period and the brown bear density estimate was similar on two days with very different bears/hour counts (Figure 2).

A pattern of increasing bears/hour counts were related to increasing density for areas such as Chichagof Island in 1992 (Figure 2). These standardized counts may have utility in the absence of thorough radio-telemetry CMR methods under narrow circumstances. For example, replicated and standardized aerial counts of brown bears might be appropriate for areas adjacent to intensive study areas. One might be able to assume that habitats and bear densities should be similar to the nearby area. With further refinements, bear counts may have utility on other portions of Chichagof and Admiralty islands. Conversely, it may be difficult to interpret counts from areas where there is no baseline information. Interpreting aerial brown bear counts from locations such as mainland southeast Alaska might prove difficult because baseline information is lacking to determine how alpine habitat counts might relate to population trends.

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Figure 1. Means and 80% maximum-likelihood confidence intervals for brown bear density estimates on Admiralty and Chichagof Islands, Alaska, 1992-93

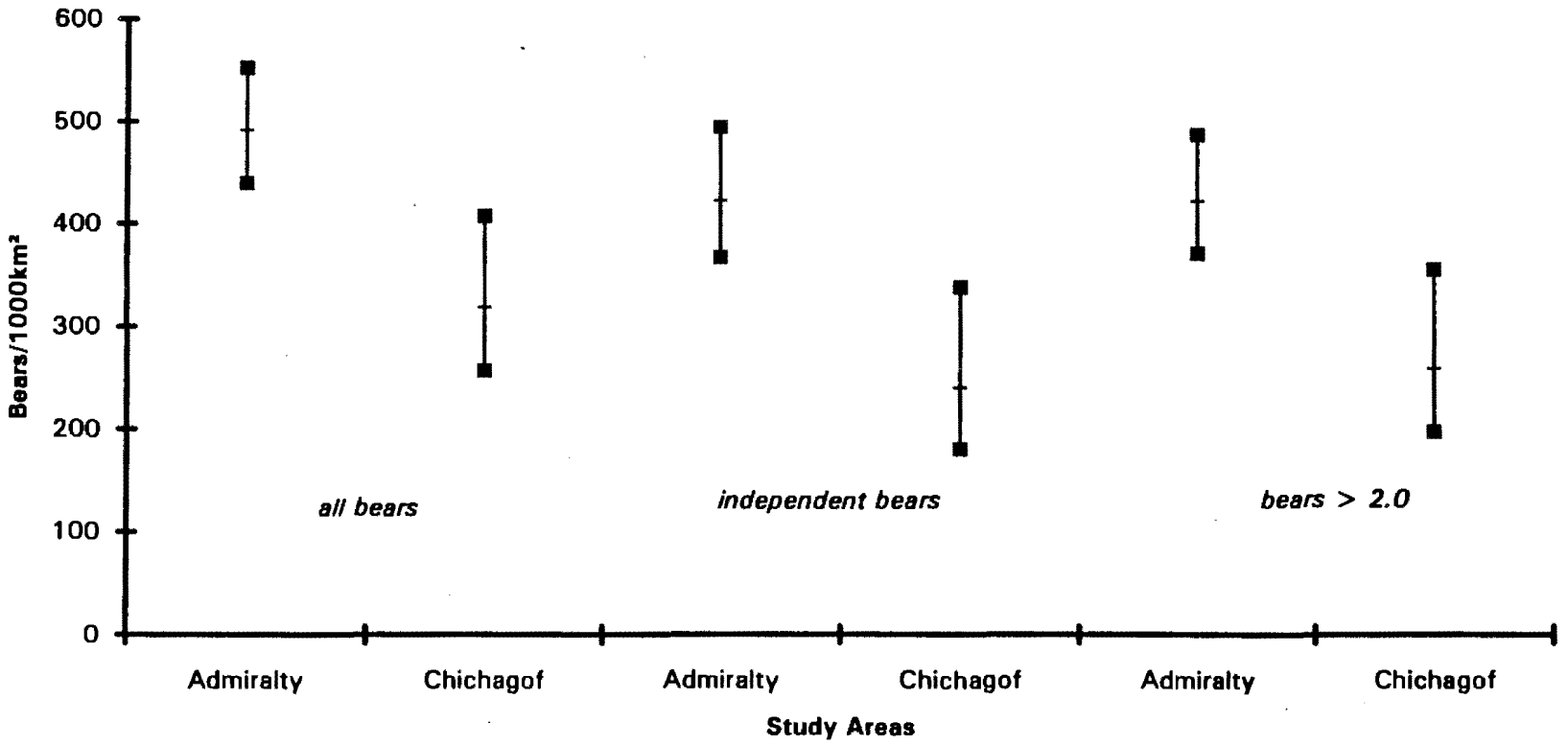


Figure 2. Daily brown bear density estimates and bears observed/hour from the same aerial surveys on Admiralty and Chichagof Islands, Alaska.

