TERROR LAKE HYDROELECTRIC PROJECT

REPORT ON BROWN BEAR STUDIES, 1984

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SUMMARY OF FINDINGS

Fifty-three brown bears (Ursus arctos) were captured in 1984 and radio collars were put on 35 adults. A total of 1,151 locations was recorded for 46 radio-collared bears in 1984. One hundred twenty-five bears have been captured and radio collars have been placed on 69 individual bears in the 1st 3 years of the study.

Sixty percent of the 20 eligible females produced cubs in 1984 and mean litter size was 2.4. First year mortality of cubs was 17% (5/29). Predation by male was a suspected in one incident of mortality in newborn cubs.

Close associations of 3-4 adults were observed in 17% (8/46) of the sightings of radio-collared bears considered to be involved in breeding activities in 1984.

Fifteen radio-collared bears were lost to the study from all sources in 1984. Six marked bears died, including 5 killed by hunters and 1 natural mortality. Twenty-eight mortalities of marked and unmarked bears were recorded in the study area in 1984 and 86% (24/28) were legally killed by hunters.

Seasonal habitat use by bears in 1984 followed patterns similar to those previously reported. A somewhat earlier vegetative green-up occurred in 1984 resulting in bears occupying a broad elevational range in May and June. Use of alpine areas declined earlier than usual in 1984. Excellent crops of salmonberry (Rubus spectabilis) and elderberry (Sambucus callicarpa) attracted bears to low and mid-elevations in mid-late summer. Salmon spawning areas on Terror River were less heavily frequented by bears in 1984.

Several radio-collared bears were not located near salmon streams.

Mean area of home range polygons in 1984 was 113 km^2 (range=6.3-279.0 km^2) for 15 radio-collared males and 23.8 km^2 (range=4.2-67.2 km^2) for 35 radio-collared females.

Patterns of movement and habitat use in 1984 by radio-collared bears which have been monitored for 2 or more years were generally similar in 1984 to those previously observed. Several radio-collared bears continued to occupy areas closely adjacent to project worksites. Two females were frequently located within 500 m of the powerhouse and construction camp. A female which was believed to have vacated the Watchout Creek area in 1983 during construction of the Kodiak transmission line, returned to her former range in 1984. An unusually long movement was recorded for a male which emigrated from the study area and was killed 61 km from his capture site.

Den sites of 34 radio-collared bears were located during the 1984-85 denning season. Mean elevation of 37 dens was 699 m (range=91-1128 m). Fifty-eight percent of the bears denned within 1 km of their previous den sites. Seven radio-collared bears denned within 5 km of project sites.

Construction of the Terror Lake hydroelectric project was completed in 1984, the 3rd year of this study. Preliminary analysis of project impacts indicates that disturbance from construction resulted in short-term shifts of activity areas by individual bears, but no major emigration from the project area was documented. Locations of radio-collared bears and observations of bears by construction workers indicated that bears continued to use the project area during the 3 years of construction. Although some bears were attracted to worksites by garbage, project

features were not a major influence on movements of most bears. The consistently high fidelity of individual bears to local denning areas and the close proximity of some dens to project sites indicated that a major disruption of denning activity did not occur.

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INTRODUCTION AND ACKNOWLEDGEMENTS

Background

This report covers results of the 3rd year's study (1984) in a 5-year research project to monitor the impacts of the Terror Lake hydroelectric project on brown bears (*Ursus arctos*). Background information and the results of the first 2 years of study were presented in Smith and Van Daele (1984) and Smith et al. (1985). The study will be continued for 2 more years during the operational or post-construction phase of the project..

The purpose of the study is to document changes in use of the study area by brown bears in response to construction and operation of the Terror Lake hydroelectric project. A pre-construction study by Spencer and Hensel (1980) identified several potential impacts on brown bears including displacement from denning areas. Smith and Van Daele (1984) and Smith et al. (1985) observed that a representative sample of sex and age classes of bears continued to use traditional feeding areas and travel routes in the Kizhuyak Bay and Terror Bay drainage during 1982 and 1983, the first two years of construction. The difficulty in correlating movements of individual bears with disturbance from construction activities lacking comparable pre-project data was emphasized by the latter authors.

Acknowledgements

The assistance of many individuals who contributed to the research effort and to the completion of this report are gratefully acknowledged. Leon Metz contributed his skills to many aspects of the study, including capture operations, radio-tracking flights and data analysis. Additional field assistance was provided by B. Ballenger, V. Barnes, R.

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METHODS

Capture methods and techniques of data collection and analysis were similar to those described in Smith and Van Daele (1984). Brown bears were captured during 2 periods, 4-8 June and 9-13 July 1984. Radio collars were installed on adult bears and movements of radio-collared bears were monitored on a scheduled weekly basis from March through December, 1984.

DESCRIPTION OF THE STUDY AREA

The study area includes approximately 1300 km^2 of northern Kodiak Island, including principally the Kizhuyak Bay, Viekoda Bay, Sharatin Bay, Terror Bay and part of the northern Uganik Bay and northern Ugak Bay drainages (Fig. 1). A more complete description of the study area was reported in Smith and Van Daele (1984).

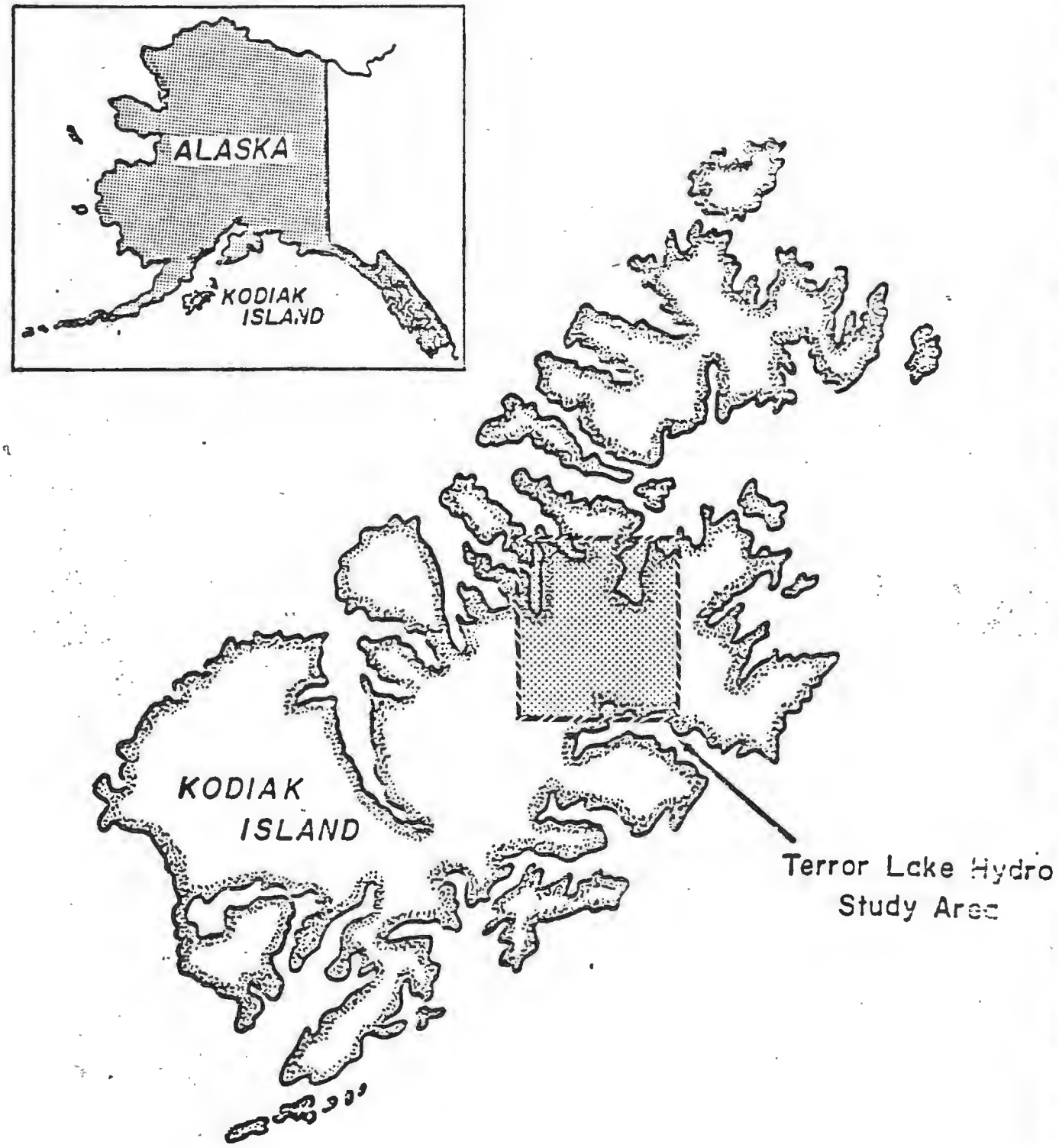

Figure 1. Location of the Terror Lake Hydroelectric Project study area, Kodiak, Alaska.

DESCRIPTION OF THE TERROR LAKE HYDROELECTRIC PROJECT CONSTRUCTION

The Terror Lake hydroelectric project was described in previous reports (Smith and Van Daele 1984; Smith et al. 1985). The intensity of construction activity in 1984, the 3rd and final year of construction, was much reduced from that of the previous 2 years. The access road to the dam site was closed by snow until April. Installation and testing of the valve gate facility at the Terror Lake dam site were completed by June 1 and the lake was beginning to be filled. Installation of equipment at the powerhouse and switchyard was the major activity in 1985. Work was completed on the Falls Creek and Rolling Rock diversion sites. Construction of the tunnel and penstock were finished. Maintenance of the powerhouse access road, including culvert installations and roadbed improvements, continued intermittently through the year. Restoration and seeding of most disturbed areas had been done by September. The access road to Terror Lake was closed by snow in mid-November. Only 1 or 2 helicopters were working in the project area during most of 1984. Most construction equipment and camp facilities were removed by November 1985 when the work force had declined to less than 50 personnel.

RESULTS AND DISCUSSION

Sex and Age Composition of Captured Bears

Fifty-three bears were captured in 2 periods, 4-8 June and 9-13 July, 1984 (Table 1). The captured bears included 23 recaptured adults, 14 first-captured adults, 12 newborn cubs and 4 older cubs.

Table 1. Brown bears captured in Terror Lake study area as of July, 1984.

Bear no.	Sex	Age	Capture date	Ear tag no.(L/R)	Comments
001	F	3.5	4/22/82	1799/1784	Pre-estrus; radio failed by 8/20/83
002	M	15.5	4/22/82	1833/1835/1844	Ear radio attached w/duflex tag to right ear; ear radio last heard on 7/20/82.
003	M	5.5	4/22/82	1839/1842	Collar shed by 6/02/83
004	M	6.5	4/22/82	1836/1834	Collar shed by 10/20/83
005	F	13.5	4/23/82	1740/1744	w/006, 007; w/2 newborn cubs on 6/15/83
006	M	2.5	4/23/82	1825/1823	w/005, 007; killed by hunter on 5/30/82; aged at 3.5 in 1982
007	M	2.5	4/23/82	1819/1824	w/005, 006; killed by hunter on 5/18/83; aged at 3.5 in 1982
008	F	11.5	4/23/82	1739/1749	w/009, 010; suspected radio failure by 10/20/83
009	M	2.5	4/23/82	1820/1829	w/008, 010
010	F	2.5	4/23/82	1726/1735	w/008, 009
011	F	6.5	4/23/82	1728/1733	w/012, 013
012	F	1.5	4/23/82	1781/1732	w/011, 013
013	M	1.5	4/23/82	1814/1816	w/011, 012
014	M	6.5	4/23/82	1818/1847	Suspected radio failure by 9/08/83
015	F	7.5	4/25/82	1741/1743	Milk in pectoral mammae only; seen w/smaller bear, possibly weaned cub on 5/04/82
016	M	11.5	4/25/82	1809/1808	w/017; collar shed by 10/20/83
017	F	21.5	4/25/82	1789/1731	w/016; signal lost between 11/12/83 and 3/19/84
018	F	5.5	4/25/82	1747/1750	w/019; probably younger than cementum age, possibly 3.5 yr. cub of #019.
019	F	6.5	4/25/82	1736/1782	w/018; pre-estrus
020	F	6.5	4/25/82	1746/1738	pectoral mammae had milk; non-estrus
021	M	5.5	4/25/82	--	w/022; capture mortality
022	F	7.5	4/25/82	1729/1730	w/021; possibly pre-estrus
023	M	3.5	4/26/82	1805/1802	w/003; recaptured 6/02/83; radio failed by 9/04/84
024	M	7.5	4/26/82	1803/1810	shed radio-collar by 5/20/84
025	M	13.5	4/26/82	1840/1827	Collar shed by 7/05/82
026	M	5.5	4/26/82	1816/1813	killed on 8/15/82
027	M	13.5	4/27/82	1812/1822	Collar shed by 5/21/82; recaptured on 6/02/83; killed by hunter on 10/14/83
028	M	3.5	4/27/82	1837/1817	Killed by hunter on 5/03/83
029	F	17.5	4/29/82	not recorded	w/030, 031, 032; dead by 10/7/82, suspected shot by hunter

Table 1. (Cont'd). Brown bears captured in Terror Lake study area as of July, 1984.

Bear no.	Sex	Age	Capture date	Ear tag no.(L/R)	Comments
030	M	2.5	4/29/82	1801/1804/1807	w/029, 031, 032; ear radio attached to left ear with duflex tag nos. 1804, 1807; suspected radio failure by 5/10/82.
031	M	2.5	4/29/82	1843/1821	w/029, 030, 032
032	M	2.5	4/29/82	1850/1806	w/029, 030, 031
033	M	3.5	5/01/82	1852/1853	Suspected radio failure by 5/20/83
034	F	13.5	5/02/82	1757/1755	w/035, 036; probable radio failure, last located 9/08/82.
035	F	2.5	5/02/82	--/1763	w/034, 036; ear radio apparently faulty, not relocated.
036	F	2.5	5/02/82	1765/1768	w/034, 035
037	F	4.5	5/02/82	1748/1788	w/038
038	F	3.5	5/02/82	1777/1797	w/037
039	M	2.5	5/02/82	--/1858	w/040, 041; ear radio; last located 5/21/82; aged at 3.5 in 1982 on 6/02/83
040	M	2.5	5/02/82	1854/1862	w/039, 041; aged at 3.5 in 1982; recaptured 6/02/83; signal lost by 9/25/84
041	M	2.5	5/02/82	1864/1841	w/039, 040; aged at 3.5 in 1982
043	F	4.5	7/22/82	1793/1745	Capture mortality
044	F	3.5	7/22/82	1796/1795	
045	M	5.5	7/22/82	1875/1863	Collar shed by 8/11/83
046	F	6.5	7/23/82	1769/1762	w/047 and 1-yearling not captured
047	F	1.5	7/23/82	1764/1773	w/046 and 1-sibling not captured
048	F	23.5	7/24/82	1794/1792	w/049, 050
049	M	1.5	7/24/82	1874/1830	w/048, 050
050	F	1.5	7/24/82	1780/1771	w/048, 049
051	F	8.5	7/24/82	1742/1791	w/052
052	F	1.5	7/24/82	1759/1761	w/051
053	F	8.5	7/24/82	--	w/054; capture mortality
054	M	1.5	7/24/82	1871/1860	w/053
055	F	13.5	7/24/82	1787/1766	w/056, 057, 058
056	F	0.5	7/24/82	1772/1753	w/055, 057, 058
057	M	0.5	7/24/82	1872/1867	w/055, 056, 058
058	M	0.5	7/24/82	1861/1856	w/055, 056, 057
059	M	3.5	7/25/82	1882/1887	
060	F	14.5	7/25/82	1718/1767	w/061, 062, 063; radio failed between 11/12/83 and 3/19/84

Table 1. (Cont'd). Brown bears captured in Terror Lake study area as of July, 1984.

Bear no.	Sex	Age	Capture date	Ear tag no.(L/R)	Comments
061	F	0.5	7/25/82	1725/1723	w/060, 062, 063
062	F	0.5	7/25/82	1714/1716	w/060, 061, 063
063	F	0.5	7/25/82	1722/1715	w/060, 061, 062
064	F	20.5	7/25/82	1724/1719	w/065, 066
065	F	1.5	7/25/82	1798/1751	w/064, 066
066	F	1.5	7/25/82	1754/1758	w/064, 065
067	F	20.5	7/25/82	1785/1783	w/068, 069
068	F	1.5	7/25/82	1737/1775	w/067, 069
069	F	1.5	7/25/82	1760/1720	w/067, 068
070	F	4.5	7/26/82	1711/1706	
071	F	8.5	7/26/82	1707/1702	w/a 0.5 yr. old cub not captured
072	F	18.5	7/26/82	1786/1756	w/073 and a 0.5 yr. old cub not captured.
073	M	0.5	7/26/82	1870/1892	w/072 and a sibling not captured
074	F	17.5	7/26/82	1727/1752	w/075, 076
075	F	1.5	7/26/82	1717/1703	w/074, 076
076	M	1.5	7/26/82	1873/1845	w/074, 075
077	F	20.5	7/26/82	1779/1705	w/3-1.5 yr. old cubs not captured; suspected radio failure by 8/31/83; killed by deer hunter on 10/28/84
023*	M	4.5	6/02/83	1950/1802	w/080; recapture
027*	M	14.5	6/02/83	1812/1822	w/078; killed by hunter on 10/12/83; recapture
040*	M	3.5	6/02/83	1854/1862	recapture
078	F	8.5	6/02/83	2025/2001	w/027; estrus
079	M	14.5	6/02/83	1928/1933	breeding w/077
080	F	25.5	6/02/83	2065/2066	w/023; estrus; collar shed by 7/21/83
081	F	10.5	6/03/83	2067/2064	w/082, 083; non-estrus
082	F	2.5	6/03/83	2012/2015	w/081, 083
083	M	2.5	6/03/83	1930/1929	w/081, 082; killed by hunter on 5/07/84
084	M	12.5	6/03/83	1927/1926	collar shed by 10/12/83
085	F	4.5	6/03/83	2055/2054	non-estrus
086	F	8.5	6/03/83	1776/1712	w/087; non-estrus
087	F	1.5	6/03/83	2073/2058	w/086
088	F	9.5	6/04/83	2071/2072	w/089, 090; non-estrus; signal lost by 9/04/84
089	F	2.5	6/04/83	2016/2007	w/088, 090

Table 1. (Cont'd). Brown bears captured in Terror Lake study area as of July, 1984.