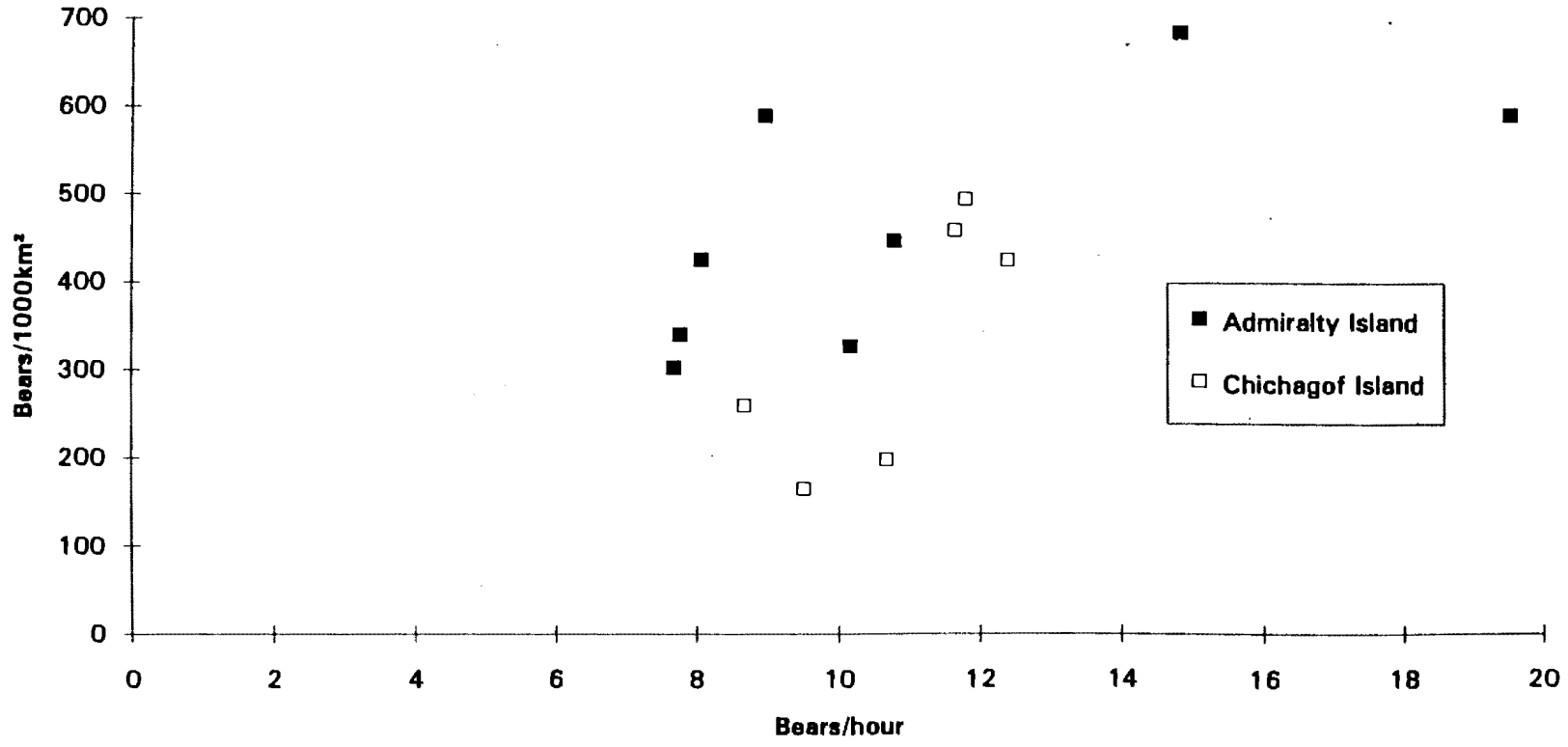


Table 1. Summary and status of brown bears captured on Admiralty Island, 28 August 1981 through 31 October 1993.

Bear No.	Location	Sex	Capture (recapture) Age[a]	Weight (kg)[b]	Date	Capture Techniques[c]	Current Status (31 October 1993)
01	Wheeler Mountain	F	8	159	7/15/91	H	--
01	Wheeler Mountain	F	9	154	(7/22/92)	H	transmitting
02	Greens Creek	M	(14)	290	6/14/93	H	unknown, lost radio
03	Upper King Salmon Creek	M	7	181	7/22/92	H	transmitting
04*	Greens Creek	F	6	214[d]	9/29/83	H	sport harvest 9-87
05	Upper King Salmon Creek	M	(9)	204	6/16/93	H	transmitting
06	Upper King Salmon Creek	F	8	150[d]	9/27/81	H	--
06	Wheeler Creek	F	10	153[d]	(6/14/83)	H	unknown, lost radio 5-86
07	Pack Creek	F	11	150	8/26/82	D	unknown, no radio
08	Pack Creek	F	10	150	8/26/82	T	--
08	Pack Creek	F	16	120	(7/19/88)	D	unknown, removed radio
09[f]	Pack Creek	F	(1)	54	8/26/82	D	unknown, no radio
09	Upper King Salmon Creek	M	7	170	7/22/92	H	unknown
10	Greens Creek	M	11	280[d]	7/02/82	H	--
10	Greens Creek	M	13	288[d]	(7/06/84)	H	--
10	Hawk Inlet	M	15	315	(6/09/86)	S	unknown, lost radio 5-87
11*	Pack Creek	M	4	120	8/28/82	T	sport harvest 5-83
12*	Greens Creek Camp	M	2	68	5/18/92	D	ore truck kill 6-92
13	Greens Creek	M	15	284[d]	6/14/83	H	--
13	Greens Creek	M	16	270[d]	(7/06/84)	H	--
13*	Hawk Inlet	M	18	270	(6/11/86)	S	sport harvest 5-88
14	Greens Creek	F	6	120	9/26/81	H	--
14	Greens Creek	F	7	90	(7/02/82)	H	--
14*	Greens Creek	F	10	95[d]	(7/08/85)	H	bear kill 9-88
B14*	Upper King Salmon Creek	F	5	100	9/26/81	H	mortality
15	Robert Barron Peak	F	4	129	7/21/92	H	transmitting
16[i]	Greens Creek	F	4[1]	90[d]	6/16/83	H	--
16[i]	Wheeler Mountain	F	8[2]	170[d]	(6/28/87)	H	--
16[i]	Greens Creek	F	10[3]	195	(7/21/92)	H	unknown, lost radio
17	Greens Creek	M	(3)	68	7/13/90	H	--
17	Upper King Salmon Creek	M	(5)	91	(6/16/93)	H	transmitting
18	Greens Creek	M	6	214[d]	6/17/83	H	unknown, last located 8-85
19*	Upper King Salmon Creek	F	13	191	9/29/83	H	mortality

Table 1. (continued)

Bear No.	Location	Sex	Capture (recapture) Age[a]	Weight (kg)[b]	Date	Capture Techniques[c]	Current Status (31 October 1993)
20	Greens Creek	M	4	100	7/30/82	S	--
20*	King Salmon	M	5	135	(5/01/83)	H	mortality
21	East Eagle Peak	F	(10)	143	6/15/93	H	transmitting
22	Greens Creek	M	(9)	195	6/22/93	H	transmitting
23	Upper King Salmon Creek	M	13	249[d]	6/27/92	H	unknown, last located 6-92
24	Greens Creek	F	(5)	82	6/14/93	H	transmitting
25[i]	Greens Creek	M	(2)	68	6/26/87	H	unknown, last located 9-89
26	Robert Barron Peak	F	16	168	7/22/92	H	--
26	Robert Barron Peak	F	18	181	(7/10/93)	H	transmitting
27[g]	Greens Creek	M	3	77	6/11/86	S	--
27[g]	Greens Creek	M	4	154[d]	(6/28/87)	H	--
27[g]	Lake Florence	M	6	159	(7/06/88)	H	unknown, removed radio
28*	Greens Creek	M	14	260	6/11/86	S	--
28	Wheeler Mountain	M	14	260	(7/10/86)	H	sport harvest 5-87
29	Wheeler Mountain	F	13	158	7/05/84	H	unknown, last located 11-84
31	Greens Creek	F	5	154	7/14/91	H	transmitting
32	Head Fowler Creek	F	6	159	7/21/92	H	transmitting
33	Greens Creek	M	6	125	6/22/92	H	unknown
34*	Mansfield Peninsula	F	2	70	7/08/82	H	sport harvest 9-83
35	Wheeler Creek	F	8	135[d]	6/17/83	H	mortality
36	Mansfield Peninsula	F	14	230	9/26/81	H	unknown, lost radio 5-82
37*	Mansfield Peninsula	F	10	270	8/03/82	S	sport harvest 10-83
38	Greens Creek	F	23	280	7/02/82	H	--
38*	Greens Creek	F	16	180[d]	(7/08/85)	H	natural mortality 5-86
39	Mansfield Peninsula	F	9[1]	270	7/08/82	S	--
39	Mansfield Peninsula	F	9[2]	171[d]	(7/09/85)	H	--
39	Mansfield Peninsula	F	15	181[d]	(6/16/89)	H	transmitting
39	Robert Barron Peak	F	18	380	(7/15/91)	H	transmitting
40	Greens Creek	M	10	180	6/21/83	H	unknown, last located 8-85
41*	Mansfield Peninsula	M	3	135	6/21/84	H	sport harvest 9-86
42	Greens Creek	M	7	154	7/15/91	H	unknown, lost radio
42	Head Wheeler Creek	M	8	186	(6/19/92)	H	transmitting

Table 1. (continued)

Bear No.	Location	Sex	Capture (recapture) Age[a]	Weight (kg)[b]	Date	Capture Techniques[c]	Current Status (31 October 1993)
43	Upper King Salmon Creek	F	15[1]	250	9/27/81	H	--
43	Greens Creek	F	9[2]	114	(7/03/86)	H	--
43	Upper King Salmon Creek	F	23	136[d]	(6/20/89)	H	--
43	Upper King Salmon Creek	F	25	127	(7/1/91)	H	transmitting
44	Greens Creek	M	(10)	243	6/22/93	H	transmitting
45	Greens Creek	M	7	410	7/01/91	H	transmitting
46	Greens Creek	M	12	248[d]	6/26/86	H	unknown, last located 1988
47	Wheeler Mountain	M	15	480	7/03/90	H	transmitting
48	Greens Creek	M	17	300	8/03/82	S	unknown, lost radio 6-83
49	Mansfield Peninsula	M	(3)	100	6/16/84	H	unknown, no radio
50	Greens Creek	M	(3)	120	9/26/81	H	--
50	Greens Creek	M	(5)	146	(6/17/83)	H	unknown, lost radio 5-85
51	Greens Creek	M	(1)	60	8/28/81	S	unknown, lost radio 9-81
52	Greens Creek	M	6	190	6/26/86	H	unknown, last located 9-89
53	Upper King Salmon Creek	F	6	147	6/22/92	H	transmitting
54[j]	Eagle Peak	M	3	73	6/26/87	H	unknown, lost radio 1988
55	Greens Creek	F	7	124	6/21/83	H	--
55	Greens Creek	F	10	155[d]	(7/10/86)	H	--
55	Greens Creek	F	11	113	(6/26/87)	H	unknown, last located 1988
56	Greens Creek	F	13[1]	170	7/30/82	S	--
56	Greens Creek	F	15[2]	158[d]	(7/08/85)	H	--
56	Greens Creek	F	20	181	(6/16/89)	H	--
56	Greens Creek	F	22	380	(7/14/91)	H	transmitting
57	Greens Creek	F	11	203[d]	9/28/83	H	unknown, last located 7-85
58	Eagle Peak	M	4	180	9/21/81	H	--
58	Hawk Inlet	M	5	194	(8/08/82)	S	unknown, sighted Hood Bay 9-84
59[c]	Greens Creek	M	3	80	9/21/81	H	--
59[c]*	Upper King Salmon Creek	M	5	113[d]	(5/01/83)	H	mortality
60	Greens Creek	F	19	160	9/21/81	H	--
60	Greens Creek	F	20	135[d]	(7/02/82)	H	--
60	Greens Creek	F	23	125[d]	(7/08/85)	H	--
60	Greens Creek	F	24	125	(7/03/86)	H	--
60*	Greens Creek	F	25	163	(6/28/87)	H	natural mortality, picked up 10-91

Table 1. (continued)

Bear No.	Location	Sex	Capture (recapture) Age[a]	Weight (kg)[b]	Date	Capture Techniques[c]	Current Status (31 October 1993)
61	Hawk Inlet	M	11	215	6/12/86	S	--
61*	Hawk Inlet	M	13	215	(6/27/88)	H	sport harvest 5-89
62	Young Bay	F	14	150	6/16/82	S	unknown, last located 9-86
63	Greens Creek	F	17	160	7/08/82	H	unknown, last located 10-84
64	North of Bear Trail	F	14[l]	190[d]	6/24/83	H	--
64	North of Bear Trail	F	17	159	(7/03/86)	H	unknown, last located 1988
64	North of Bear Trail	F	7[2]	380	(7/15/91)	H	transmitting
65	Wheeler Mountain	F	(16)	150	6/22/93	H	transmitting
66	Greens Creek	M	4	180[d]	6/22/83	H	unknown, last located 8-85
67	Greens Creek	F	(2)	60	8/02/82	S	no radio, sighted L.Florence 9-85
68*	Greens Creek	F	5	146[d]	9/28/83	H	sport harvest 9-88
69[k]	Eagle Peak	M	(2)	59	7/09/85	H	unknown, lost radio 5-86
70[e]	Greens Creek	F	(3)	77	7/16/87	H	--
70[e]	Upper King Salmon Creek	F	(4)	118	(9/16/88)	H	unknown, lost radio
71	Wheeler Mountain	F	4	148	6/29/87	H	unknown, lost radio 8-87
72*	Eagle Peak	M	6	200	7/08/82	H	sport harvest 5-93
73[l]	Robert Barron Peak	M	(3)	79	6/15/93	H	transmitting
74*	Greens Creek	F	10	380	7/01/91	H	sport harvest 5-92
74N[m]*	Upper King Salmon Creek	M	3	160	6/28/91	H	sport harvest 9-91
75	Wheeler Mountain	F	9	159	7/03/90	H	--
75	Greens Creek	F	10	159	(6/28/91)	H	sport harvest 5-92
76[h]	Greens Creek	M	3	130[d]	7/10/86	H	--
76[h]*	Lake Florence	M	5	168	(7/06/88)	H	sport harvest 10-92
77[n]*	Greens Creek	M	3	115	6/26/86	H	sport harvest 5-89
78[n]*	Greens Creek	F	(3)	91	7/10/86	H	mortality 8-86
79*	Hawk Inlet	F	6	124	6/11/86	S	sport harvest 9-87
80	Greens Creek	F	3	127	7/03/90	H	--
80	Greens Creek	F	5	136	(7/21/92)	H	transmitting
81*	Mansfield Peninsula	F	15[l]+17[2]	200	6/21/84	H	natural mortality, picked up 11-92
82	West of Bear Trail	M	(9)	354	6/22/93	H	unknown, lost radio
83	Greens Creek	M	(13)	425	6/28/91	H	transmitting
84	Wheeler Mountain	F	12	147	7/09/86	H	unknown, last located 4-90
85	Wheeler Mountain	F	12	150	7/11/86	H	unknown, last located 1988

Table 1. (continued)

Bear No.	Location	Sex	Capture (recapture) Age[a]	Weight (kg)[b]	Date	Capture Techniques[c]	Current Status (31 October 1993)
86	Wheeler Mountain	F	(adult)	375	7/16/87	H	unknown, last located 1988
87	Greens Creek	M	4	300	6/28/91	H	unknown, lost radio
89[O]*	Admiralty Cove	F	16	150	7/09/86	H	DLP 8-87
90	Upper King Salmon Creek	M	(7)	170	6/16/93	H	transmitting
91	Pack Creek	F	19	162[d]	6/21/83	H	unknown, lost radio 1984
92	Pack Creek	F	16	159[d]	6/21/83	H	unknown, lost radio 5-86
93	Pack Creek	M	5	158[d]	6/21/83	H	--
93	Pack Creek	M	10	170	(6/27/88)	H	unknown, removed radio
94	Pack Creek	F	10	156[d]	7/13/83	T	--
94	Pack Creek	F	15	114	(7/19/88)	D	unknown, removed radio
95	Mansfield Peninsula	F	8	170	7/08/82	H	--
95	Mansfield Peninsula	F	14	200	(9/16/88)	H	transmitting
95	Robert Barron Peak	F	19	147	(6/14/93)	H	transmitting
96	Mansfield Peninsula	F	7	148	7/03/86	H	unknown, last located 10-87
97	Greens Creek	M	12	293[d]	7/10/86	H	unknown
98	Greens Creek	M	19	315[d]	6/26/86	H	unknown, last located 4-90
99	Greens Creek	F	17	200	7/08/82	H	--
99	Greens Creek	F	19	158	(6/21/84)	H	unknown, lost radio 9-85
101	Robert Barron Peak	M	(8)	177	6/23/93	H	transmitting
102	Robert Barron Peak	F	(20)	159	6/23/93	H	transmitting
103	Upper King Salmon Creek	M	(5)	95	6/23/93	H	unknown, no radio
104	Robert Barron Peak	F	(10)	163	6/23/93	H	transmitting
105	Robert Barron Peak	F	(13)	186	6/26/93	H	transmitting
106	Wheeler Mountain	F	(10)	168	6/26/93	H	transmitting
107	Robert Barron Peak	F	(6)	122	6/26/93	H	transmitting
108	Robert Barron Peak	M	(9)	209	6/26/93	H	unknown, lost radio

Table 1. (continued)

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

[#] Age determined by tooth sectioning at different years.