Bear no.	Sex	Age	Capture date	Ear tag no.(L/R)	Comments
090	F	2.5	6/04/83	2024/2005	w/088, 089
091	F	8.5	6/04/83	2056/2075	w/unmarked adult; estrus
092	F	5.5	6/05/83	2052/2074	w/093, 094; did not rejoin cubs; non-estrus; signal lost by 10/09/84
093	F	1.5	6/05/83	2006/2020	w/092, 094; aged by dentition; abandoned
094	F	1.5	6/05/83	2003/2023	w/092, 093; aged by dentition; abandoned
095	M	4.5	6/05/83	1907/1921	w/unmarked adult; apparently killed by another bear between 5/09/84 and 5/20/84
096	F	7.5	6/05/83	2062/2069	estrus
027*	M	14.5	6/05/83	1812/1822	w/078; recaptured to adjust radio-collar; killed by hunter on 10/12/83.
098	M	7.5	6/04/84	1865/1910	
064*	F	22.5	6/04/84	1724/1719	recapture; estrus
048*	F	25.5	6/05/84	1794/2034	recapture; estrus
099	F	10.5	6/05/84	2030/2035	estrus
100	M	5.5	6/05/84	1949/1877	
011*	F	8.5	6/05/84	1728/---	recapture; w/2 newborn cubs not captured
101	M	10 est.	6/05/84	1831/1883	age by tooth wear
037*	F	6.5	6/05/84	1748/1788	recapture; estrus
102	M	5.5	6/05/84	1890/1915	
103	M	6.5	6/06/84	1880/1938	
002*	M	17.5	6/06/84	1833/1948	recapture; radio-collar removed
015*	F	9.5	6/06/84	1741/1743	recapture; estrus; recently nursed, suspect lost newborn litter
104	M	4.5	6/08/84	1889/1924	
022*	F	9.5	6/08/84	1730/1729	recapture; estrus
072*	F	20.5	6/08/84	1786/1756	recapture; estrus
055*	F	15.5	6/08/84	---/---	recapture; estrus
105	M	5.5	6/08/84	1935/1939	killed by hunter on 11/04/84
018*	F	7.5	6/08/84	1747/1750	recapture; estrus; recently nursed, suspect lost newborn litter
044*	F	5.5	7/09/84	1796/1795	recapture; estrus
046*	F	8.5	7/09/84	1769/1762	recapture; w/106, 107 and one 0.5 yr old cub not captured
106	F	0.5	7/09/84	2044/2032	w/046, 107 and one sibling not captured
107	M	0.5	7/09/84	1916/1898	w/046, 106 and one sibling not captured

Table 1. (Cont'd). Brown bears captured in Terror Lake study area as of July, 1984.

Bear no.	Sex	Age	Capture date	Ear tag no.(L/R)	Comments
038*	F	5.5	7/09/84	1777/1797	recapture; possible estrus
067*	F	22.5	7/09/84	2017/2219	recapture; estrus
074*	F	19.5	7/09/84	1727/1752	recapture; w/108, 109, 110; killed by deer hunter on 10/28/84
108	M	0.5	7/09/84	1914/1932	w/074, 109, 110
109	M	0.5	7/09/84	1918/1832	w/074, 108, 110
110	F	0.5	7/09/84	2031/2042	w/074, 108, 109
079*	M	15.5	7/09/84	1928/---	recapture; radio-collar removed
020*	F	8.5	7/10/84	1746/2049	recapture; estrus; lactating; suspect recently lost newborn cubs
071*	F	10.5	7/10/84	1707/2045	recapture; w/111, 112, 113
111	F	0.5	7/10/84	2018/2215	w/071, 112, 113
112	F	0.5	7/10/84	2219/2213	w/071, 111, 113
113	F	0.5	7/10/84	2019/2022	2/071, 111, 112
070*	F	6.5	7/10/84	2224/1706	recapture; w/2-0.5 yr old cubs not captured
114	F	6.5	7/10/84	1925/1922	w/2-1.5 yr old cubs not captured; shed collar by 8/28/84
005*	F	15.5	7/11/84	2059/1740	recapture; w/2-1.5 yr old cubs not captured
059*	M	5.5	7/11/84	1822/1920	recapture
019*	F	8.5	7/12/84	1736/1782	recapture; w/115, 116
115	M	0.5	7/12/84	1917/1911	w/019, 116
116	M	0.5	7/12/84	1866/1923	w/019, 115
051*	F	10.5	7/12/84	1742/1791	recapture; w/117, 118
117	F	0.5	7/12/84	2039/2029	w/051, 118
118	F	0.5	7/12/84	2043/2041	w/051, 117
119	F	6.5	7/13/84	2205/2208	estrus
120	M	12.5	7/13/84	1946/1945	
121	F	13.5	7/13/84	2203/2202	w/122 and 1 uncaptured yearling
122	F	1.5	7/13/84	2014/2002	w/121 and 1 uncaptured sibling
123	F	13.5	7/13/84	2009/2037	w/124, 125, 126
124	F	2.5	7/13/84	2027/2201	w/123, 125, 126
125	F	2.5	7/13/84	2223/2036	w/123, 124, 126
126	F	2.5	7/13/84	2046/2033	w/123, 124, 125
127	F	8.5	7/13/84	2217/2038	estrus; killed by hunter on 11/03/84

* Recaptures

Radio collars were replaced on 21 of the 23 recaptured bears, including 1 adult male and 20 adult females. Radio collars were not replaced on 2 adult males (#'s 002, 079). Radio collars were also installed on the 14 first-captured adults.

First-captured bears included 8 males, 3 single females and 3 maternal females. Four offspring of the 3 maternal females were captured, including 1 yearling male and 3-2.5 year old females.

Ages of 7 newly captured males ranged from 4.5 to 12.5 years with a mean age of 6.8 years. The 6 first-captured females ranged from 6.5 to 13.6 years old with a mean age of 9.9 years.

A total of 125 individual bears has been captured since the study began in 1982. Radio collars have been placed on 69 different bears, including 28 males and 41 females. Thirty-five radio-collared bears were still being monitored by 1 December 1984.

Reproductive Status

Reproductive Status of Females and Cub Survival

Twenty females were predicted to produce cubs in 1984 based on their 1983 reproductive status (Table 2). Only 12 of the 20 bears (60%) were seen with litters but at least 3 other females were believed to have had cubs. Two of the females predicted to have cubs (#'s 015, 018) were lactating when re-captured in June and July, 1984, indicating they had recently lost cubs.

Predation by a male was suspected in one incident of cub mortality. Remains of 2 newborn cubs were found near the den of female, #096, on 20 May. The cubs had recently been killed and mostly consumed by one or more bears. The female was about 0.5 km away, followed by a larger adult, probably a male. Although it could not be verified that the large adult killed the cubs or that the cubs belonged to #096, tracks in the snow and the close proximity of the cubs and the adults to the den site indicated that scenario. The sow had last been located at the den on May 9 and no sign of other bears near the den was observed.

Three of the single females which did not produce cubs may have been too young to breed successfully. Females #'s 037, 038 and 044 were 6.5, 5.5 and 5.5 years old respectively. Female #022, which was 8.5 years old, has not produced a litter since she was captured as a single 5.5 year old bear in 1982. Female #072, a 20.5 year old which lost a litter of newborn cubs late in 1982 has not produced cubs subsequently..

Female #081, an 11.5 year old which was predicted to be single in 1984, produced a litter of 3 cubs. This bear was captured with a litter of 2-2.5 year old cubs on 3 June 1983 and was judged to be non-estrus. She was observed without her cubs by 11 July 1983.

Twelve radio-collared females produced 29 cubs for a mean litter size of 2.4 (range = 2-3). The 12 females with newborn litters ranged from 6.5 to 22.5 years old with a mean age of 11.2 yrs.

Mortality of cubs from the 12 litters through late October was 17% (5/29). Females #'s 020 and #046 both lost their entire litters of 2 and 3 cubs respectively. The litters of females #'s 074 and 077 probably did not survive

long after those females were killed by deer hunters in separate incidents on 28 October.

Three radio-collared females each had litters of 2 yearlings for a mean litter size of 2.0. Female #005, the only radio-collared female which produced cubs in 1983, retained her litter of 2 yearlings and 2 females with litters of yearlings were captured in 1984 (#114, 121).

Two radio-collared females had litters of 2.5 year old cubs. Female #055 apparently weaned her single 2.5 year old between 20 and 29 May. She was observed breeding on the latter date. Female #060, however, was observed with her 2-2.5 year old cubs as late as 11 September.

Breeding Activity

Paired adults were observed by 29 May and as late as 4 August, 1984. Observations of paired radio-collared bears indicated that the peak of breeding occurred in mid-late June.

Associations of 3-4 breeding age adults were seen on 8 occasions from 29 May to 22 July 1984. Although sex of the unmarked bears could not be verified in most cases, relative sizes and behavior indicated that single males were associated with 2-3 females.

Female #055, a 15.5 year old, was observed in a "breeding group" on 3 occasions. On 29 May she was seen copulating with a male within about 15 m of 2 bedded adults. On 15 June she was seen bedded with 2 adults. On 29 June a smaller adult bear, apparently a female, was making short rushes at #055. A larger adult, probably a male, was following within about 50 m. When the smaller female

Table 2. Predicted versus actual reproductive status of radio-collred female brown bears in the Terror Lake study area, 1984.

Bear No.	Age	Predicted Status in 1984	Actual Status in 1984
005*	15.5	w/2 yrlgs	w/2 yrlgs
011*	8.5	w/cubs	w/2 cubs
015*	9.5	w/cubs	single; lactating; suspect lost cubs; estrus on 6/6/84
018*	7.5	w/cubs; 1st litter?	single; lactating; suspect lost cubs; estrus on 6/06/84
019*	8.5	w/cubs; 1st litter?	w/2 cubs
020*	8.5	w/cubs; 1st litter?	w/2 cubs on 6/15/84; w/adult on 6/4/84; estrus on 7/10/84
022*	9.5	w/cubs	single; estrus on 6/08/84
037*	6.5	w/cubs; 1st litter?	single; estrus on 6/05/84
038*	5.5	w/cubs; 1st litter?	single; pre-estrus on 7/09/84
044*	5.5	w/cubs; 1st litter?	single; estrus on 7/09/84
046*	8.5	w/cubs	w/3 cubs; w/2 cubs on 10/02/84; alone on 11/21/84
048*	25.5	single	w/2-3 yrs old; single on 6/05/84 w/2 adults; estrus
051*	10.5	w/cubs	w/2 cubs
055*	15.5	single or w/2-2 yrs old	w/1-2 yrs old; single and breeding on 5/29/84 estrus on 6/08/84
060	16.5	single or w/2-2 yrs old	w/2-2 yrs old
064*	22.5	single	w/1-3 yrs old; single on 5/29; estrus on 6/04/84
067*	22.5	single	w/2-3 yrs old; single on 6/04/84 and estrus
070*	6.5	w/cubs	w/2 cubs
071*	10.5	w/cubs	w/3 cubs
072*	20.5	w/cubs	single
074*	19.5	w/cubs	w/3 cubs; killed by hunter 10/28/84
077	22.5	w/cubs	w/2 cubs; killed by hunter 10/28/84
078	9.5	w/cubs	w/2 cubs
081	11.5	single	w/3 cubs
085	5.5	single	single
086	9.5	single	single
088	10.5	single	single; weaned 2-3 yrs old by 5/29/84
091	9.5	w/cubs	w/3 cubs

Table 2. (Continued). Predicted versus actual reproductive status of radio-collared female brown bears in the Terror Lake study area, 1984.

Bear No.	Age	Predicted Status in 1984	Actual Status in 1984
092	6.5	single or w/cubs	single
096	8.5	w/cubs	single; 2 dead cubs consumed by bear near den site on 5/20/84
099**	10.5		single
114**	6.5		w/2-1.5 yrs old not captured
119**	6.5		single; estrus
121**	13.5		w/2-1.5 yrs old; 1 captured
123**	13.5		w/3-2.5 yrs old; non-estrus
127**	8.5		single; estrus; killed by hunter on 11/03/84

* re-captured in 1984
** captured in 1984

approached #055 too closely, she would stop and confront the smaller bear. This sequence was repeated several times while the bears were being observed from a fixed-wing aircraft circling above. The male continued to follow the smaller bears at a steady, but unhurried pace.

A similar incident occurred on 15 June when female #022, a 7.5 year old, was observed approaching a pair of mating bears. The female of the breeding pair fled and #022 remained with the male.

The composition of one "breeding group" was confirmed when all 3 members of the group were captured on 5 June. Female #048, a 25.5 yr old estrus female, was captured with a 5.5 year old male (#100) and a 10.5 year old estrus female (#099).

Although these incidents suggest a scarcity of breeding males, most of the breeding season associations were of 2 bears. For radio-collared bears only 17% (8/46) of the apparent breeding associations observed from 15 May through 31 July were judged to be of 1 male and multiple females. Thirty-seven associations (80%) were of apparent male/female pairs. One association included a radio-collared male (#023) paired with a radio-collared female (#085). A radio-collared male (#101) was located within 50 m of the paired bears, but he was not observed interacting with the pair.

Mortality

Mortalities of Marked Bears in 1984

Six marked bears (3 males, 3 females) were known to have died in 1984. Three bears (2 males, 1 female) were

legally killed by sport hunters, 2 females were killed in defense of life or property and 1 male died from natural causes.

Bear #083, a 3.5 year old male, was shot by a sport hunter on 7 May 1984 near the head of Kizhuyak Bay. This bear was tagged near upper Kizhuyak River with his mother (#081) and sibling (#082) on 3 June 1983. He was killed 6 km northeast of his tagging location.

Bear #095, a 5.5 year old male, was found dead in May west of Sharatin Bay about 8 km north of his 5 June 1983 capture site. An investigation on 21 May 1984 revealed that the carcass had been partially consumed by another bear. Puncture wounds and major hemorrhaging in the head, shoulder and groin areas indicated this bear had been killed by another bear.

Two radio-collared females with cubs-of-the-year, #074 (19.5 years old) and #077 (22.5 years old), were shot by deer hunters in separate incidents on 28 October 1984. Both bears were killed when they reportedly charged hunters who were returning to retrieve deer shot on the previous day. Bear #074 was killed near Pestchani Creek, 4.0 km northwest of her 26 July 1982 capture site. Bear #077 was killed near Barabara Cove, 2.5 km southeast of her 26 July 1982 capture site.

Bear #127, an 8.5 year old single female, was killed by a sport hunter near Barabara Cove on 3 November 1984, about 1.3 km from her 13 July 1984 tagging site.

Bear #105, a 5.5 year old male, was killed near Barling Bay by a sport hunter on 4 November 1984. This bear was tagged near upper Baumann Creek on 8 June 1984, 61 km north of the kill location.

Sport Harvest and Other Mortality

Twenty-eight bear mortalities (20 males, 8 females) were recorded from all sources in the Terror Lake study area during 1984 (Table 3). Twenty-four (86%) were legally killed by sport hunters, 3 (10%) were killed in defense of life or property, and 1 (4%) died of natural causes. The locations of these mortalities by major drainage were: Ugak Bay -- 9; Sharatin Bay -- 8; Kizhuyak Bay -- 7; Terror Bay -- 2; Viekoda Bay -- 2. The mean age of these bears was 7.6 years (n=27; range = 2.5-21.5).

Bear sport harvest in the entire Kodiak archipelago (Game Management Unit 8) totaled 192 bears in 1984. This was a 24% increase over the 1983 harvest and the highest sport harvest since 1966 when 200 bears were taken.

Sport harvest in the study area was also higher in 1984 with 24 bears killed by sport hunters compared to 17 in 1983 and 18 in 1982. Mean ages of bears harvested during those years were 6.5 in 1984 (n=24; range = 2.5-12.5); 5.5 yrs in 1983, and 5.8 yrs in 1982.

Exploitation Rates of Radio-collared Bears

Analyzing mortality data from radio-collared bears provided an index to exploitation rates in the study area.

Thirty-five bears (28 females, 7 males) had functional radio collars during the spring 1984 hunting season (1 April - 15 May). Twelve radioed females were with cubs during the spring season and were therefore ineligible for harvest. No radio-collared bears were harvested during the spring season.

Forty-one bears (33 females and 8 males) had functional radio collars during the fall (25 October-30 November) season. One bear, female #127, was killed by a bear hunter and 2 females, #074 and #077, were killed in defense of life or property. Another radio-collared bear, male #105, was killed during the fall but was excluded from this analysis because he emigrated from the study area shortly after capture. The resulting overall exploitation rate for the fall season was 7% (3/41) for all bears and 9% (3/33) for all females. Fifteen females were with cubs during the fall season and were thereby ineligible for harvest, although 2 of those were killed by deer hunters. Excluding those bears from the total resulted in a harvest rate from eligible bears of 4% (1/26) for both sexes and 6% (1/18) for females.