[b] Weight estimated.

[c] S = snare; H = helicopter; D = darted, free ranging; T = trap.

[d] Actual weight.

[e] Offspring of No. 60.

f Offspring of No. 07 (Pack Creek bear called "Pest")

g Offspring of No. 56, sibling of No. 76.

h Offspring of No. 56, sibling of No. 27.

i Offspring of No. 55, however No. 16 and No. 25 are not siblings.

j Offspring of No. 64.

k Offspring of No. 99.

l Offspring of No. 39.

m Offspring of No. 43.

n Siblings, No. 77 & No. 78.

o DLP = defense of life or property.

* Bear confirmed dead.

Table 2. Reproductive history of radio-collared female brown bears on Admiralty Island, 28 August 1981 through 31 October 1993.

Bear No.	Age at capture (yrs)	Offspring[a] by year								
		1981	1982	1983	1984	1985	1986	1987	1988	1989
01	8									
04*	6			0	2 coy	2 1-yr	no[s]	no[l]		
06	8	0	no	1 coy[f]	0	0	no	no	no	no
07	11		1 1-yr	1 2-yr	no	no	no	no	no	no
08	10		0	0	2 coy	2 1-yr	2 2-yr	2 3-yr[b]	1 coy	no
09[p]	1		0	0	0	0	0	0	0	0
14*	7	0	0	0	2 coy	0[d]	0	2 coy	2 1-yr[e]	
15	4									
16[n]	4			0	no	no	0	0	0	0
21	(21)									
24	(5)									
26	16									
29	13				3 1-yr[i]	no	no	no	no	no
31	5									
32	6									
34	2		0	0[l]						
36	14	2 coy	no	no	no	no	no	no	no	no
37*	10		0	1 coy[l]						
38*	23		0	0	0	0	0	no[m]		
39	9		0	0	2 coy	0[f]	1 coy	?	1 coy	1 1-yr
43	15	0	2 coy	2 1-yr	no	no	no	2 coy	2 1-yr	2 2-yr
53	6									
55	7			0	no	no	1 1-yr	1 2-yr	1 3-yr[b]	?
56	13		2 2-yr	2 3-yr[b]	2 coy	2 1-yr	2 2-yr[b]	1 coy	0[f]	0[g]
57	11			2 2-yr	2 3-yr	2 coy	no	no	no	no
60*	20	1 2-yr	1 3-yr[b]	2 coy[c]	1 coy	1 1-yr	1 2-yr	1 3-yr	1 4-yr[b]	0
62	14		0	0	0	0	0	no	no	no
63	17		2 cubs	0	0	2 coy	no	no	no	no
64	14			1 1-yr	1 2-yr[b]	2 coy	2 1-yr	2 2-yr	1 3-yr[b]	0
65	(16)									
67	2		0	no	0[s]	no	no	no	no	no
68*	5			0	0	0	0	?	0[l]	
70[r]	3							0	0	0

Table 2. (continued)

Bear No.	Age at capture (yrs)	Offspring[a] by year								
		1981	1982	1983	1984	1985	1986	1987	1988	1989
71	4							0	no	no
74*	10									
75*	10									
78*	3						0			
79*	6						0	0[hl]		
80	3									
81*	15				0	0	0	no	no	no
84	12						2 coy	2 1-yr	2 2-yr	2 3-yr[b]
85	12						1 coy	1 1-yr	1 2-yr	no
86	adult							2-2-yr	2 3-yr	no
89*	16						2 coy	2 1-yr[k]		
91	19		0	0	no	no	no	no	no	no
92	16			0	2 coy	no	no	no	no	no
94	10			0	2 coy	2 1-yr	2 2-yr[b]	2 coy	2 1-yr	2 2-yr
95	8		2 1-yr	2 2-yr	0	2 coy	2 1-yr	no	2 coy	2 1-yr
96	7						3 coy[f]	2 1-yr	no	no
99	17		2 3-yr	2 coy	2 1-yr	1 2-yr[f]	no	no	no	no
102	(20)									
104	(10)									
105	(13)									
106	(10)									
107	(6)									

Table 2. (continued)

Bear No.	Age at capture (yrs)	Offspring[a] by year			
		1990	1991	1992	1993
01	8		2 2-yr	0[o]	no
04*	6				
06	8	no	no	no	no
07	11	no	no	no	no
08	10	no	no	no	no
09[p]	1	2 coy	0[f]	0	0
14*	7				
15	4			2 2-yr	2 3-yr
16[n]	4	no	no	no	no
21	(10)				0
24	(5)				0
26	16			2 3-yr	0
29	12	no	no	no	no
31	5		0	no	0
32	6			0	1 coy
34*	2				
36	14	no	no	no	no
37*	10				
38*	23				
39	9	no	3 coy	3 1-yr	0
43	15	2 3-yr	0[q]	0	1 coy
53	6			0	no
55	7	no	no	no	no
56	13	no	1 coy	no	1 2-yr[i]
57	11	no	no	no	no
60*	20	no	no[m]		
62	14	no	no	no	no
63	17	no	no	no	no
64	14	no	3 coy	no	2 2-yr[b]
65	(16)				0
67	2	no	no	no	no
68*	5				
70	3	no	no	no	no

Table 2. (continued)

Bear No.	Age at capture (yrs)	Offspring[a] by year			
		1990	1991	1992	1993
71	6	no	no	no	no
74*	10		1 2-yr	1 3-yr[ql]	
75*	15	2 coy	2 1-yr	2 2-yr[ql]	
78*	3				
79*	4				
80	6	0	0	0	0
81*	14	no	no[m]		
84	12	2 coy	no	no	no
85	7	no	no	no	no
86	adult	no	no	no	no
89*	10				
91	19	no	no	no	no
92	16	no	no	no	no
94	10	no	no	no	no
95	8	no	no	no	0
96	7	no	no	no	no
99	17	no	no	no	no
102	(20)				2 1-yr
104	(10)				0
105	(13)				2 coy
106	(10)				1 1-yr
107	(6)				0

Table 2. (continued)

[a] Female observed with:
coy = cub of year
1-yr = yearling
2-yr = 2-year-old
3-yr = 3-year-old
4-yr = 4-year-old
cub = cub older than coy
0 = no cubs observed
no = no observation of marked bear

[b] Cubs disappeared over summer.

[c] Male killed cubs in June.

[d] Female ate cubs in den.

[e] Female killed by marked male, fate of cubs unknown.

[f] Cubs disappeared over winter.

[g] Female lactating but no cubs present.

[h] Observed breeding.

[i] One cub disappeared over summer.

[k] Female killed in DLP by deer hunter 8/87.

[l] Sport harvested.

[m] Natural mortality.

[n] Offspring of No. 55.

[o] Cubs kicked out 2 weeks prior to capture of No. 01.

[p] Offspring of No. 07.

[q] Cubs kicked out this spring.

[r] Offspring of No. 60.

[s] Ear tagged, no collar. (No. 67 sighted L.Florence Ck. 9/84 by LB)
(No. 04 sighted Jims's Ck. 9/86 & 9/87 by LB)

* Bear confirmed dead.

Table 3. Values used in a brown bear mark-resight density estimate for a 344km² area on northern Admiralty Island, Alaska, 1993.

Bears of All Ages

DAY	DATE	MARKS PRESENT	MARKS SEEN	TOTAL SEEN	MIN. # PRESENT	DAILY LINCOLN-PETERSEN	DENSITY No.1000km2	SIGHTABILITY	CUM. MARKS PRESENT	CUM. MARKS SEEN	CUM. TOTAL SEEN
1	07-Jul	41	12	34	63	112.1	325.8	0.293	41	12	34
2	08-Jul	41	9	55	87	234.2	680.8	0.220	82	21	89
3	09-Jul	41	11	57	87	202.0	587.2	0.268	123	32	146
4	11-Jul	41	9	27	59	116.6	339.0	0.220	164	41	173
5	12-Jul	41	7	27	61	146.0	424.4	0.171	205	48	200
6	13-Jul	41	11	29	59	104.0	302.3	0.268	246	59	229
7	14-Jul	41	5	28	64	202.0	587.2	0.122	287	64	257
8	14-Jul	41	8	32	65	153.0	444.8	0.195	328	72	289
			means =	36.13	68.13	158.73	461.4	21.951			
					SE=	16.10			%marked =	24.9	

Independent Bears

DAY	DATE	MARKS PRESENT	MARKS SEEN	TOTAL SEEN	MIN. # PRESENT	DAILY LINCOLN-PETERSEN	DENSITY No.1000km2	SIGHTABILITY	CUM. MARKS PRESENT	CUM. MARKS SEEN	CUM. TOTAL SEEN
1	07-Jul	30	8	29	51	102.3	297.5	0.267	30	8	29
2	08-Jul	30	6	41	65	185.0	537.8	0.200	60	14	70
3	09-Jul	30	7	39	62	154.0	447.7	0.233	90	21	109
4	11-Jul	30	5	17	42	92.0	267.4	0.167	120	26	126
5	12-Jul	30	4	21	47	135.4	393.6	0.133	150	30	147
6	13-Jul	30	8	22	44	78.2	227.4	0.267	180	38	169
7	14-Jul	30	3	23	50	185.0	537.8	0.100	210	41	192
8	14-Jul	30	6	24	48	109.7	318.9	0.200	240	47	216
			means =	27.00	51.13	130.21	378.5	19.583	%marked =	21.8	
					SE=	13.67					

Table 3 (cont.).

Bears > age 2.0

DAY	DATE	MARKS PRESENT	MARKS SEEN	TOTAL SEEN	MIN. # PRESENT	DAILY LINCOLN-PETERSEN	DENSITY No.1000km2	SIGHTABILITY	CUM. MARKS PRESENT	.m2* CUM. MARKS SEEN	n2* CUM. TOTAL SEEN
1	07-Jul	32	9	30	53	101.3	294.5	0.281	32	9	30
2	08-Jul	32	6	47	73	225.3	654.9	0.188	64	15	77
3	09-Jul	32	7	40	65	168.1	488.7	0.219	96	22	117
4	11-Jul	32	7	19	44	81.5	236.9	0.219	128	29	136
5	12-Jul	32	5	22	49	125.5	364.8	0.156	160	34	158
6	13-Jul	32	8	22	46	83.3	242.2	0.250	192	42	180
7	14-Jul	32	5	26	53	147.5	428.8	0.156	224	47	206
8	14-Jul	32	6	24	50	116.9	339.7	0.188	256	53	230
			means =	28.75	54.13	131.18	381.3	20.703	%marked =	23.0	
				SE=		16.00					

Table 4. Summary and status of brown bears captured on Northeast Chichagof Island, 13 October 1989 through 31 October 1993.

Bear No.	Location	Sex	Capture (recapture) Age[a]	Weight (kg)[b]	Date	Capture Techniques[c]	Current Status (31 October 1993)
101	Mt. head Seal Ck.	F	6	159[d]	10/13/89	H	transmitting
102	Repeater Mountain	M	13	345[d]	6/12/90	H	unknown, lost radio
102	Hoonah Dump	M	13	374	(7/28/90)	S	unknown, lost radio 8/90
102	Hoonah Dump	M	13	374	(8/14/90)	S	Hoonah Dump 10/90
102*	Hoonah Dump	M	14	363	(10/10/91)	S	illegal harvest 9/93
103	Mt. S. False Bay	M	2	170	10/13/89	H	unknown
104	Mt. head Seal Ck.	F	(3)	113[d]	10/13/89	H	unknown, lost radio
105	Repeater Mountain	F	13	127	6/12/90	H	transmitting
106	Den Mountain	F	8	172	6/13/90	H	transmitting
107	Den Mountain	F	8	154[d]	6/13/90	H	transmitting
108	3 foot Mountain	M	11	318[d]	6/13/90	H	unknown, lost radio
109	Den Mountain	F	4	91	6/13/90	H	unknown, lost radio
110	Repeater Mountain	F	3	73	6/19/90	H	unknown, lost radio 4/91
110	Repeater Mountain	F	4	73	(6/26/91)	H	transmitting
111	Repeater Mountain	M	(3)	82	6/19/90	H	unknown, lost radio
112*	Mt. N. Fk. Freshwater Ck.	M	4	136	6/19/90	H	sport harvest 5/92
113	Mts. E. Indian River	F	10	172	6/19/90	H	transmitting
114	Mt. N. Fk. Freshwater Ck.	F	(3)	73	6/21/90	H	unknown, lost radio
115*	Mts. E. Salt Lake Bay	F	24	127	6/21/90	H	unknown mortality
116	Mt. S. of 3 Foot Mt.	F	6	136	6/21/90	H	unknown, lost radio
117	Repeater Mountain	F	9	159	6/21/90	H	unknown, lost radio
118	Repeater Mountain	F	(3)	64	6/21/90	H	unknown, lost radio
118	Repeater Mountain	F	(5)	118	6/30/92	H	transmitting
119	Mts. E. Indian River	F	(3)	68	6/22/90	H	unknown, lost radio
120	Mts. E. Indian River	F	12	163	6/22/90	H	unknown, lost radio
121	Mts. E. Indian River	M	4	170	6/22/90	H	transmitting
122	Mts. E. Indian River	M	11	295	6/22/90	H	unknown, lost radio
123	Tenakee Mts. mile 20	M	(18)	249	6/22/90	H	unknown, lost radio
124	S. Fk. Freshwater Ck.	M	8	267	6/22/90	H	unknown, lost radio 5/93
125	Tenakee Mts. mile 20	M	8	193	6/25/90	H	unknown, lost radio
126	Mts. E. of Narrows	F	16	159	6/25/90	H	unknown, lost radio
127	Mts. E. of Narrows	F	26	204	6/25/90	H	unknown, lost radio 8/90
128	Mt. South Den Mt.	F	9	136	6/26/90	H	unknown, lost radio 4/91