Other Losses of Radio-collared Bears

Fifteen radio-collared bears were lost from the study in 1984. Sources of loss were: hunter kill - 4; natural mortality - 1; confirmed or suspected transmitter failure - 6; shed radio collars - 2; removed radio collars - 2.

Cumulative Mortality of Marked Bears

One hundred twenty-five brown bears (49 males and 76 females) have been tagged since the Terror Lake study began in April 1982 (Table 1). Sixty-four of those bears (14 adult males, 34 adult females, 5 juvenile males, 11 juvenile

females) were known to be alive at the end of 1984. Fifteen (9 males, 6 females) were known to be dead (Tables 4 and 5). The fate of the remaining 46 bears (21 males, 25 females) is unknown.

Seasonal Habitat Use

Seasonal Activities and Feeding

Radio-collared bears exhibited habitat use patterns in 1984 similar to those described previously (Smith and Van Daele 1984; Smith et al. 1985). Vegetative green-up began by late April and by late May was well-advanced. Radio-collared bears were distributed over a broad elevational range in May and June, similar to the distribution noted in 1983. Green-up in 1984 was slightly later than in 1983, but much advanced over the green-up reported in 1982 by Smith and Van Daele (1984).

Bears generally remained at higher elevations and by 4 July most were in alpine habitat where they remained through late July. A few bears began to appear near Barabara Lake, a sockeye salmon (Oncorhynchus nerka) source, by 4 July. By 25 July, 7 radio-collared bears and 3 unmarked bears were near the Barabara Lake sockeye streams and bears throughout the study area had generally moved to lower elevations. By 4 August alpine feeding habitat had been largely abandoned and radio-collared bears were near salmon streams or on brushy slopes below 300 m elevation. This was a somewhat earlier movement from alpine habitat than had been observed in the 2 previous years.

Although salmon were available in low to moderate numbers in all major streams in the study area by 25 July, only 2 radio-collared bears were located near Terror River and 2 were near Kizhuyak River salmon spawning areas.

Table 3. Brown bear mortality in the Terror Lake study area, Alaska, 1984.

Sealing Cert. No.	Age	Kill Date	Location	Cause of Death
Males				
49750	9.5	4/13/84	Rough Creek	hunter kill
58394	--	4/17/84	Sharatin Bay	hunter kill
58261	16.5	4/22/84	Anton Larsen Bay	hunter kill
49718	8.5	4/26/84	Viekoda Bay	hunter kill
58280	5.5	4/30/84	Hidden Basin	hunter kill
49743	5.5	5/84	Sharatin Bay	natural(#095)
49706	4.5	5/01/84	Rough Creek	hunter kill
58275	4.5	5/03/84	Terror Bay	hunter kill
58279	5.5	5/04/84	Hidden Basin	hunter kill
58277	3.5	5/05/84	Sharatin Bay	hunter kill
58299	3.5	5/07/84	Kizhuyak Bay	hunter kill(#083)
49717	12.5	5/10/84	Terror Bay	hunter kill
49737	9.5	5/14/84	Hidden Basin	hunter kill
49741	7.5	5/17/84	Pestchani Creek	hunter kill
49745	4.5	5/21/84	Wild Creek	hunter kill
49748	5.5	5/21/84	Rough Creek	hunter kill
49746	8.5	5/23/84	Pestchani Creek	hunter kill
49747	5.5	5/26/84	Kizhuyak Bay	hunter kill
49644	3.5	10/29/84	Rough Creek	hunter kill
57116	5.5	11/14/84	Viekoda Bay	hunter kill
	mean age =6.8 years (n=19)			
	range = 3.5 - 12.5 years			
Females				
58260	4.5	5/02/84	Sharatin Mtn.	hunter kill
49608	2.5	5/31/84	Saltery Cove	hunter kill
49623	21.5	10/28/84	Barabara Cove	dlp* (#077)
49624	18.5	10/28/84	Pestchani Creek	dlp (#074)
49636	8.5	11/03/84	Kizhuyak Bay	hunter kill(#127)
49645	7.5	11/05/84	Sharatin Bay	dlp
57056	3.5	11/05/84	Sharatin Bay	hunter kill
57109	7.5	11/11/84	Elbow Creek	hunter kill
	mean age = 9.3 years (n=8)			
	range = 2.5-21.5 years			

* Killed under State of Alaska "defense of life or property" provisions (5 AAC 92.410).

Table 4. Mortality of marked brown bears in the Terror Lake study area, Alaska, 1982-1984.

Bear	Age	Sex	Date of Kill	Cause	Location
006	2.5	M	5/30/82	hunter	Kizhuyak Bay
007	3.5	M	5/18/83	hunter	Kizhuyak Bay
021	5.5	M	4/25/82	capture	Terror Bay
026	5.5	M	8/16/82	dlp*	NE Arm Uganik Bay
027	14.5	M	10/14/83	hunter	Saltery Lake
028	4.5	M	5/03/83	hunter	Kizhuyak Bay
029	17.5	F	Fall '82	unknown	Sharatin Bay
043	4.5	F	7/22/82	capture	Barabara Flats
053	8.5	F	7/24/82	capture	Terror Bay
074	19.5	F	10/28/84	dlp	Pestchani Creek
077	22.5	F	10/28/84	dlp	Barabara Cove
083	3.5	M	5/07/84	hunter	Kizhuyak Bay
095	5.5	M	5/84	natural	Sharatin Bay
105	5.5	M	11/4/84	hunter	Barling Bay
127	8.5	F	11/3/84	hunter	Barabara Cove

* Killed under State of Alaska "defense of life or property" provisions (5 AAC 92. 410).

Table 5. Causes of mortality of marked brown bears in the Terror Lake study area, Alaska, 1982-1984.

Cause	Male	Female	Total
Hunter	6	0	6
Defense life/ property	1	2	3
Capture	1	2	3
Natural	1	1	2
Unknown	0	1	1
TOTAL	9	6	15

Several radio-collared bears were located within 1-2 km of Terror River spawning areas by 4 August, but a gradual movement away from that stream was evident by mid-late August. It appeared that salmon fishing activity on Terror River was less than had been noted during 1982 and 1983.

Ripening elderberries (Sambucus callicarpa) were prominently visible on lower slopes by 4 August and bears were probably feeding heavily on them. Field examination of bear scats in the Kizhuyak drainage confirmed that. On 13, 14 and 28 August several radio-collared bears were observed feeding on elderberries. A good crop of salmonberries (Rubus spectabilis) was also available in 1984 and bears generally favored dense brushy slopes where both species of berries were available from late July through early September.

The chronology of bear concentrations on salmon streams in the study area was similar in 1984 to that observed in 1983. However, fewer radio-collared bears were located near Terror River in August 1984. Four radio-collared bears were near Terror River on 4 September and on 11 September 4 unmarked bears were seen feeding on salmon there, indicating bears may have returned to feeding on salmon as the berry crop declined. Subtle differences in chronology of salmon availability between years might have been a factor also. Salmon abundance was high with the 1984 escapement of 80,000 pink salmon (O. gorbuscha) the 2nd highest since 1960 for an even year (Prokopowich and Brown 1984). Peak salmon escapement counts for study area streams are shown in Table 6.

Bear feeding activity on Kizhuyak River, Elbow Creek and Hilary Creek salmon spawning areas peaked by mid-September. Five radio-collared bears located near Kizhuyak River, 3 were near Elbow Creek and 2 were near Hilary creek

on 11 September. Intensive fishing activity continued through late September on the Elbow Creek and Kizhuyak River drainages. This was a similar period of peak fishing activity as occurred in 1982 and 1983 in these drainages.

An upward elevational movement toward denning habitat was noted by 10 October 1984, but some use of salmon streams continued. One radio-collared bear (#103) was observed on that date near upper Uganik River where coho salmon (O. kisutch) were reported abundant (K. Manthey, personal communication). One radio-collared bear (#071) remained near Kizhuyak River through early November, probably feeding on coho salmon. The commercial harvest of coho salmon in 1984 in the Kodiak area was the highest on record and escapements of coho were rated fair to excellent overall (Manthey et al. 1985).

Seasonal habitat use patterns appeared to be most closely correlated with vegetative phenology and with salmon availability. Other food sources also attracted bears in the study area in 1984. The attraction of bears to garbage sources and predation and scavenging on Sitka black-tailed deer (Odocoileus hemionus sikensis) were previously reported (Smith and Van Daele 1984; Smith et al. 1985). Bears again frequented construction sites and were observed feeding on garbage. Two bears (#'s 074, 077) were killed in the study area by deer hunters who had returned to kill sites to retrieve deer carcasses.

A large carcass, apparently that of a sea lion (Eumatopia jubatus), had attracted several bears to a beach south of Hilary creek on 25 September 1984. Female #123 was seen feeding on the carcass and refused to leave it even after several aerial passes were made to verify her identity. Four other radio-collared bears were located within 300 m of the site.

Table 6. Peak salmon escapement counts in Terror lake study area, 1984.

Location	Stream number	Survey date	Number of pinks	Number of chums	Number of sockeye	Number of coho
Terror River	253-331	7/29	12,000	10.000	---	---
		8/27	68,000	---	---	---
Baumann Creek	253-332	8/27	21,000	---	---	---
Claras Creek	253-333	8/27	3,200	---	---	---
E. Viekoda Creek	253-322	10/6	0	0	0	0
S. Viekoda Creek	253-321	10/6	0	0	0	6
Pestchani Creek	259-366	7/31	2,700	---	---	---
Barabara Creek	259-363	6/23	---	---	1,600	---
		8/27	200	---	---	6
Hilary Creek	259-364	7/31	2,500*	---	---	---
Kizhuyak River	259-365	7/31	2,500	---	---	---
		9/10	34,000	9,000	---	---
Elbow Creek	259-371	8/13	24,500	11.500		
Saltery Creek	259-415	7/20	---	---	120.000	---
		7/29	---	10.000	---	---
		8/03	28,000			
		9/10	---	---	---	2,100

* at creek mouth

Mountain goats (Oreamnos americanus) were also targets of opportunity for bears in 1984. Tim Tobey, a project employee, observed an incident of attempted predation on mountain goats on 1 June 1984. The adult bear was observed descending into sheer cliffs in Falls Creek canyon where it approached a group of 2 adult and 2 newborn kid goats. The adult goats charged toward the bear, who hesitated only momentarily before continuing to advance. The adult goats bolted up a rock face when the bear approached the approximately 3 m^2 shelf to which they had retreated. One kid either fell or was knocked off the cliff by the bear. The kid fell more than 30 m before disappearing and was undoubtedly killed in the fall. The bear remained on a ledge about 7 m below the other 3 goats for about an hour before ascending the slope where he was first seen.

A hunter reported seeing a bear feeding on a mountain goat carcass south of Shotgun Creek in early September. It was suspected that the goat had been killed by a hunter who couldn't retrieve it because of the precipitous terrain.

Habitat Use Indicated by Elevations of Radio-locations

Analysis of mean elevations of radio-collared bear locations in 1984 by half month period indicated seasonal habitat use patterns similar to those previously reported (Smith and Van Daele 1984; Smith et al. 1985). A comparison of 1982, 1983 and 1984 data did not reveal any statistically significant differences ($p > 0.10$) between years. In 1984 mean elevations again varied significantly ($p < 0.01$) by season and reproductive status (Figure 2). Males and single females occupied significantly different elevations ($p < 0.02$) as did males and females with cubs ($p < 0.02$).

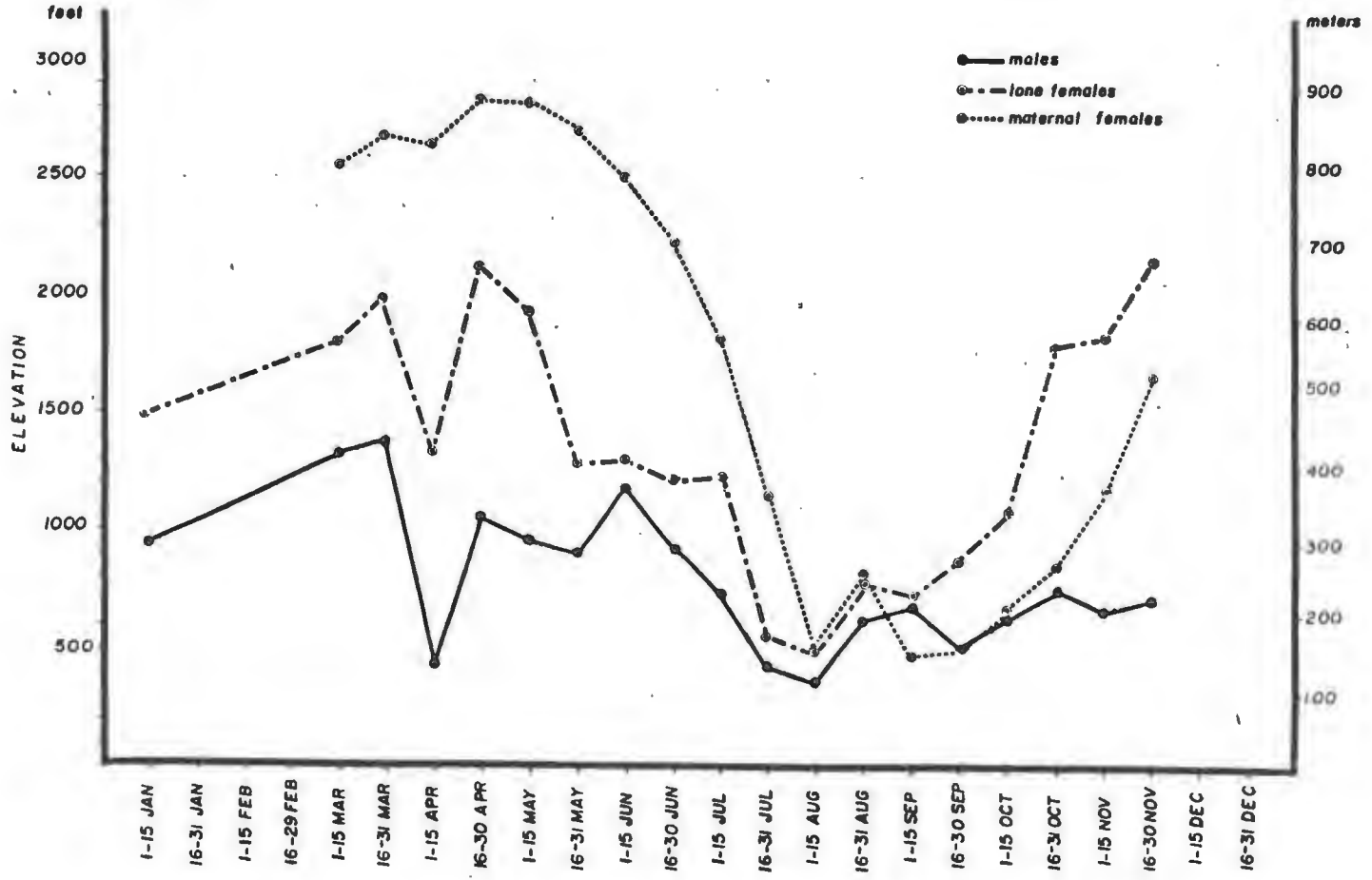

Fig. 2. Mean seasonal elevations of radio-collared bears in Terror Lake study area, 1984.

No statistically significant differences were noted between lone females and females with cubs ($p > 0.10$).

Movements and Home Range

Movements of 51 radio-collared bears, including 15 males and 36 females, were monitored in 1984. Radio-tracking flights were made 3-4 times per month from March through November. A total of 1,151 locations for study animals was recorded in 1984.

Home Range Areas

Home range areas of radio-collared bears in 1984 are shown in Table 4. Mean home range area for 15 males in 1984 was 113.0 km^2 (range = 6.3-279.0 km^2) which compared closely with the 111.8 km^2 mean home range recorded in 1983 (Smith et al. 1985) but was smaller than the 141.2 km^2 mean home range for males in 1982 (Smith and Van Daele 1985). Mean home range area for 35 females in 1984 was 23.8 km^2 (range = 4.2-67.2 km^2), less than the 29.9 km^2 and 30.2 km^2 reported for 1982 and 1983 respectively by Smith et al. (1985).

The mean home range area for 12 females (#s 018, 019, 020, 022, 037, 038, 040, 051, 055, 072, 086, 088) which occupied mainly the Terror Bay drainages was 21.7 km^2 (range = 4.6 - 51.1 km^2). Fourteen females (#s 005, 011, 044, 060, 067, 070, 071, 074, 078, 081, 091, 114, 123, 127) which occupied the Kizhuyak Bay drainages had a mean home range area size of 17.6 km^2. Smith et al. (1985) noted that females in the Terror Bay drainages had larger home range areas than females in the Kizhuyak Bay drainages in 1982 and 1983.

Analysis of home range areas for females by reproductive status indicated that single females had the largest mean home range size followed by females with 0.5 year old cubs and females with yearling or older cubs. Mean home range size for 19 single females was 28.1 km^2 (range = 4.6 - 67.2 km^2). Mean home range size for 10 females with 0.5 year old cubs was 21.0 km^2 (range = 5.9 - 51.1 km^2). Five females with yearling or older cubs had a mean home range area of 17.1 km^2 (range = 12.4 - 22.9 km^2).

Movements of Males

Data on movements of 15 radio-collared males were collected in 1984. Five of the males (#002, 023, 024, 040 and 059) were captured in 1982, the first year of study. Data for the entire year were collected only for male #059.