Table 4. (continued)

Bear No.	Location	Sex	Capture (recapture) Age[a]	Weight (kg)[b]	Date	Capture Techniques[c]	Current Status (31 October 1993)
129*	Tenakee Mts. mile 20	M	21	295[d]	6/26/90	H	DLP 10/90 Hoonah[e]
130*	Tenakee Mts. mile 20	F	(3)	73	6/26/90	H	sport harvest 5/93
131	Mt. S. of 3 Foot Mt.	F	23	147	6/26/90	H	unknown, lost radio 5/93
132	Mt. South Den Mt.	F	12	159	6/26/90	H	unknown, lost radio 5/93
133	Tenakee Mts. mile 20	F	11	147	6/28/90	H	unknown, lost radio
134	Mt. South Den Mt.	F	8	170	6/28/90	H	unknown, lost radio
135	Den Mountain	F	16	143	6/28/90	H	unknown
136	Mts. E. of Narrows	F	2	68	6/28/90	H	--
136	Tenakee Mts. mile 20	F	4	70	(6/26/92)	H	unknown, lost radio
137	Spasski Creek	M	4	136	7/17/90	S	unknown, lost radio
138	Spasski Creek	M	(20)	227	7/17/90	S	unknown, lost radio 6/91
139[f]	Spasski Creek	M	(1)	27	7/20/90	S	unknown, lost radio at den 4/92
140*	Spasski Creek	M	4	136	7/25/90	D	sport harvest 5/91
141	Spasski Creek	F	5	147	7/26/90	S	transmitting
142	Hoonah Dump	M	4	170	7/27/90	D	Hoonah Dump
142	Hoonah Dump	M	4	170	(8/10/90)	D	Hoonah Dump
142	Hoonah Dump	M	6	272	(9/9/91)	D	Hoonah Dump
142	Hoonah Dump	M	8	454	(10/13/93)	D	transmitting
143	Hoonah Dump	M	8	306	7/27/90	S	Hoonah Dump 10/90
143	Hoonah Dump	M	8	306	(8/14/90)	S	Hoonah Dump 10/90
143	Hoonah Dump	M	9	318	(10/10/91)	S	sighted Hoonah Dump 10/93
144	Game Creek	M	9	159	8/13/90	S	unknown, lost radio
145	Game Creek	F	5	159	8/13/90	S	transmitting
146	Hoonah Dump	M	5	272	8/13/90	S	--
146	Hoonah Dump	M	6	249	(8/8/91)	S	unknown, lost radio 5/93
147	Hoonah Dump	M	20	340	8/14/90	S	sighted Hoonah Dump 8/92
147	Hoonah Dump	M	21	318	(9/11/91)	S	sighted Hoonah Dump 10/93
148	Game Creek	F	6	147	8/14/90	S	unknown, lost radio
149*	Repeater Mountain	F	13	136	6/26/91	H	unknown mortality
150	Repeater Mountain	F	5	147	6/26/91	H	transmitting
151	Mts. E. Indian River	M	4	125	6/26/91	H	--
151	Mts. E. Indian River	M	5	136	(6/29/92)	H	unknown, lost radio
152	Repeater Mountain	F	15	154	7/5/91	H	unknown, lost radio

Table 4. (continued)

Bear No.	Location	Sex	Capture (recapture) Age[a]	Weight (kg)[b]	Date	Capture Techniques[c]	Current Status (31 October 1993)
153	Mt. head Seal Ck.	F	9	147	7/5/91	H	transmitting
154	Mts. E. Indian River	F	12	125	7/5/91	H	unknown
155	Bear Creek	F	6	127	7/25/91	S	unknown, lost radio
156	Mt. head Seal Ck.	F	16	159	6/23/92	H	transmitting
157*	Bear Creek	F	4	132	7/25/91	S	sport harvest 5/92
158	Mt. head Seal Ck.	F	16	170	6/23/92	H	transmitting
159	Tenakee Mts. mile 20	F	11	150	6/23/92	H	transmitting
160	Tenakee Mts. mile 20	M	4	91	6/23/92	H	unknown last located 5/93
161	3 foot Mountain	F	22	170	6/24/92	H	transmitting
162	Mts. E. Indian River	F	21	193	6/24/92	H	transmitting
163	Mts. E. Indian River	F	11	159	6/24/92	H	transmitting
164	Mts. E. Indian River	M	5	227	6/24/92	H	unknown, lost radio 9/92
165	Mt. head Seal Ck.	F	8	136	6/25/92	H	transmitting
166	Virgin Mts.	M	3	102	6/25/92	H	unknown, lost radio
167	Virgin Mts.	F	13	170	6/25/92	H	transmitting
168	Virgin Mts.	M	2	73	6/25/92	H	unknown
169	Head Gypsum Ck.	F	13	209	6/25/92	H	unknown, lost radio
170	Mts. E. Salt Lake Bay	M	5	163	6/26/92	H	transmitting
171	Ridge S. Gypsum Ck.	F	4	125	6/26/92	H	transmitting
172	Mts. E. Indian River	F	2	70	6/26/92	H	unknown, lost radio
173*	Whitestone Ck. clearcut	M	4	167	6/28/92	H	DLP 8/92 Kennel Ck.[e]
174	Tenakee Mts. mile 8	F	13	145	6/29/92	H	transmitting
175	Tenakee Mts. mile 8	F	16	141	6/30/92	H	transmitting
176	Tenakee Mts. mile 8	F	10	159	6/30/92	H	transmitting
177	3 foot Mountain	F	11	154	6/30/92	H	unknown, lost radio
178	Seagull Creek	F	14	193	8/30/92	S	transmitting
179	Bear Creek	F	10	265	8/31/92	S	unknown, lost radio
180	Hoonah Dump	F	(10)	238	10/13/93	D	transmitting
181[g]*	Hoonah Dump	F	(.8)	59	10/13/93	D	unknown mortality 10/14/93
182[g]*	Hoonah Dump	M	(.8)	68	10/13/93	D	bear kill
184	Hoonah Dump	M	(8)	254	10/13/93	D	transmitting

Table 4. (continued)

[a] Age determined by tooth sectioning or (estimated).
[b] Weight estimated.
[c] S = Snare; H = helicopter; D = darted, free ranging.
[d] Actual weight.
[e] DLP = Defense of life or property.
[f] A male coy, no sow observed, family status unknown.
[g] Offspring of No. 180.
[*] Bear confirmed dead.

Table 5. Reproductive history of radio-collared female brown bears on Northeast Chichagof Island, 13 October 1989 through 31 October 1993.