Male #002, a 17.5 year old, continued to frequent the project area in 1984 (Fig. 5). He again occupied the Rolling Rock Creek drainage during the winter and early spring. This bear remained active at least into mid-January when it was seen near Kizhuyak Bay. He was next located near Rolling Rock Creek on 13 March at approximately the same location he occupied during the previous winter. On 19 March he was seen bedded approximately 1 km north of the tunnel portal in Rolling Rock Creek. Between 28 March and 4 April this bear moved from Rolling Rock Creek about 4 km east to Watchout Creek. On 24 and 30 April he was located in dense brush within 100 m of the access road near Kizhuyak River. The bear was bedded and appeared to be undisturbed by nearby vehicular traffic when seen on 24 April. He was re-captured near Hilary Creek on 6 June and his radio-collar was removed. Construction workers subsequently reported seeing a large ear-flagged bear near the tunnel portal in Rolling Rock Creek which was probably #002. Among males

Table 7. Home range areas for radio-collared brown bears in the Terror Lake study area, 1984 (bears with 5 or more locations).

Bear Number	Age	Observation period	Number of locations	Home range area in km^2 (mi^2)	Comments
MALES (n=15)					
002	17.5	Jan-Jun	14	44.6 (17.2)	collar removed
023	9.5	Jan-Sep	26	71.8 (27.7)	
024	9.5	Mar-May	6	6.3 (2.4)	shed collar
040	5.5	Mar-Sept	24	76.5 (29.6)	
059	5.5	Jan-Nov	29	44.0 (17.0)	
079	15.5	Jan-Jul	20	67.4 (26.0)	collar removed
095	5.5	Mar-May	7	32.6 (12.6)	natural mortality
098	7.5	Jun-Nov	22	77.0 (29.7)	
100	5.5	Jun-Jan[A]	18	279.0 (107.7)	
101	--	Jun-Nov	20	164.4 (63.5)	
102	5.5	Jun-Nov	19	174.5 (67.4)	
103	6.5	Jun-Jan[A]	23	253.2 (97.8)	
104	4.5	Jun-Nov	17	98.1 (37.9)	
105	5.5	Jun-Nov	5	187.8 (72.5)	hunting mortality
120	12.5	Jun-Nov	16	118.0 (45.6)	
		Range =	5-29	6.3-279.0 (2.4-107.7)	
		Mean =	17.7	113.0 (43.6)	
FEMALES (n=35)					
005	15.5	Mar-Nov	22	15.4 (5.9)	
011	8.5	Mar-Nov	35	32.4 (12.5)	
015	9.5	Mar-Nov	28	63.8 (24.6)	
018	7.5	Mar-Nov	29	16.1 (6.2)	
019	8.5	Jun-Nov	20	11.5 (4.5)	
020	8.5	Mar-Nov	31	4.6 (1.8)	
022	9.5	Mar-Nov	28	12.1 (4.7)	
037	6.5	Mar-Nov	29	34.2 (13.2)	
038	5.5	Mar-Nov	29	34.9 (13.5)	
044	5.5	Mar-Nov	34	16.2 (6.3)	
046	8.5	Mar-Nov	30	20.5 (7.9)	
048	25.5	Mar-Nov	26	20.0 (7.7)	
051	10.5	Mar-Nov	36	51.1 (19.7)	
055	15.5	Mar-Nov	26	16.9 (6.5)	
060	16.5	Apr-Sep	6	15.0 (5.8)	
064	22.5	Mar-Nov	28	47.9 (18.5)	
067	22.5	Mar-Nov	39	29.1 (11.2)	
070	6.5	Jun-Nov	20	5.9 (2.3)	
071	10.5	Mar-Jan[A]	33	23.4 (9.0)	
072	20.5	Mar-Nov	29	9.8 (3.8)	
074	19.5	Mar-Oct	32	10.3 (4.0)	DLP mortality
078	9.5	Mar-Nov	31	7.1 (2.7)	

Table 7. (Continued). Home range areas for radio-collared brown bears in the Terror Lake study area, 1984 (bears with 5 or more locations).

Bear Number	Age	Observation period	Number of locations	Home range area in km^2 (mi^2)	Comments
081	11.5	Mar-Nov	28	18.7 (7.2)	
085	5.5	Mar-Nov	26	67.2 (25.9)	
086	9.5	Jan-Nov	26	15.8 (6.1)	
088	10.5	Mar-Aug	15	33.2 (12.8)	Radio failure
091	9.5	Mar-Nov	30	29.0 (11.2)	
092	6.5	Mar-Oct	23	17.8 (6.9)	Radio failure
096	8.5	Jan-Nov	29	13.1 (5.1)	
099	10.5	Jun-Nov	19	52.7 (20.4)	
114	6.5	Jul-Aug	8	12.4 (4.8)	Shed collar
119	6.5	Jul-Nov	19	4.2 (1.6)	
121	13.5	Jul-Jan [A]	17	39.5 (15.3)	
123	13.5	Jul-Nov	16	22.9 (8.8)	
127	8.5	Jul-Nov	14	8.0 (3.1)	Hunting mortality
		Range =	6-39	4.2-67.2 (1.6-25.9)	
		Mean =	25.5	23.8 (9.2)	

[A] - observation period extended to 2 January 1985 to include 84-85 den location

this bear was the one most consistently found in close proximity to Kizhuyak project sites during the 3 years of construction.

Male #040, a 4.5 year old, occupied the same general area east of Kizhuyak Bay in 1983 and 1984 (Fig. 8). This bear was more frequently located in the Watchout Creek drainage in 1984 than in 1983 when the Kodiak transmission line was being constructed. Smith et al. (1985) suggested that transmission line construction activity in 1983 might have deterred this bear from moving into the lower Kizhuyak River and Watchout Creek areas where salmon were available. No movements into the lower Kizhuyak River drainage were recorded in 1984. This bear was found near salmon spawning streams in the Elbow Creek drainage in September 1984. He was not located near a source of salmon in 1983 (Smith et al. 1985).

Male #098, a 7.5 year old, which was captured on 4 June 1984 in upper Elbow Creek, remained in the Sharatin Bay drainage through July (Fig. 17). He was located near lower Elbow Creek salmon spawning areas in September. In early October he moved to the west side of Kizhuyak Bay but returned to his previous activity area in Elbow Creek by 7 November. His closest approach to project sites occurred on 26 October when he was located 2.8 km west of the Kizhuyak jetty.

Male #079, a 15.5 year old, frequented South Viekoda Creek and Barabara Lake areas in both 1983 and 1984. He was located near upper Kizhuyak Bay from mid-April through mid-June 1984, an area he did not frequent in 1983.

Male #023, a 5.5 year old, was not active near the project sites in 1984. His movements were similar to those recorded in 1983. He probably denned near Baumann Creek and

subsequently moved to the upper South Viekoda Creek and Barabara Lake areas. He was found near the salmon spawning stream southwest of Barabara Lake for 9 consecutive locations from 22 June through late August when he shed his radio collar.

Male #101, a 9.5 year old, ranged from his 5 June 1984 capture site in lower Baumann Creek northeastward into the Viekoda Bay and Kizhuyak Bay drainages (Fig. 20). He was located within 3 km of Port Lions village in late October. An extensive network of off-road vehicular trails west of Port Lions transect much of this bear's home range. He was located several times within 1 km of this trail network. He apparently did not frequent salmon streams extensively, although he was found near Barabara Lake on 25 July when sockeye salmon were available.

Male #104, a 4.5 year old captured east of Kizhuyak Bay on 8 June 1984, moved to near Barabara Lake by mid-July. He remained there through mid-August probably feeding on sockeye salmon (Fig. 23). He then moved about 10 km to near Whale Passage north of Port Lions where he was most often found subsequently. This bear's close proximity to Port Lions suggests that he may have been visiting the village garbage dump.

Male #120, a 12.5 year old, occupied a small activity area, about 25 km^2, between Sharatin Bay and Kizhuyak Bay from mid-July through early November (Fig. 27). He was located near salmon spawning areas on lower Elbow Creek 3 times in September. Between 6 November and 21 November he moved 21 km west to near Uganik Passage. By 29 November he was located on Uganik Island. This was the first known movement by a radio-collared bear to Uganik Island during this study.

Male #059, a 5.5 year old, occupied a relatively small home range (99 km^2) in 1984, moving alternately between the west side of the Northeast Arm of Uganik Bay and the north side of Uganik Lake. Smith et al. (1985) believed that this bear's vacating its 1982 home range in the Terror River drainage to move into the Uganik drainage in 1983 was a dispersal movement correlated with increased maturity. That conclusion was supported by this bear's exclusive occupancy of the Uganik drainage in 1984.

Male #100, a 5.5 year old, had the largest home range (279 km^2) for a male in 1984 (Fig. 19). His longest move between successive locations occurred between 9 and 20 October when he moved 26 km from the Northeast Arm of Uganik Bay to near Barabara Lake. By 26 October he had returned to the Uganik drainage, a linear movement of 22 km.

Male #102, a 5.5 year old, occupied mainly the Terror River drainage from late July through November (Fig. 21). In June and early July during the breeding season, he was most often located several km northwest of Terror River in the upper Baumann Creek and Viekoda Bay drainages. His close proximity to lower Terror River in late July and August indicate that he was feeding on salmon. He was located 2 km downstream from the Terror Lake dam on 9 October. He denned in the upper Uganik River drainage about 6.5 km southwest of Terror Lake.

Male #103, a 6.5 year old, captured in upper Hatchout Creek on 6 June 1984, moved about 30 km to Uganik Lake drainage by early July (Fig. 22). He remained within a 5 km radius of upper Uganik Lake through 29 November when he was last located. This bear's activities apparently centered around the abundant sockeye and coho salmon available in this drainage from mid-July through November.

Male #105, a 5.5 year old captured with female #055 north of Den Mountain on 8 June, remained in that area through 22 June (Fig. 24). He was not located after that date. On 19 July a marked bear believed to be #105 was reported seen near Heitman Lake about 10 km south of the town of Kodiak. A hunter killed this bear on 4 November on southeastern Kodiak Island near Barling Bay, 61 km from its original capture location. That was the longest movement recorded during this study. Dispersal by young males coincident with the breeding season is probably not unusual, however.

Male #095, a 5.5 year old, moved about 20 km from Terror River to Kizhuyak Bay within 2 weeks after emerging from his Den Mountain den site. A reverse movement was seen in 1983 when the bear moved from of Kizhuyak Bay to Terror River in July and remained in the Terror Bay drainage for the rest of that year. This bear was apparently killed by another bear in May 1984, 3 km north of Pestchani Creek.

Movements of Females

Movement data was collected for 36 females in 1984. Sixteen females had home ranges mostly confined to the Kizhuyak Bay drainages (#s 005, 011, 044, 060, 067, 070, 071, 074, 077, 078, 081, 091, 114, 119, 123, 127). Two females favored the Sharatin Bay drainage (#s 092, 121). Six females had home ranges including parts of the Viekoda Bay, Kizhuyak Bay and Terror Bay drainages (#s 015, 046, 064, 085, 098, 099). Twelve females had home ranges mainly in the Terror Bay drainages (#s 018, 019, 020, 022, 037, 038, 048, 051, 055, 072, 086, 088).

Female #005, a 14.5 year old with 2 yearlings, moved back into the Hatchout Creek and lower Kizhuyak River area

which she had apparently vacated in 1983 (Fig. 6). Her activity area in 1984 more closely resembled that recorded in 1982. Smith et al. (1985) suggested that this bear's shift to the north in 1983 was correlated with disturbance from construction of the Kodiak transmission line. She frequented the lower Watchout Creek and Kizhuyak River area near salmon spawning grounds in September 1984, much as she did in 1982. Smith et al. (1985) noted that her activity area in 1983 was generally separated from the transmission line by the prominent ridge north of Watchout Creek and south of Pestchani Creek. In 1984 she was most frequently located south of that ridge in lower Watchout Creek to Dovolno Point. Although differences in seasonal food availability, reproductive status or other environmental factors offer possible alternate explanations for these movements, there was close correlation with changes in intensity of construction activities.

Female #011, an 8.5 year old with 2 newborn cubs exhibited little change in 1984 from her home range during the previous 2 years of observation (Fig. 7). She frequented alpine habitat west of Kizhuyak River through July, much as she did in 1982 and 1983. Although she was seen near Barabara Lake once in August, she apparently did not use salmon to much extent again in 1984. After spending most of September in upper South Viekoda Creek, she moved to west of Kizhuyak River where she remained into late November, denning near Lake Leanne. This fall movement was her closest approach to construction sites in the 3 years of study.

Female #044, a 5.5 year old single bear, continued to favor higher elevations west of Kizhuyak Bay (Fig. 9). She left her den site at 1070 m elevation between 15 and 22 June, an unusually late emergence date. She remained in alpine habitat through late July and frequented lower slopes

west of Kizhuyak River in early September. On 11 September she was located in dense cover between the access road and the Kizhuyak River flats, indicating she had probably been feeding on salmon. She favored the slopes west of Kizhuyak Bay for the rest of the year and denned near her previous den site in late November.

Female #071, a 10.5 year old with a litter of 3 newborn cubs, occupied approximately the same area during the first 3 years of the study (Fig. 11). She remained in alpine habitat in the southern Watchout Creek drainage through mid-July 1984. She then moved to the lower Watchout Creek salmon spawning areas, remaining near a salmon source about a month longer than she did in 1983. Smith et al. (1985) suggested that the construction activity did not seriously disrupt this bear's activities in 1983.

Female #078, a 9.5 year old with 2 newborn cubs, occupied approximately the same areas in 1983 and 1984. She was located within 500 m of salmon streams in lower Kizhuyak River on 11 and 18 September 1984 (Fig. 12). During the construction of the Kodiak transmission line in 1983, this bear was not found closer than 1.5 km to these salmon streams. This suggests that transmission line construction activity might have been a deterrent to her fishing in 1983.

Female #081, an 11.5 year old with 3 newborn cubs, exhibited similar seasonal movements in 1983 and 1984 (Fig. 13). This bear exhibited a high tolerance for construction activities in 1984 as was previously noted by Smith et al. (1985). She remained in alpine habitat southeast of the construction camp above 670 m through early July. She then moved lower into brushy habitat east of the construction camp in the Kizhuyak River drainage. In September and October she moved alternately between the lower Kizhuyak River and the immediate environs of the

construction camp. On 18 and 25 September she was located in dense cottonwoods adjacent to the lower Kizhuyak River about 4 km north of the camp, probably attracted by salmon. On 19 and 20 October she was seen within 200 m of the powerhouse. It was suspected that she was attracted to the metal dump where some garbage was being dumped in violation of project license stipulations. Construction workers did not report seeing this bear, but bear tracks and feces were commonly found at the metal dump in 1984. Possibly this bear was feeding at the dump nocturnally. This bear denned east of upper Kizhuyak River about 2.5 km south of her previous den location.

Female #091, a 9.5 year old with 3 newborn cubs, again ranged between the north and south sides of Watchout Creek in 1984 (Fig. 16). She was found near salmon spawning areas in lower Watchout Creek twice in September 1984. Smith et al. (1985) noted that she mainly frequented the upper part of Watchout Creek in 1983 during construction of the Kodiak transmission line.

Female #119, a 6.5 year old single bear, centered her activities around the Kizhuyak construction camp where she was attracted by garbage (Fig. 26). This bear was captured on 13 July 1984, when she was seen walking on the access road approximately 4 km south of the Kizhuyak jetty. She was repeatedly located within a few hundred meters of the construction camp until early November when she moved into upper Falls Creek to den.

Workers reported that a radio-collared bear made repeated forays into the construction camp to raid trash storage containers on 22 and 23 July. Photographs provided by workers confirmed that the bear was #119. She was located within 100 m of the northern edge of the camp pad at 1017 hr on 25 July. By 1550 hr she had moved to within 100

m of the south side of the camp pad. An inspection on 26 July confirmed that food scraps were present at several work sites in the camp. A subsequent visit to the camp on 3 October revealed that one or more bears were still visiting the camp, attracted by food scraps in the metal dump and near the incinerator.

The 4.2 km^2 home range of #119 was the smallest recorded for a female in 1984. The easy availability of garbage at the construction camp and at other nearby work sites strongly influenced this bear's movements. She was observed digging tundra vegetation once in October and she was seen near a salmon spawning area in mid-August, but the construction camp was clearly the hub of this bear's activity area.

Female #067, a 22.5 year old which weaned 2-2.5 year old cubs in May, ranged from Barabara Lake to alpine habitat west of Kizhuyak Bay through mid-July (Fig. 10). This was approximately the same area she had occupied in 1983 when the Port Lions transmission line was under construction. In 1982 she was located near salmon spawning areas in lower Kizhuyak River, a movement which was not observed in either 1983 or 1984. For the 3rd consecutive year she denned in the peaks west of the Kizhuyak Bay jetty.

Female #060, a 16.5 year old with 2-2.5 year old cubs, continued to range mainly from Barabara Lake south to the mountain west of lower Kizhuyak River. Although her radio transmitter failed while she was denned, she was identified by her ear flags 6 times in 1984. She was seen near the salmon stream south of Barabara Lake on 25 July and she was observed with her cubs fishing in Hilary Creek on 11 September.

Female #070, a 6.5 year old with 2 newborn cubs, used alpine habitat south of Pestchani Creek through mid-July. Her 5.9 km^2 home range was the 3rd smallest recorded for a female in 1984. She moved alternately between Pestchani Creek and Kizhuyak Bay near Dovolno Point through early November. For the 3rd consecutive year this bear was not located near salmon streams in the study area.

Female #074, a 19.5 year old with 3 newborn cubs, again occupied a small home range (10.3 km^2) centered around Pestchani Creek. She remained in alpine habitat north of Pestchani Creek through late July. She moved alternately between the north and south sides of Pestchani Creek through late October. For the 3rd consecutive year she apparently did not frequent a salmon stream. She was killed when she reportedly charged a hunter who had returned to retrieve a deer carcass.

Female #077, a 22.5 year old with 2 newborn cubs, was killed near Barbara Lake on 28 October 1984, 2 km southeast of her 26 July 1982 capture location. This bear, whose radio failed in 1983, had been seen only once in 1984 when she escaped a recapture attempt. Hunters killed the bear when she reportedly charged them as they attempted to recover a deer. This bear had previously charged a deer hunter in apparent defense of her cubs (Smith and Van Daele 1984).

Female #123, a 13.5 year old with 3-2.5 year old cubs, ranged from near Hilary Creek to lower Kizhuyak River after her 13 July 1984 capture 6 km west of the Kizhuyak jetty (Fig. 29). Her closest location to construction sites occurred on 25 July when she was located in Kizhuyak River flats near a salmon stream east of the access road.

Female #127, an 8.5 year old single bear captured on 13 July 1984, occupied a small home range southeast of Barabara Lake (Fig. 30). She was killed by a bear hunter on 3 November. Her home range was nearly identical to that of female #077, which coincidentally was killed by deer hunters a few days earlier.

Two females ranged mainly in the Sharatin Bay drainage in 1984. Female #121, a 13.5 year old bear with 2 yearlings, ranged between Sharatin and Kizhuyak Bays after her 13 July 1984 capture (Fig. 28). She was frequently found near the coast and moved to near salmon spawning areas on lower Elbow Creek in September. She moved about 5 km south of her summer/fall range to den south of Pestchani Creek. Female #092, a 6.5 year old single bear, ranged exclusively in the lower Elbow Creek drainage until early October when her transmitter apparently failed. She was usually located within 1 km of salmon spawning areas and probably fed intermittently on salmon from early August through early October.

Three females had similar home ranges centered near Baumann Creek. Female #086, a 9.5 year old single bear, occupied nearly identical areas in 1983 and 1984 in the lower Baumann Creek and Clara's Creek drainages into Terror Bay. Female #018, a single 7.5 year old bear, occupied lower Baumann Creek and Clara's Creek, an area similar to her 1982 and 1983 home ranges. Female #019, an 8.5 year old with 2 newborn cubs occupied a small home range (11.5 km^2) in the lower Baumann Creek area similar to the areas occupied in 1982 and 1983. She remained near her den through mid-June and frequented sub-alpine habitat north of Baumann Creek through July. In early October she moved to the coast at Baumann Creek and apparently remained there through early November. She may have been foraging on salmon in lower Baumann Creek during that period, although

peak salmon availability occurred there much earlier. She denned in Baumann Creek for the 3rd consecutive year.

Females #s 020, 022 and 072 had small home ranges east of Terror Bay in the Baumann Creek and Falls Creek area. Female #020, an 8.5 year old, remained in or near her den until the last week of May. She was seen on 15 June with 2 newborn cubs. When observed on 4 July she was with an adult, probably a male, and the cubs were missing. Her home range of only 4.6 km^2 was the 2nd smallest recorded for a female in 1984. During 3 years of observation this bear has not been found near a salmon stream.

Female #022, a 9.5 year old single bear, occupied a 12.1 km^2 home range east of Terror Bay similar to the areas occupied in the 2 previous years. She occupied alpine and sub-alpine areas east of Terror Bay from den emergence in late April through early July. She was located within about 0.5 km of Terror River on 14 August, her closest location to a salmon stream in 1984.

Female #072, a 20.5 year old which has been single for 2 years, continued to occupy an area centered near Falls Creek east of Terror Bay. For the 3rd consecutive year she was not located near salmon streams. In 1984 she remained at elevations from 215 m - 565 m from den emergence through early October.

Females #s 037, 038, 048, 051, 055, and 088 had home ranges mainly confined to the Terror River and Baumann Creek drainages. Female #037, a 6.5 year old single bear, intermittently occupied the slope east of lower Terror River and a site in upper Baumann Creek near her 1983-84 den, a pattern of movement noted by Smith et al. (1985) in 1983. She was within about 1 km of Terror River in August and

early September where she may have been alternately seeking salmon and elderberries which were abundant by mid-August.

Female #038, a 5.5 year old single bear, has occupied much the same area between Terror River and Baumann Creek for 3 consecutive years. She was found in sub-alpine habitat over 300 m from early June through early July 1984 in the upper Baumann Creek drainage. By late July she was located near Terror River, probably fishing. From mid-August through October she was located north of Terror River at elevations above 200 m. She denned on Den Mountain for the 3rd consecutive year.

Female #048, a 25.5 year old single bear, exhibited little change from the areas used in the first 2 years of the study. She remained in sub-alpine habitat in the Terror River drainage through early July 1984. She was located within 1 km of Terror River in late July and early August, possibly fishing for salmon. She occupied the southern slope of Den Mountain after 4 August and denned on Den Mountain by 21 November.

Female #051, a 10.5 year old with 2 newborn cubs, exhibited seasonal movements similar to those observed in 1982 and 1983. She remained near her den at 1070 m on Den Mountain unusually late, finally moving from it between 4 and 9 July. She moved into the Terror River drainage in August and into the lower Baumann Creek drainage in September. She returned to Den Mountain area by 2 October and denned there by 6 November.

Female #055, a 15.5 year old which weaned a 2.5 year old cub shortly after den emergence, ranged in approximately the same area occupied in the previous 2 years. She was located in alpine habitat through early July and then moved to near Terror River where she remained through early

September, probably feeding on salmon. She moved to progressively higher elevations in the fall and denned on Den Mountain for the 3rd consecutive year.

Female #088, a 10.5 year old, again used the southern slope of Den Mountain east to the pass north of the Terror Lake dam (Fig. 15). A pattern of alpine feeding through early July, followed by a move to near Terror River, similar to that observed in 1983, was again noted before the bear's transmitter failed in late August 1984. Smith et al. (1985) noted that this bear's home range was one of the 2 closest to Terror Lake dam in 1983.

Females #015, 046, 064, 085, 096 and 099 had home ranges centered in the Viekoda Creek drainage. Female #015, a 9.5 year old single bear, exhibited seasonal movements in 1984 similar to those recorded in 1982 and 1983. Female #046, an 8.5 year old with 3 newborn cubs, occupied an inland home range from Den Mountain north to upper South Viekoda Creek. She was located no closer than about 5.5 km to the coast in 1984 and apparently did not frequent a salmon stream.

Female #064, a 22.5 year old single bear, utilized similar areas during the first 3 years of the study. Her 1984 home range again included lower Terror River, upper Baumann Creek and South Viekoda Creek drainages. She was located in alpine habitat through early July. She apparently spent little time near salmon streams, although she was located near Barabara Lake on 28 August and near Terror River on 25 July.

Female #085, a 5.5 year old single female, again occupied an activity area near South Viekoda Creek and Barbara Lake approximately 20 km north of her den southwest of Terror Lake (Fig. 14). This bear moved from her den site

to near Barabara Lake between 9 and 20 May. Between 9 and 20 October, she returned to Terror Lake to den within 0.5 km of her previous den site. A similar movement from her main activity area to her den site was reported in 1983 (Smith et al. 1985).

Female #096, a 6.5 year old whose 2 newborn cubs were apparently killed by a male in May, displayed similar movements in 1983 and 1984. She ranged mainly in the South Viekoda drainage except in July and August 1984 when she was intermittently located near Barabara Lake where sockeye salmon were available.

Female #099, a 10.5 year old single bear, was captured west of Kizhuyak Bay on 5 June 1984 (Fig 18). She remained in sub-alpine habitat near her capture location through early July before moving north to Barabara Lake where sockeye salmon were available. By mid-September she moved south into the South Viekoda Creek area. On 2 October she was located within 0.5 km of the Terror Lake dam, the closest location of radio-collared bear to Terror Lake recorded in 1984. She denned in upper Baumann Creek by 6 November.

DENNING

Thirty-two radio-collared brown bears (28 females, 4 males) were monitored throughout the 1983-84 denning season. Data on 1983-84 den locations and approximate den entrance dates were reported in Smith et al. (1985). Data on 1984-85 dens are listed in Table 8.

Table 8. Den site characteristics for brown bear during 1984 in the Terror Lake Hydro study area, Kodiak, Alaska.

FEMALES

Bear(age)	Emergence date 1983-4 den	Entrance date 1984-5 den	Elevation in meters (ft) 1984-5 den	Location by drainage 1984-5 den	Comments
005a(15.5)	---	6-21 Nov	671 (2200)	Kizhuyak Bay	changed dens
005b(15.5)	---	2 Jan-13 Mar	853 (2800)	Kizhuyak Bay	between 2 Jan 85 and 13 Mar 85
011 (8.5)	20-29 May	6-21 Nov	610 (2000)	Kizhuyak Bay	
015 (9.5)	4-16 Apr	6-21 Nov	335 (1100)	Terror Bay	
018 (7.5)	12 Nov-19 Mar	6-21 Nov	625 (2050)	Terror Bay	
019 (8.5)	24 Apr-8 Jun	21-29 Nov	122 (400)	Terror Bay	
020a(8.5)	19-28 Mar	26 Oct-6 Nov	213 (700)	Terror Bay	changed dens
020b(8.5)	---	21 Nov-13 Mar	396 (1300)	Terror Bay	between 21 Nov 84 13 Mar 85
022a(9.5)	4-16 Apr	26 Oct-6 Nov	518 (1700)	Terror Bay	changed dens
022b(9.5)	---	28 Mar-15 Apr	366 (1200)	Terror Bay	between 28 Mar and 15 Apr 85
037 (6.5)	2 Dec-13 Mar	26 Oct-6 Nov	823 (2700)	Terror Bay	
038 (5.5)	24-30 Apr	6-11 Nov	914 (3000)	Terror Bay	
044 (5.5)	20-29 May	7-21 Nov	1021 (3350)	Terror Bay	
046 (8.5)	4-12 Jun	21-29 Nov	1006 (3300)	Terror Bay	
048 (25.5)	30 Apr-9 May	6-21 Nov	975 (3200)	Terror Bay	
051 (10.5)	15-22 Jun	26 Oct-6 Nov	975 (3200)	Terror Bay	
055 (15.5)	30 Apr-9 May	26 Oct-6 Nov	960 (3150)	Terror Bay	
060 (16.5)	24-31 Apr	---	---	---	
064 (22.5)	30 Apr-9 May	26 Oct-6 Nov	1067 (3500)	Terror Bay	
067 (22.5)	30 Apr-9 May	26 Oct-6 Nov	975 (3200)	Terror Bay	
070 (6.5)	24 Apr-5 Jun	---	732 (2400)	Kizhuyak Bay	
071 (10.5)	9-20 May	---	732 (2400)	Kizhuyak Bay	
072 (20.5)	28 Mar-4 Apr	26 Oct-6 Nov	91 (300)	Terror Bay	
074 (19.5)	20-29 May	---	---	---	
078 (9.5)	29 May-4 Jun	6-21 Nov	792 (2600)	Kizhuyak Bay	
081 (11.5)	20-29 May	---	975 (3200)	Kizhuyak Bay	
085 (5.5)	19 Mar-16 Apr	26 Oct-6 Nov	1128 (3700)	Terror Bay	
086 (9.5)	14 Jan-19 Mar	26 Oct-6 Nov	244 (800)	Terror Bay	
088 (10.5)	24-30 Apr	---	---	---	
091 (9.5)	9-20 May	27 Oct-6 Nov	747 (2450)	Kizhuyak Bay	
092 (6.5)	30 Apr-9 May	---	---	---	
096 (8.5)	9-20 May	9-20 Oct	320 (1050)	Viekoda Bay	
099 (10.5)	---	27 Oct-6 Nov	671 (2200)	Terror Bay	
119 (6.5)	---	6-21 Nov	457 (1500)	Kizhuyak Bay	
121 (13.5)	---	---	655 (2150)	Kizhuyak Bay	
123 (13.5)	---	7-21 Nov	975 (3200)	Terror Bay	

Table 8. (Cont.) Den site characteristics for brown bear during 1984 in the Terror Lake Hydro study area, Kodiak, Alaska.

Bear(age)	Emergence date 1983-4 den	Entrance date 1984-5 den	Elevation in meters (ft) 1984-5 den	Location by drainage 1984-5 den	Comments
MALES					
024 (9.5)	28 Mar-4 Apr	---	---	---	
040 (5.5)	30 Apr-9 May	---	---	---	
059 (5.5)	14 Jan-19 Mar	---	427 (1400)	Uganik Bay	
095 (5.5)	16-24 Apr	---	---	---	
098 (7.5)	---	29 Nov-2 Jan	732 (2400)	Kizhuyak Bay	
100 (5.5)	---	29 Nov-2 Jan	1036 (3400)	Terror Bay	
102 (5.5)	---	20 Oct-12 Dec	1097 (3600)	Uganik Bay	
103 (6.5)	---	---	640 (2100)	Uganik Bay	

Denning Chronology

Males were the first to emerge from their dens in 1984 with over 50% of the radio-collared boars out of their dens by early April (Fig. 3). All boars (n=4) had emerged by 9 May 1984. Lone sows exhibited a similar pattern and all radio-collared lone females (n=12) were out of their dens by 29 May 1984. Maternal females emerged later than lone bears. All radio-collared sows with older cubs (n=6) were out of their dens by 9 May 1984, but all sows with new cubs (n=10) were not out until 22 June 1984.

Bears began entering 1984-85 dens between 26 October and 6 November. Males entered dens later than females. Two of 3 radio-collared males were still not denned by 29 November 1984 while all sows (n=28) were in dens by that date. Two males, #s 101 and 120, did not den or did so for only brief periods.

Den Locations and Site Characteristics

Thirty-four bears (29 females, 5 males) were located at 37 den sites during the 1984-85 denning season. There were 22 dens (59%) in Terror Bay drainage, 11 (30%) in Kizhuyak Bay drainage, 3 (8%) in Uganik Bay drainage and 1 (3%) in Viekoda Bay drainage. Den Mountain, lower Baumann Creek, Pestchani Mountain, and LeAnne Mountain continued to be important denning areas as previously reported (Smith and Van Daele 1984; Smith et al. 1985). Figure 4 depicts the den locations of radioed bears in the study area during the 1984-85 season.

Most dens were located in alpine or subalpine habitats (70%; n=26). The other 11 dens (30%) were in brushlands. Steep slopes, estimated at 45° or greater, were the most

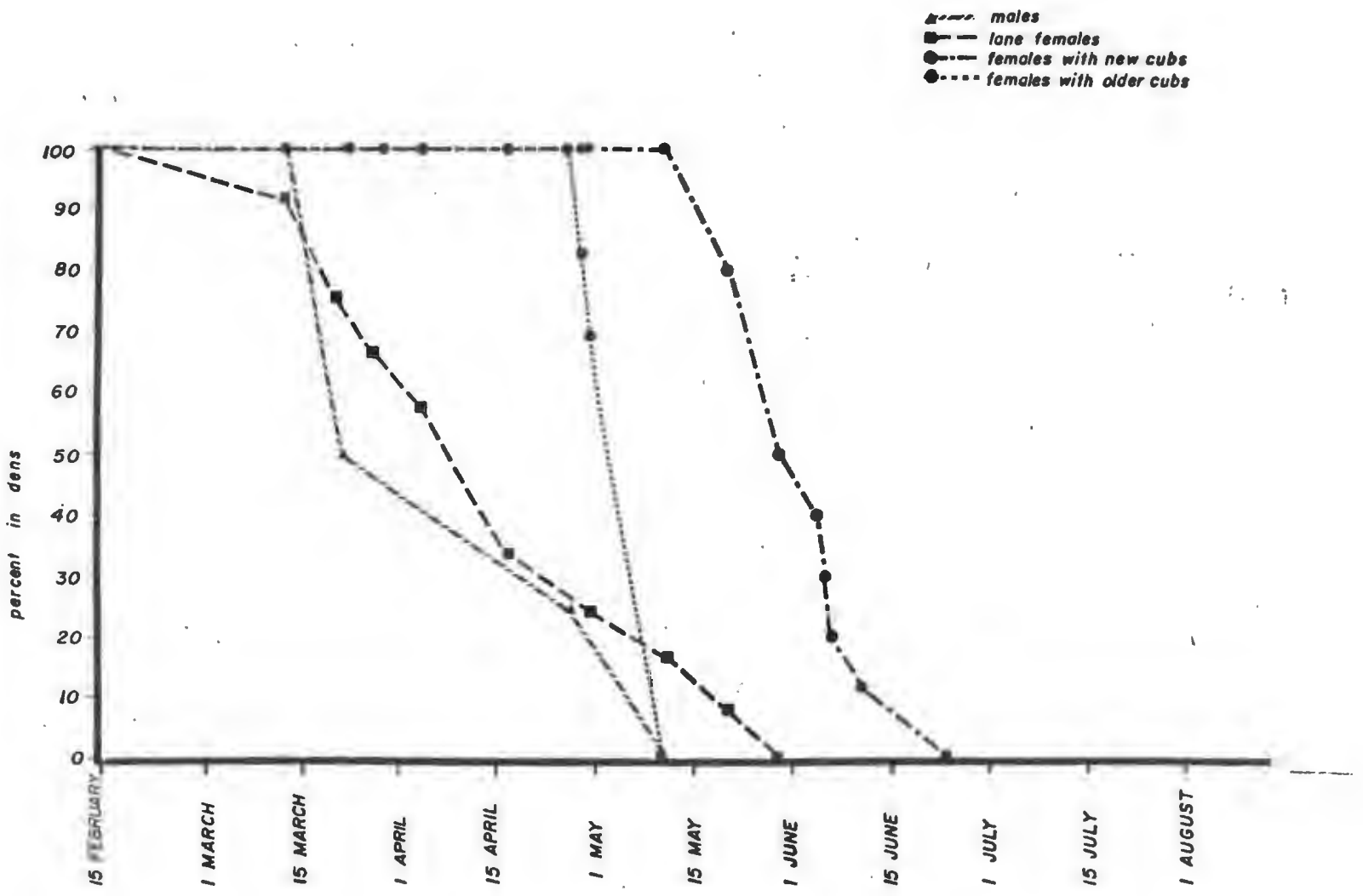

Fig. 3. Chronology of den emergence by radio-collared brown bears in Terror Lake study area, 1984.

common locations for dens (70%; n=26). Ten den sites (27%) were on moderate slopes (30-45°) and 1 (3%) was on a gentle slope (30°). Eighty-two percent (n=9) of the dens on moderate or gentle slopes were associated with cliffs or rock outcrops. These data suggest that steep terrain is an important factor in the selection of den sites in the study area.