Bear No.	Age at capture (yrs)	Offspring[a] by year				
		1989	1990	1991	1992	1993
101	6	0	0	no	no	no
104	(3)	0	0	no	no	no
105	13		0	no	no	no
106	8		0	no	0	no
107	8		0	no	2 coy	no
109	4		0	0	no	no
110	(3)		0	0	no	no
113	10		0	no	no	0
114	(3)		0	no	no	no
115*	24		0	no[g]	no	no
116	6		0	no	no	no
117	9		1 coy	no	no	no
118	(5)		0	no	0	0[i]
119	(3)		0	no	no	no
120	12		0	no	no	no
126	16		0	no	no	no
127	26		0	no	no	no
128	9		0	no	no	no
130*	(3)		0	no	no	no[f]
131	23		1 1-yr	no	0	no
132	12		1 1-yr	no	no	no
133	11		0	no	no	no
134	8		0	no	0	no
135	16		3 coy	1 coy[b]	2 1-yr	no
136	4		0	no	0	no
139[c]	coy		no	no	no	no
141	5		1 coy[c]	no	1 1-yr	no
145	5		0[c]	0	2 1.5-yr	1 2.5-yr
148	6		0[c]	no	no	no
149*	13			2 1-yr[g]	no	no
150	5			0	0	no
152	15			1 1-yr	0	no
153	9			1 2-yr	0	no
154	12			2 1-yr	no	no
155	6			0	0	no
156	16				1 1-yr	1 2.5
157*	4			0	no[f]	no
158	16				1 1-yr	1 2-yr
159	11				2 1-yr	no
161	22				1 1-yr	1 2-yr
162	21				2 coy	2 1-yr
163	11				1 coy	no
165	8				2 1-yr	no
167	13				3 1-yr	no
169	13				0	no
171	4				0	0
172	2				0	no

Table 5. (continued)

Bear No.	Age at capture (yrs)	Offspring[a] by year				
		1989	1990	1991	1992	1993
174	13				2 1-yr	no
175	16				0	0
176	10				0	no
177	11				0	no
178	14				2 2.5-yr	2 3.5-yr
179	10				0[e]	no
180	(10)				no[h]	2 coy

[a] Female observed with:
coy = cub of year
1-yr = yearling
1.5-yr = 1.5-year-old
2-yr = 2-year-old
2.5-yr = 2.5-year-old
3.5-yr = 3.5-year-old
0 = no cubs observed
no = no observation of marked bear.

[b] Aerial observation, poor visibility because of vegetation.

[c] A male coy, no sow observed, family status unknown.

[e] Snared along salmon stream, limited visibility. If cubs present may not be visible.

[f] Sport harvested.

[g] Unknown mortality/picked up.

[h] Observed mating with #142.

[i] Observed with another bear.

[*] Bear confirmed dead.

Table 6. Values used in a brown bear density estimate for a 1112km² area on northeast Chichagof Island, Alaska, 1992.

Bears of All Ages

DAY	DATE	MARKS PRESENT	MARKS SEEN	TOTAL SEEN	MIN. # PRESENT	DAILY LINCOLN-PETERSEN	DENSITY No.1000km²	SIGHTABILITY	CUM. MARKS PRESENT	CUM MARKS SEEN	CUM. TOTAL SEEN
1	Jul 1	69	8	36	97	286.8	257.7	0.116	69	8	36
2	Jul 2	69	12	33	90	182.1	163.6	0.174	138	20	69
3	Jul 5	69	6	50	113	509.0	457.4	0.087	207	26	119
4	Jul 7	69	5	46	110	547.3	491.8	0.072	276	31	165
5	Jul 17	69	13	43	99	219.0	196.8	0.188	345	44	208
6	Jul 18	69	7	53	115	471.5	423.7	0.101	414	51	261
			means=	43.50	104.00	369.28	331.8	12.32%	%marked =	19.54%	
					SE=	59.19					

Independent Bears

day	DATE	MARKS PRESENT	MARKS SEEN	TOTAL SEEN	MIN. # PRESENT	DAILY LINCOLN-PETERSEN	DENSITY No.1000km²	SIGHTABILITY	CUM. MARKS PRESENT	CUM. MARKS SEEN	CUM TOTAL SEEN
1	Jul 1	46	4	21	63	205.8	184.9	0.087	46	4	21
2	Jul 2	46	8	27	65	145.2	130.5	0.174	92	12	48
3	Jul 5	46	5	33	74	265.3	238.4	0.109	138	17	81
4	Jul 7	46	2	23	67	375.0	337.0	0.043	184	19	104
5	Jul 17	46	6	29	69	200.4	180.1	0.130	230	25	133
6	Jul 18	46	4	35	77	337.4	303.2	0.087	276	29	168
			means=	26.60	69.17	254.86	229.0	10.51%	%marked =	17.26%	
					SE=	32.81					

Table 6 (cont.).

Bears > age 2.0

day	DATE	MARKS PRESENT	MARKS SEEN	TOTAL SEEN	MIN. # PRESENT	DAILY LINCOLN-PETERSEN	DENSITY No1000km²	SIGHTABILITY	CUM. MARKS PRESENT	CUM. MARKS SEEN	CUM. TOTAL SEEN
1	Jul 1	50	4	25	71	264.2	237.4	0.080	50	4	25
2	Jul 2	50	8	29	71	169.0	151.9	0.160	100	12	54
3	Jul 5	50	5	40	85	347.5	312.2	0.100	150	17	94
4	Jul 7	50	2	24	72	424.0	381.0	0.040	200	19	118
5	Jul 17	50	8	35	77	203.0	182.4	0.160	250	27	153
6	Jul 18	50	6	37	81	275.9	247.9	0.120	300	33	190
			means=	30.60	76.17	280.59	252.1	11.00%	%marked =	17.37%	
					SE=	34.88					

Table 7. Comparison of brown bear densities based on mean daily Petersen estimates from northern Admiralty Island, 1993, and the northeast portion of Chichagof Island, Alaska, 1992.

Study area	*N*	Mean/1000 km^2	Std. dev.	*t*	*df*	*P*
All Bears						
Admiralty	8	461.4	141.5			
Chichagof	6	331.8	142.7	1.69	12	0.117
Independent Bears						
Admiralty	8	378.5	120.1			
Chichagof	6	229.0	79.1	2.63	12	0.021
Bears >age 2.0						
Admiralty	8	381.3	140.6			
Chichagof	6	252.1	84.1	1.99	12	0.070

Table 8. Frequency of observing groups of one or more brown bears during mark-resight aerial survey flights on Admiralty and Chichagof islands, Alaska.

STUDY AREA	'Groups' of 1 Bear	Cub-of-the-year family groups	Yearling family groups	> Yearling Family Groups	Adult and sibling groups	Total groups seen
Chichagof Island 1992						
No. groups	78	18	21	12	19	148
Mean group size	1	3.0	2.86	2.58	2.11	1.78
% of sightings	52.7	12.2	14.2	8.1	12.8	100
Admiralty Island 1993						
No. groups	124	25	13	10	22	194
Mean group size	1	2.28	2.54	2.5	2.05	1.46
% of sightings	63.9	12.9	6.7	5.2	11.3	100
Admiralty Island 1986						
No. groups	47	39	35	13	20	154
Mean group size	1	2.6	2.92	2.6	2.2	2.14
% of sightings	30.5	25.3	22.7	8.4	13.0	100
Admiralty Island 1987						
No. groups	80	41	23	89	30	263
Mean group size	1	2.73	2.88	2.47	2.0	2.05
% of sightings	30.4	15.6	8.7	33.8	11.4	100

Table 9. Number of brown bears observed per hour during mark-resight aerial surveys on Admiralty Island, Alaska 1993.