Den elevations ranged from 91 to 1128 m with a mean of 699 m. Sixteen dens (43%) were higher than 750 m, 18 (49%) were between 240 and 750 m and 3 (8%) were below 240 m. The mean elevation for the dens of females was 686 m (range = 91-1128 m; n = 32). The dens of males were at a mean elevation of 786 m (range = 427-1097 m; n = 5). Mean elevations noted during the 1984-85 season for dens of all radio-collared bears and for dens of females were within the ranges reported previously (Smith and Van Daele 1984. Smith et al. 1985). The 786 m mean den elevation for males was higher than reported for previous seasons (566 m in 1982-83, 588 m in 1983-84).

Fidelity to Denning Areas

Radio-collared bears continued to exhibit a high degree of fidelity to previously used denning areas (Table 9). Fifty-eight percent (15/27) of the radio-collared bears occupied dens less than 1 km from their 1983-84 sites, including 3 females (#s 046, 070, 078) who used approximately identical den sites in 1983-84 and 1984-85. Twenty-seven percent (7) of the dens were 1- 3 km apart and 15% (4) used sites that were greater than 3 km apart. The mean distance between 1983-84 and 1984-85 individual den sites for females was 1.3 km (range = 0-4.1 km; n=25). That compares closely ($p>0.2$) with distances noted between 1982-83 and 1983-84 den sites of females ($\bar{x}$ = 1.2 km; range =

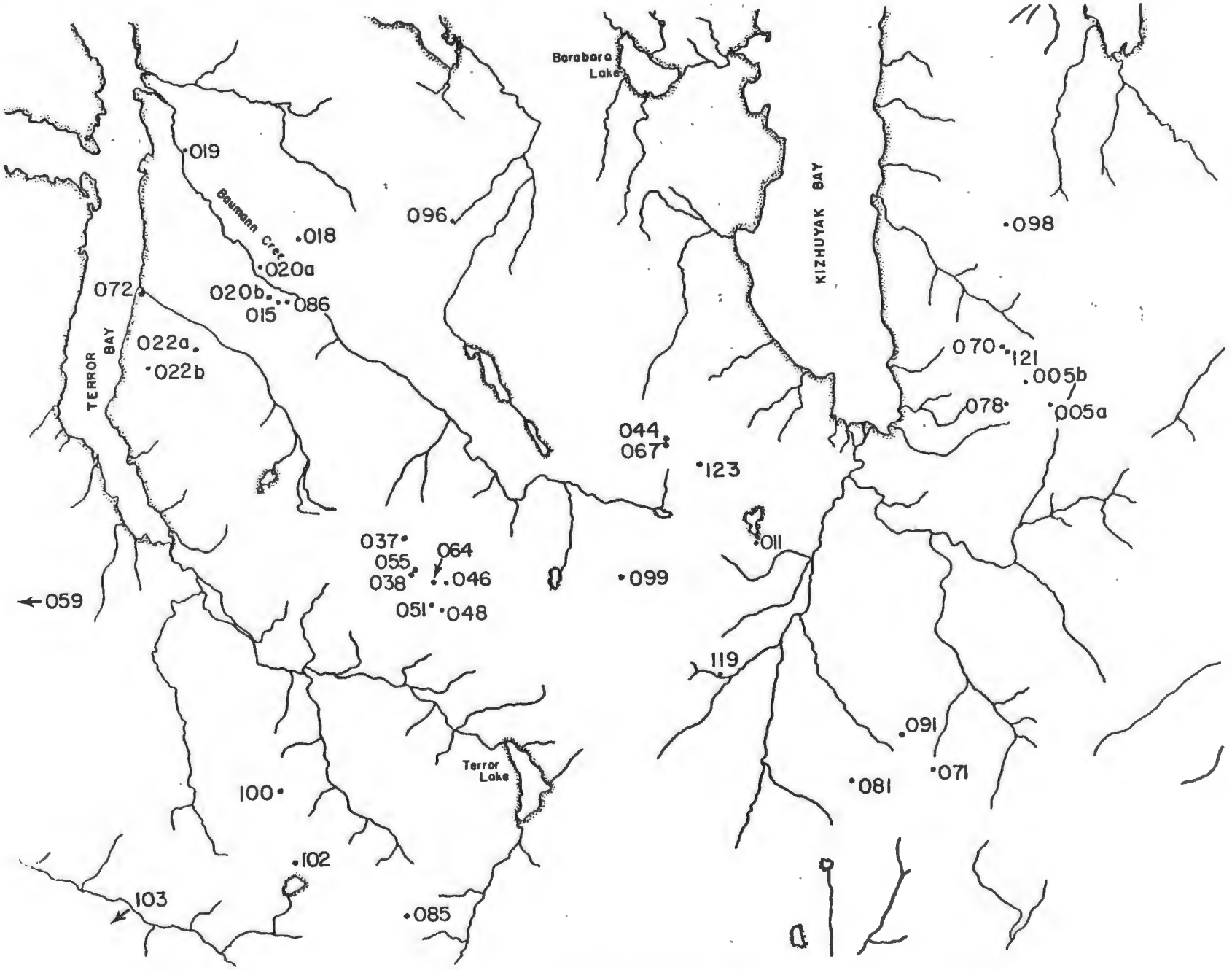

Fig. 4. Den locations of radio-collared brown bears in the Terror Lake study area during the 1984-85 denning period.

Table 9. Distance between den locations of individual brown bears in the Terror Lake Hydro study area, 1982-1985.

Bear	Distance between 1982/3 and 1983/4 dens	Distance between 1983/4 and 1984/5 dens	Maximum distance between 1982/3, 1983/4 and 1984/5 dens
FEMALES			
005	1.2 km	1.8 km	1.8 km
011	0.5 km	4.1 km	4.2 km
015	0.5 km	0.4 km	0.5 km
017	0.5 km	---	---
018	1.1 km	1.9 km	1.9 km
019	2.0 km	3.4 km	4.5 km
020	---	0.8 km	---
022	0.2 km	3.4 km	3.4 km
037	4.0 km	3.7 km	4.0 km
038	0.4 km	0.6 km	0.6 km
044	1.7 km	0.9 km	2.1 km
046	1.2 km	0.0 km	1.2 km
048	0.1 km	0.1 km	0.1 km
051	0.2 km	0.8 km	0.8 km
055	0.2 km	0.3 km	0.4 km
060	3.6 km	---	---
064	0.1 km	0.1 km	0.1 km
067	2.5 km	2.3 km	2.5 km
070	0.1 km	0.0 km	0.1 km
071	2.2 km	1.8 km	2.2 km
072	2.3 km	0.2 km	2.8 km
074	2.5 km	---	---
078	---	0.0 km	---
081	---	0.4 km	---
085	---	0.4 km	---
086	---	1.0 km	---
091	---	0.1 km	---
096	---	1.8 km	---
MALES			
024	12.4 km	---	---
059	20.0 km	2.0 km	20.0 km

0.1-3.6; n=22). Den sites of bear #059, the only radio-collared male with known den locations in both 1983-84 and 1984-85, were 1.96 km apart.

Den sites of nineteen radio-collared bears (18 females, 1 male) have been located for 3 consecutive years. The mean maximum distance between dens of individual females was 1.9 km (range = 0.1-4.2 km; n=18). Thirty-seven percent (7) of those bears had all 3 dens within 1 km. Thirty-seven percent (7) had dens between 1-3 km apart and 26% (5) had dens greater than 3 km apart.

Proximity of Dens to Project Activities

Seven radio-collared bears (20%) denned relatively close to major project features in 1984. Female #011 denned near the outlet of Leanne Lake about 1.1 km west of the access road and transmission line. Female #119 denned in Falls Creek canyon 0.4 km south of the access road. Females #005 and #078 occupied dens north of Hatchout Creek within 3.5 km of the Kodiak transmission line. Females #081 and #091 denned in steep hillsides near the head of Kizhuyak River, approximately 5 km southwest of the powerhouse. Female #085 denned about 5 km southwest of the Terror Lake dam.

Preliminary Analysis of Construction Impacts

Impacts of Construction

Analysis of construction impacts awaits 2 years of comparative post-construction data, hence results from 3 years of study during the construction phase are preliminary. Because construction activities were confined to fewer sites and were of less intensity and duration in

1984, the impacts on habitat use by brown bears should have been less than occurred in 1983 when construction activity was at its peak. Smith et al. (1985) considered that maximum short-term effects of the construction should have occurred in 1983, but they reported few shifts in activity areas used by radio-collared brown bears which appeared to be correlated with disturbance by construction.

Comparing the movements and activity areas of individual radio-collared bears during the first 3 years of study produced conflicting results about the effects of construction. Female #005, which Smith et al. (1985) believed had avoided the area where the Kodiak transmission line was under construction in 1983, returned to her former range in 1984. Females #'s 071, 078 and 091 were considered relatively tolerant of transmission line construction in 1983 (Smith et al. 1985). However, they were more often found near lower Hatchout Creek and Kizhuyak River in 1984, suggesting that 1983 construction activity may have been a deterrent to their use of salmon spawning areas in these drainages. Male #002 continued to frequent upper Rolling Rock Creek near the lower tunnel portal worksite. Two radio-collared females occupied the immediate environs of the Kizhuyak camp and powerhouse site in 1984. Female #081, which frequented the camp area in 1983 (Smith et al. 1985), continued to do so in 1984. It was suspected that this female was attracted to the project site by garbage. Female #119 appeared to be habituated to human activities and human foods seemed to constitute an important food source for her in 1984.

Temporary or short-term avoidance by bears of worksites and of favored feeding and travel areas adjacent to worksites was difficult to detect with methods used in this study. The frequent observations of bears by construction workers and locations of radio-collared bears near worksites

throughout the study area indicated that a major disruption of bear habitat use did not occur during the 3 years of construction. Some bears were attracted to worksites by food scraps. Inherent curiosity and normal movements between preferred habitats in the project area probably explained other sightings.

The relatively close proximity of several den sites to major project features each year indicates that the zone of impact on denning activities was relatively small. The consistently high fidelity of individual radio-collared bears to localized denning areas in successive years supports that preliminary conclusion.

Three males (#'s 103, 105, 120) made relatively long movements within and outside the study area in 1984. Those movements were believed to be normal dispersal movements unrelated to project activities.

There have been no known brown bear mortalities resulting directly from construction activities since the project was begun in 1982. Although 2 incidents of intra-specific predation were documented in 1984 there is no evidence to verify that these incidents were the result of increased intra-specific strife precipitated by project impacts as was predicted by Spencer and Hensel (1980).

Females in the Terror and Viekoda drainages generally had similar activity areas during the first 3 years of the project. Because only minimal construction activity occurred in the Terror drainage in 1984, habitat use patterns were probably little affected in 1984.

One direct impact of the project on brown bears was the improper disposal of garbage which Smith et al. (1985) previously identified as a problem with long-term

implications. Continued improper disposal of garbage at several work sites and at the Kizhuyak camp occurred in 1984 despite repeated attempts by the U.S. Fish and Wildlife Service environmental monitor to get the contractor to comply with project license stipulations.

Reports of bears visiting the camp to feed on garbage prompted inspections by the Alaska Departments of Fish and Game and Public Safety. The contractor was first issued a written warning and subsequently was cited into court for violation of 5 Alaska Administrative Code 81.218, which prohibits leaving food or garbage in such a manner that it attracts bears. The outcome of the case against the contractor, Kiewit-Groves, Inc., was a "dismissal on civil compromise", whereby the contractor paid a $1000 settlement and agreed to implement a set of specific stipulations on storage and handling of garbage. The agreement drafted jointly by the Alaska Department of Fish and Game and Department of Law is included in Appendix 3.

The inadequacies of the project's mitigation plan regarding food and garbage handling were glaringly apparent in practice. The agreement with Kiewit Groves was a "too-little-too-late" attempt to correct those inadequacies. Hosking's (1984) recommendations that an on-site environmental monitor should be invested with authority to require immediate compliance with environmental stipulations on future projects are fully supported. Specific requirements for design, construction, maintenance and operation of facilities for food and garbage should be included in the bidding documents and included in the project license stipulations, with a penalty clause for non-compliance.

Bear Observations by Construction Workers

A summary of bear observations reported by construction workers from 1982 through 1984 is contained in Appendix 2. Although forms were available in camp, interested workers usually reported their sightings to the U.S. Fish and Wildlife Service environmental monitor who recorded the observations. The reported sightings represent only a minimum sample of the bears observed in the project area by workers. That bears were commonly observed pursuing a range of normal activities in the immediate area of construction is well-demonstrated by these observations. Additional analysis of these observations will be reported in the final report in 1987.

RECOMMENDATIONS

Continuation of the present methods are recommended for 1985, the beginning of 2 years of post-construction study.

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APPENDIX I.

HOME RANGE MAPS FOR RADIO-COLLARED BROWN BEARS

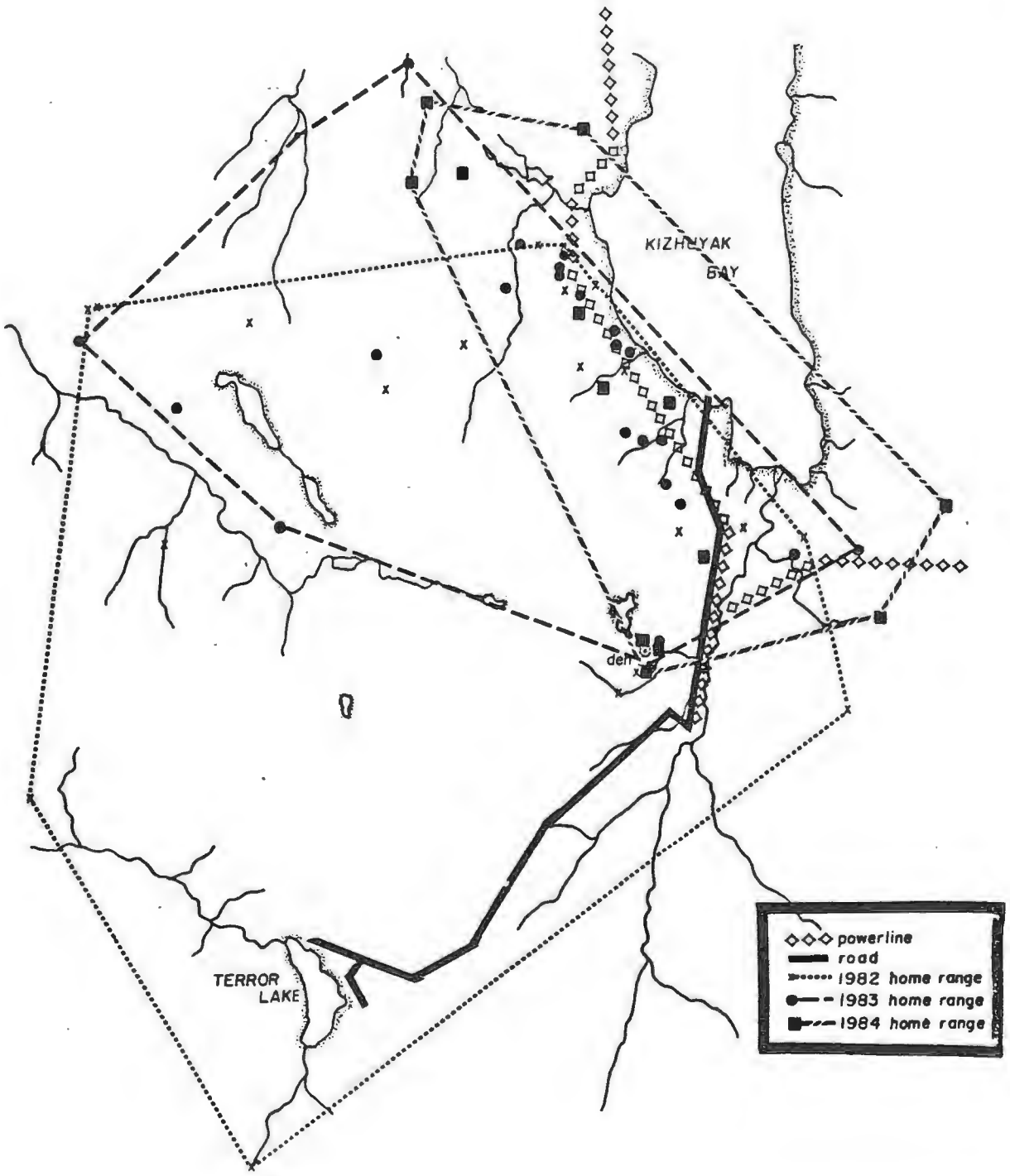

Fig. 5. Point locations and home ranges for male brown bear #002 in 1982, 1983 and 1984. (Scale 1cm = 1.2km)

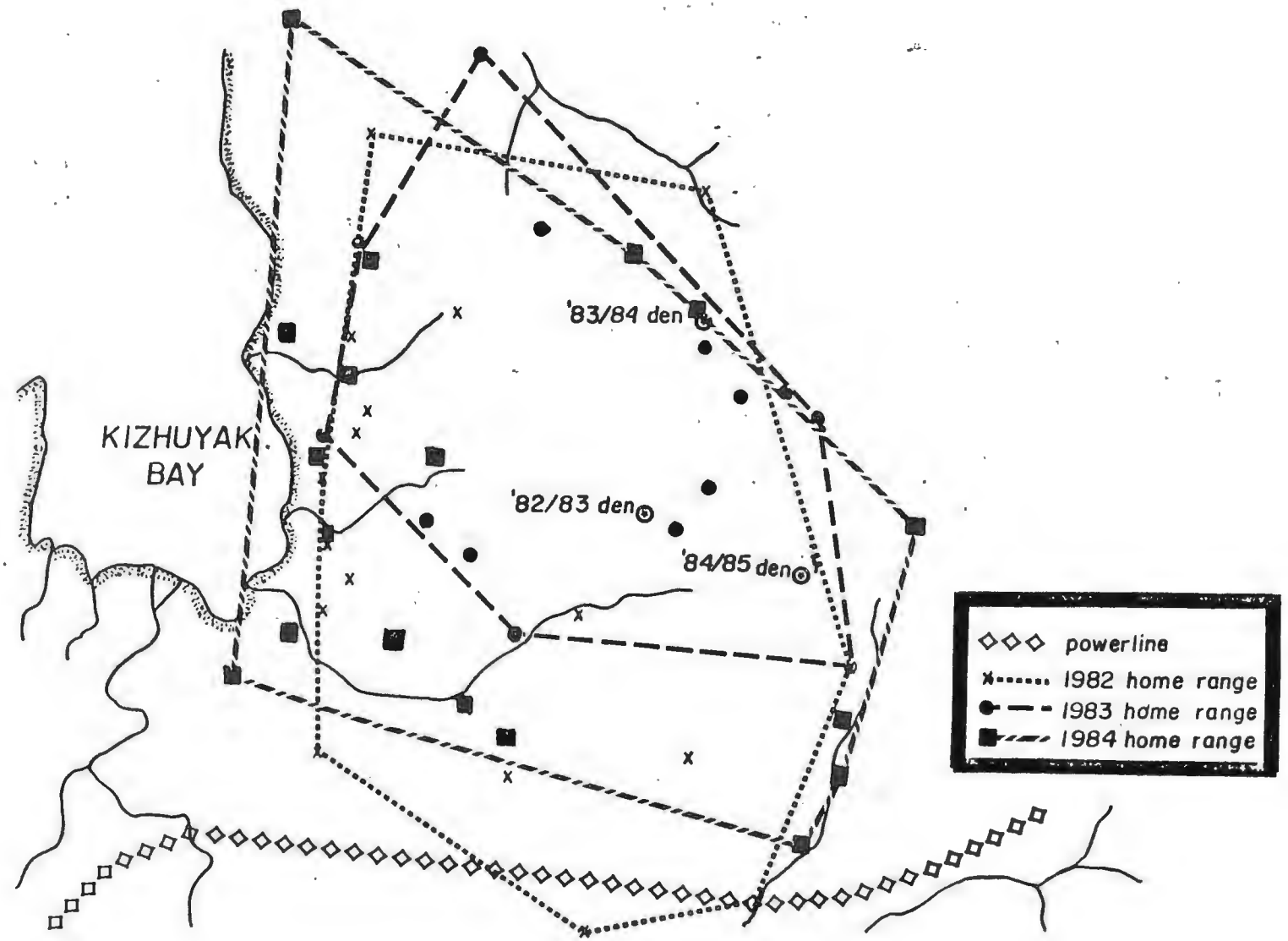

Fig. 6. Point locations and home ranges for female brown bear #005 in 1982, 1983 and 1984. (Scale: 1cm = 0.4km)

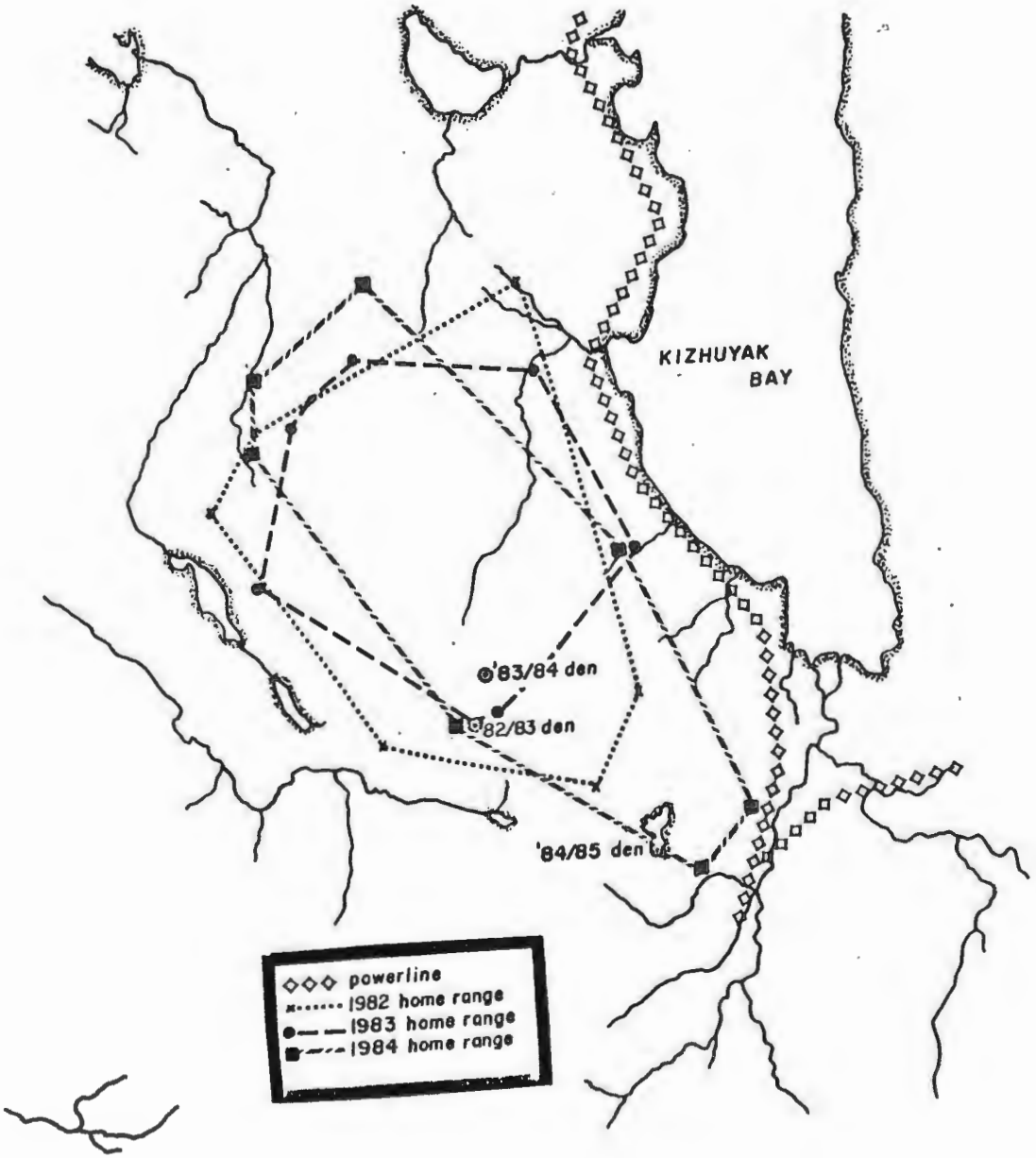

Fig. 7. Home ranges for female brown bear #011 in 1982, 1983 and 1984. (Scale: 1cm = 1.2km)

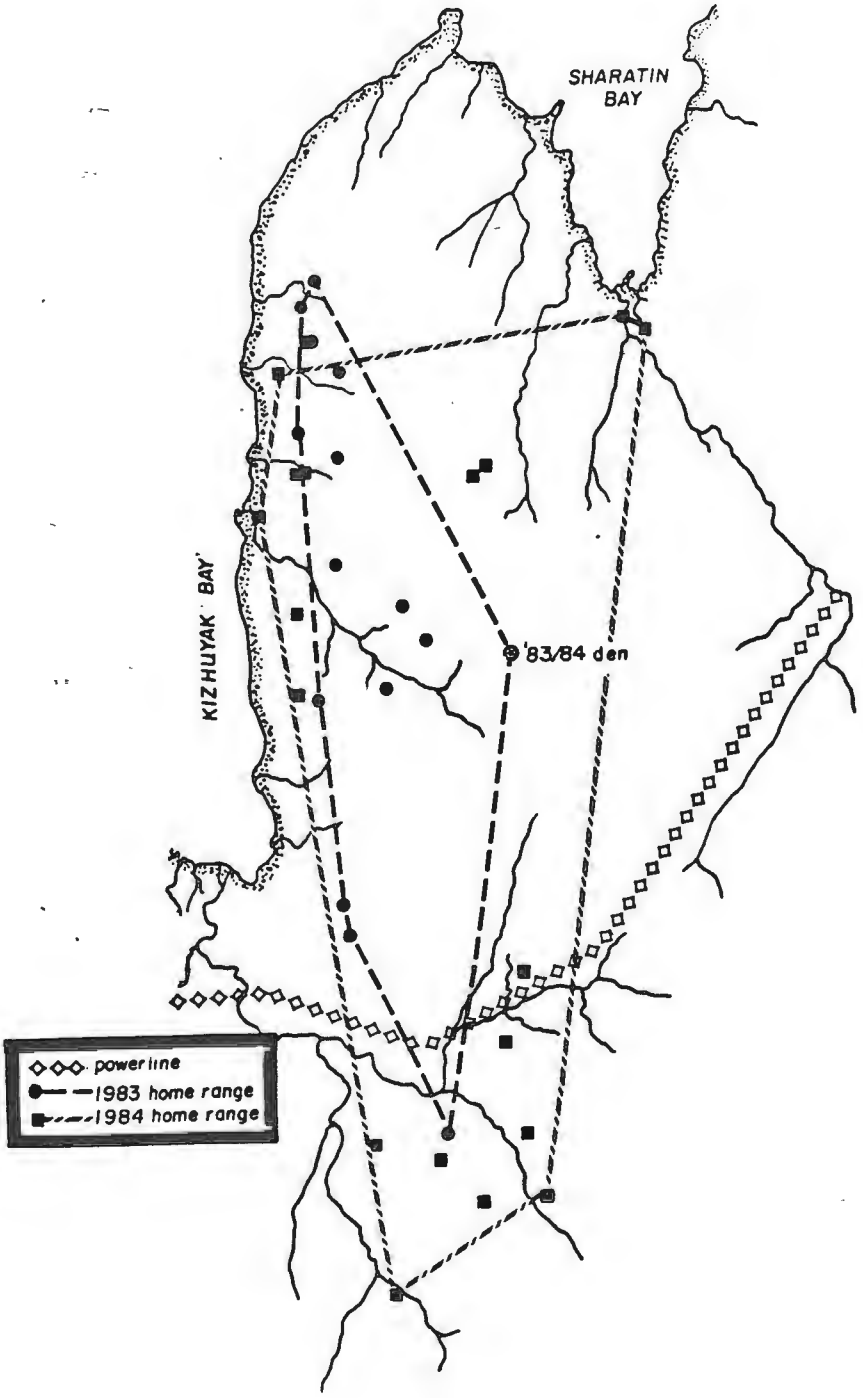

Fig. 8. Point locations and home ranges for male brown bear #040 in 1983 and 1984. (Scale: 1cm = 1.3km)

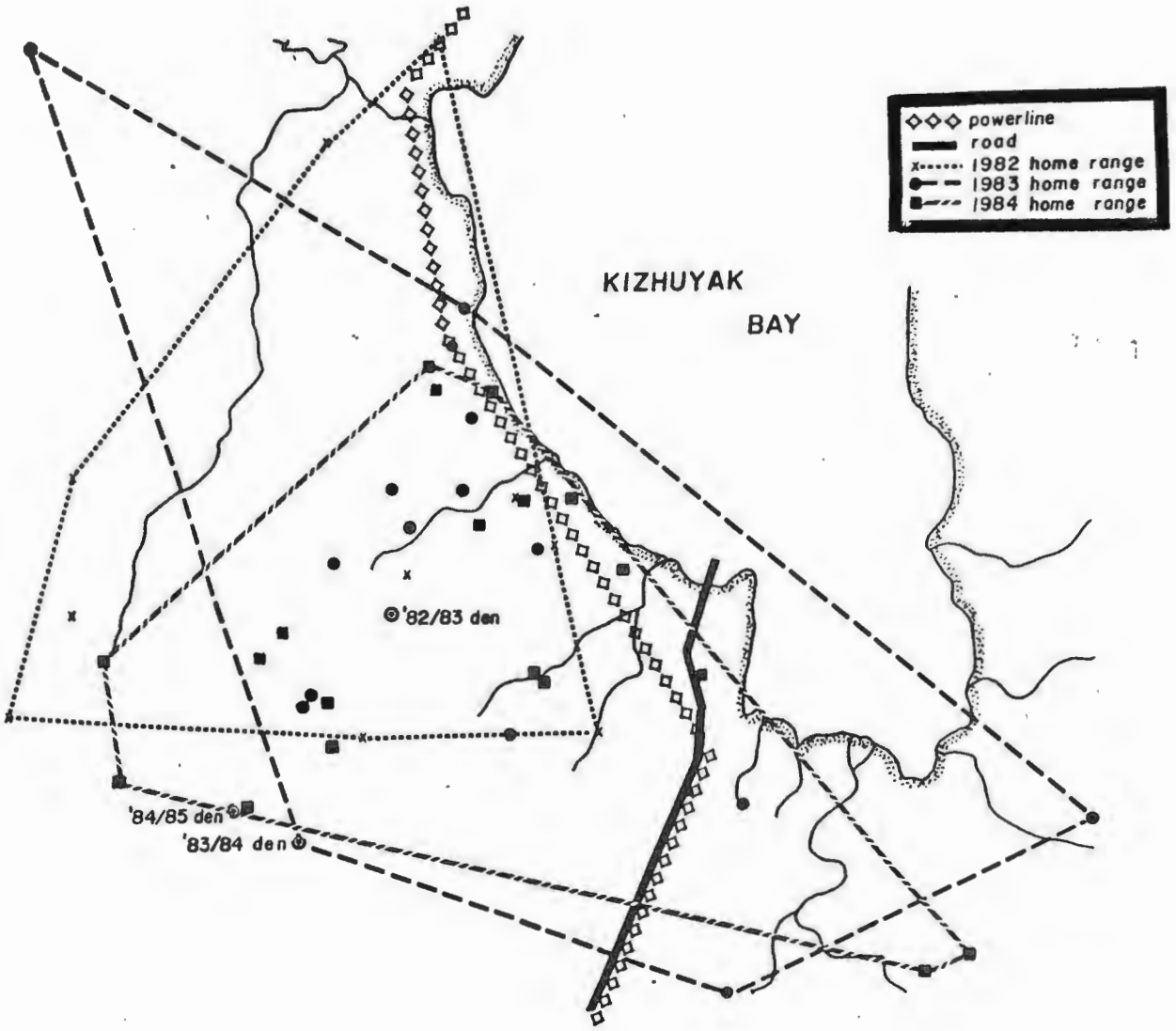

Fig. 9. Point locations and home ranges for female brown bear #044 in 1982, 1983 and 1984. (Scale: 1cm = 0.6km)

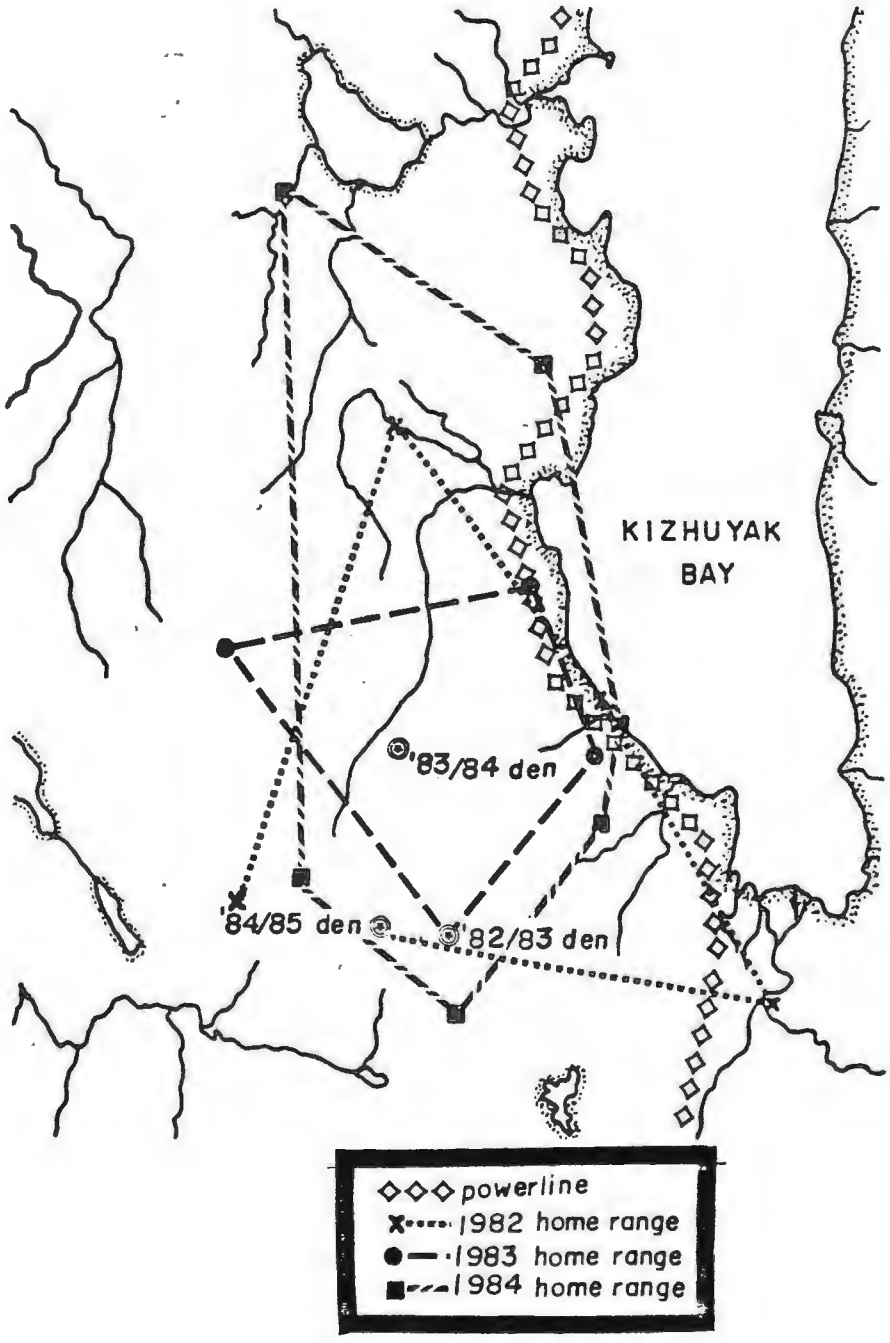

Fig. 10. Point locations and home ranges for female brown bear #067 in 1982, 1983 and 1984. (Scale: 1cm = 1km)