Bears of All Ages

DAY	DATE	TOTAL SEEN	SURVEY TIME (HR)	BEARS/ HR
1	07-Jul	34	3.35	10.15
2	08-Jul	55	3.7	14.86
3	09-Jul	57	2.92	19.52
4	11-Jul	27	3.48	7.76
5	12-Jul	27	3.35	8.06
6	13-Jul	29	3.78	7.67
7	14-Jul	28	3.12	8.97
8	14-Jul	32	2.97	10.77
	TOTAL	289	26.67	
	MEAN	36.13	3.33	10.84

Independent Bears

DAY	DATE	TOTAL SEEN	SURVEY TIME (HR)	BEARS/ HR
1	07-Jul	29	3.35	8.66
2	08-Jul	41	3.7	11.08
3	09-Jul	39	2.92	13.36
4	11-Jul	17	3.48	4.89
5	12-Jul	21	3.35	6.27
6	13-Jul	22	3.78	5.82
7	14-Jul	23	3.12	7.37
8	14-Jul	24	2.97	8.08
	TOTAL	216	26.67	
	MEAN	27.00	3.33	8.10

Bears > age 2.0

DAY	DATE	TOTAL SEEN	SURVEY TIME (HR)	BEARS/ HR
1	07-Jul	30	3.35	8.96
2	08-Jul	47	3.7	12.70
3	09-Jul	40	2.92	13.70
4	11-Jul	19	3.48	5.46
5	12-Jul	22	3.35	6.57
6	13-Jul	22	3.78	5.82
7	14-Jul	26	3.12	8.33
8	14-Jul	24	2.97	8.08
	TOTAL	230	26.67	
	MEAN	28.75	3.33	8.62

Table 10. Number of brown bears observed per hour during mark-resight aerial surveys on Chichagof Island, Alaska 1992.

Bears of All Ages

DAY	DATE	TOTAL SEEN	SURVEY TIME (HR)	BEARS/ HR
1	01-Jul	36	4.15	8.67
2	02-Jul	33	3.47	9.51
3	05-Jul	50	4.3	11.63
4	07-Jul	46	3.9	11.79
5	17-Jul	43	4.03	10.67
6	18-Jul	53	4.28	12.38
	TOTALS =	261	24.13	
	MEANS =	43.50	4.02	10.82

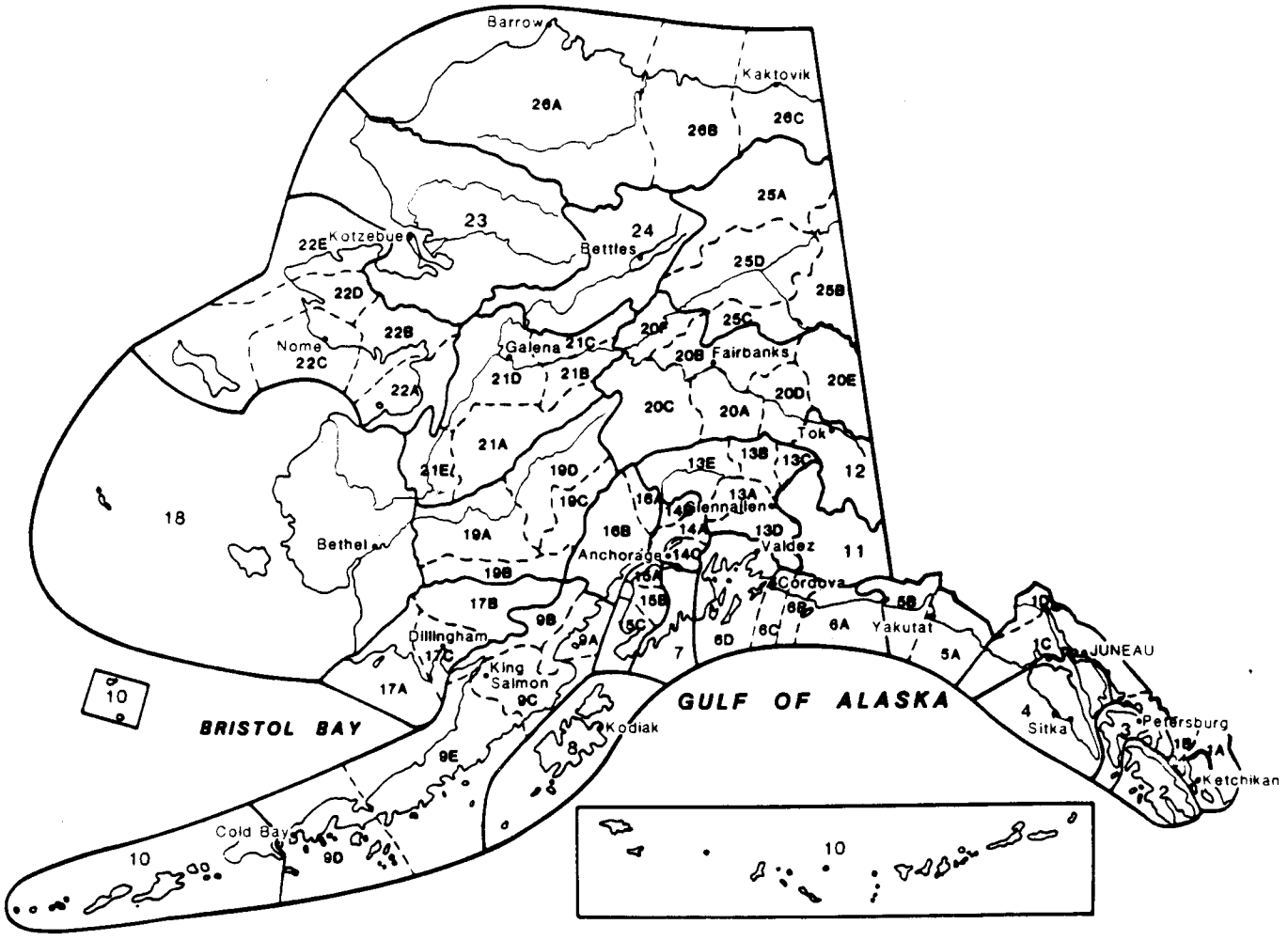
Independent Bears

DAY	DATE	TOTAL SEEN	SURVEY TIME (HR)	BEARS/ HR
1	01-Jul	21	4.15	5.06
2	02-Jul	27	3.47	7.78
3	05-Jul	33	4.3	7.67
4	07-Jul	23	3.9	5.90
5	17-Jul	29	4.03	7.20
6	18-Jul	35	4.28	8.18
	TOTALS =	168	24.13	
	MEANS =	28.00	4.02	6.96

Bears > age 2.0

DAY	DATE	TOTAL SEEN	SURVEY TIME (HR)	BEARS/ HR
1	01-Jul	25	4.15	6.02
2	02-Jul	29	3.47	8.36
3	05-Jul	40	4.3	9.30
4	07-Jul	24	3.9	6.15
5	17-Jul	35	4.03	8.68
6	18-Jul	37	4.28	8.64
	TOTALS =	190	24.13	
	MEANS =	31.67	4.02	7.87

Alaska's Game Management Units



Federal Aid in Wildlife Restoration

The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sales of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program then allots the funds back to states through a formula based on each state's geographic area and the number of paid hunting license holders in the state. Alaska receives 5% of the revenues collected each year, the maximum allowed. The Alaska Department of Fish and Game uses the funds to help restore, conserve, manage, and enhance wild birds and mammals for the public benefit. These funds are also used to educate hunters to develop the skills, knowledge, and attitudes necessary to be reponsible hunters. Seventy-five percent of the funds for this project are from Federal Aid.