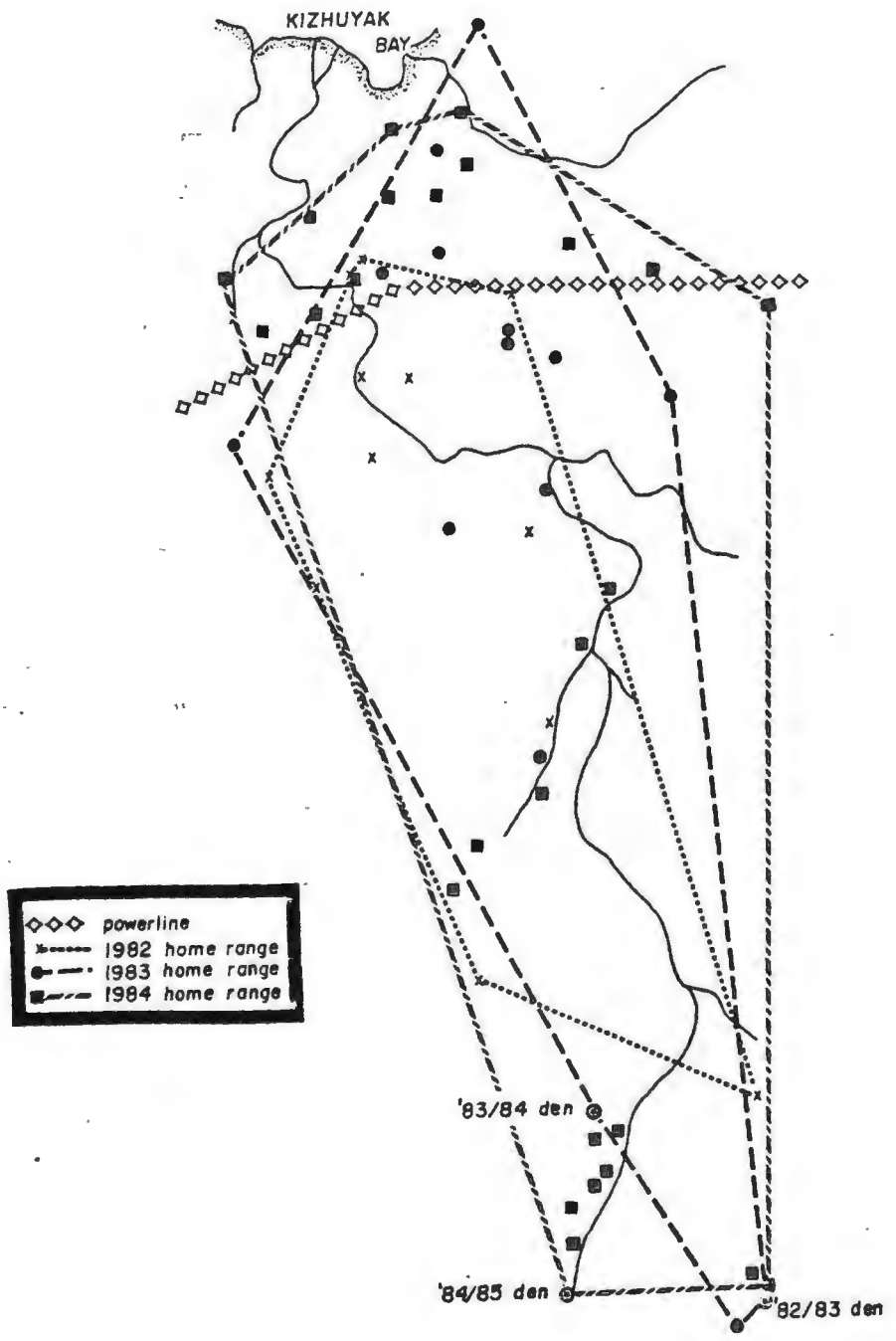

Fig. 11. Point locations and home ranges for female brown bear #071 in 1982, 1983 and 1984. (Scale: 1cm = 0.6km)

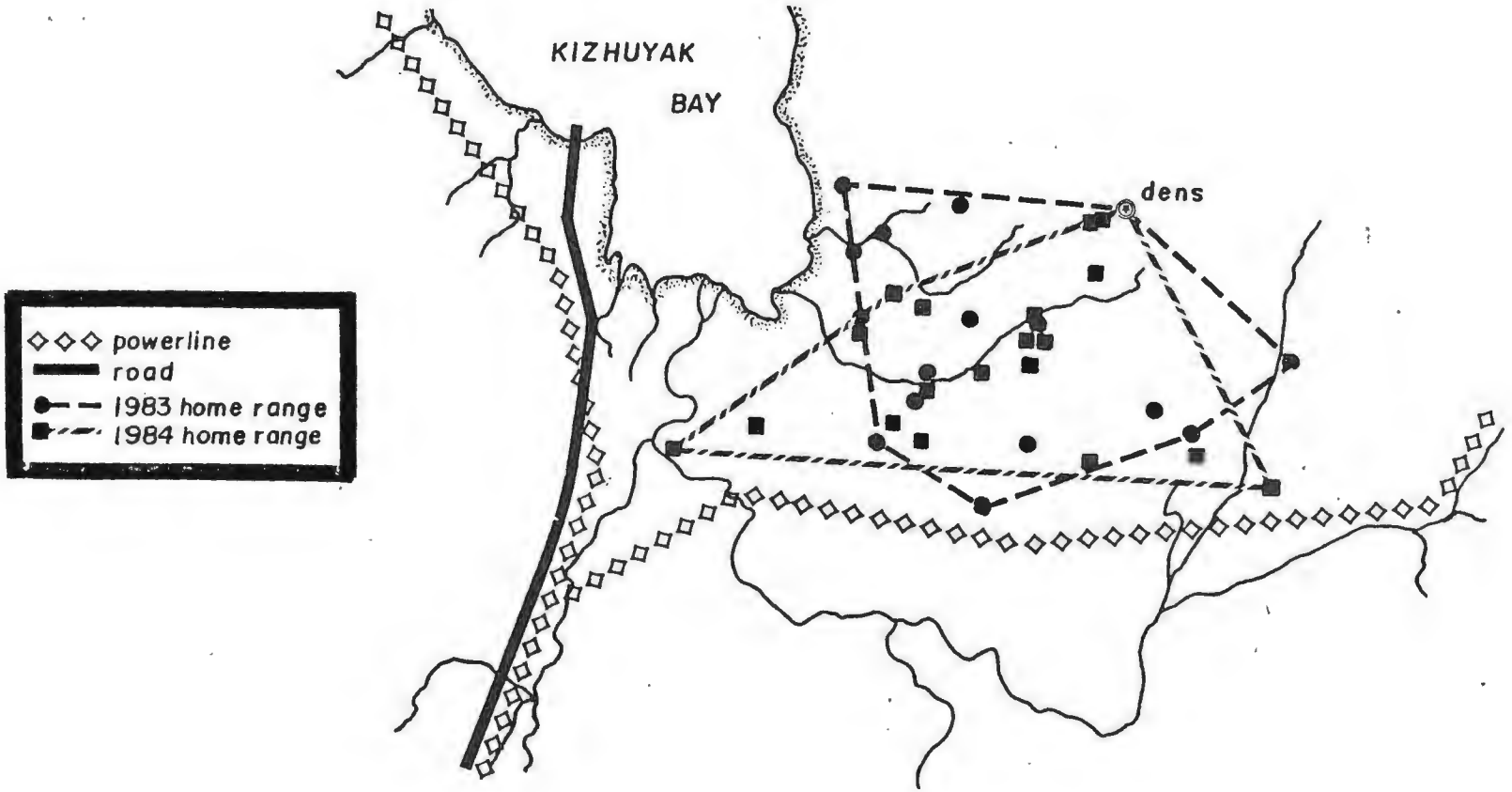

Fig. 12. Point locations and home ranges for female brown bear #078 in 1983 and 1984. (Scale 1cm = 0.6km)

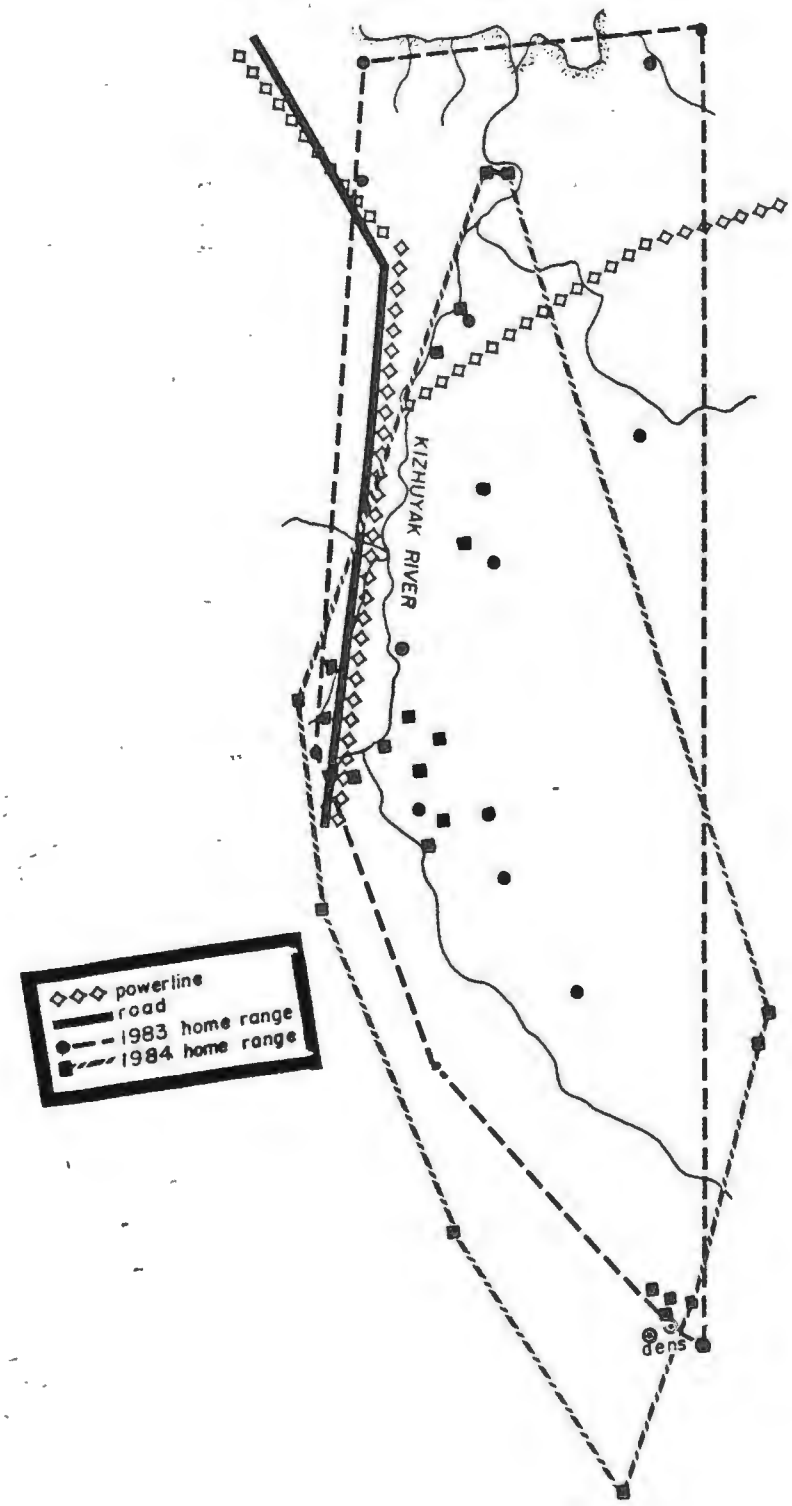

Fig. 13. Point locations and home ranges for female brown bear #081 in 1983 and 1984. (Scale: 1cm = 0.6km)

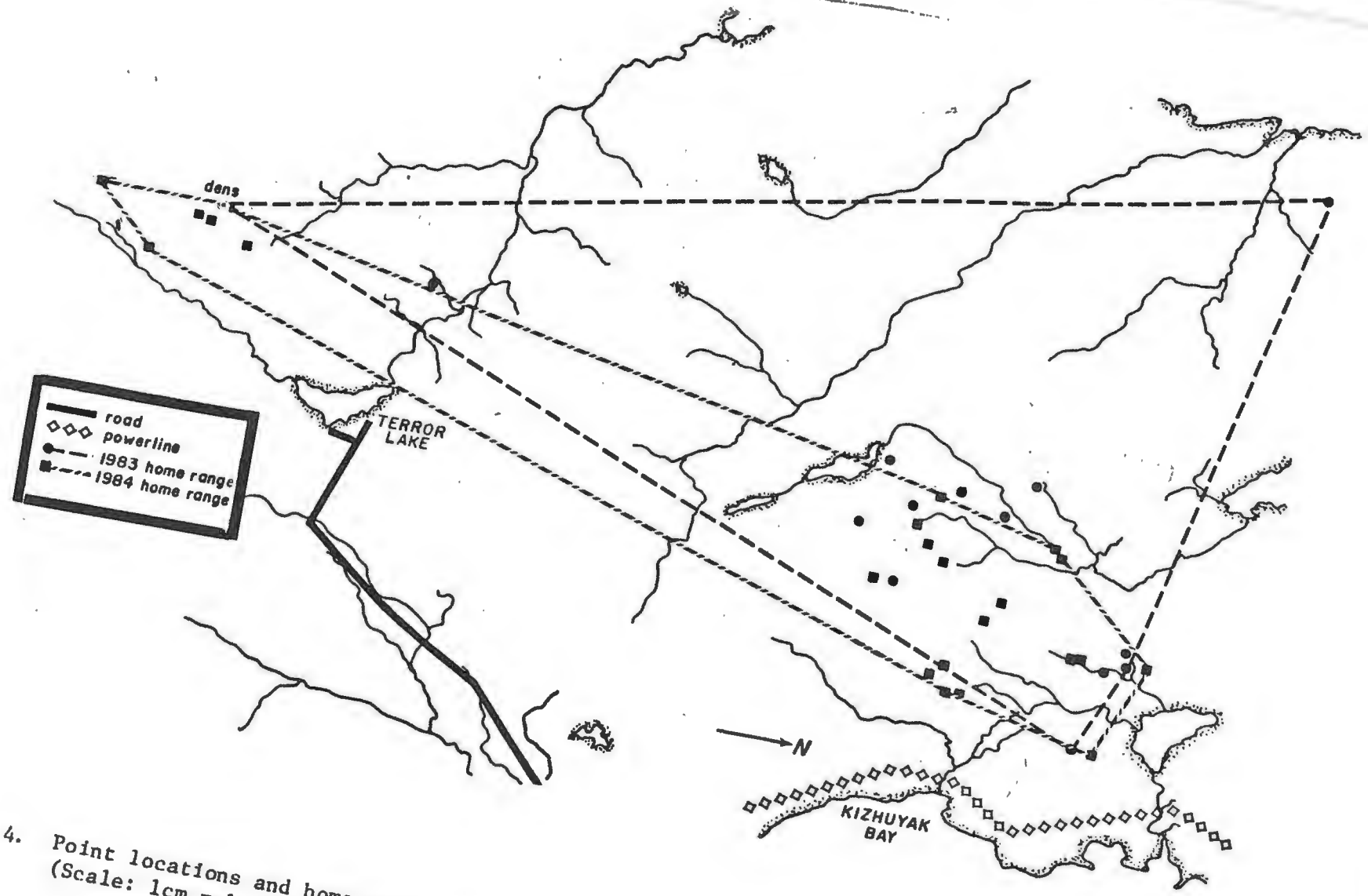

Fig. 14. Point locations and home ranges for female brown bear #085 in 1983 and 1984. (Scale: 1cm = 1.4km)

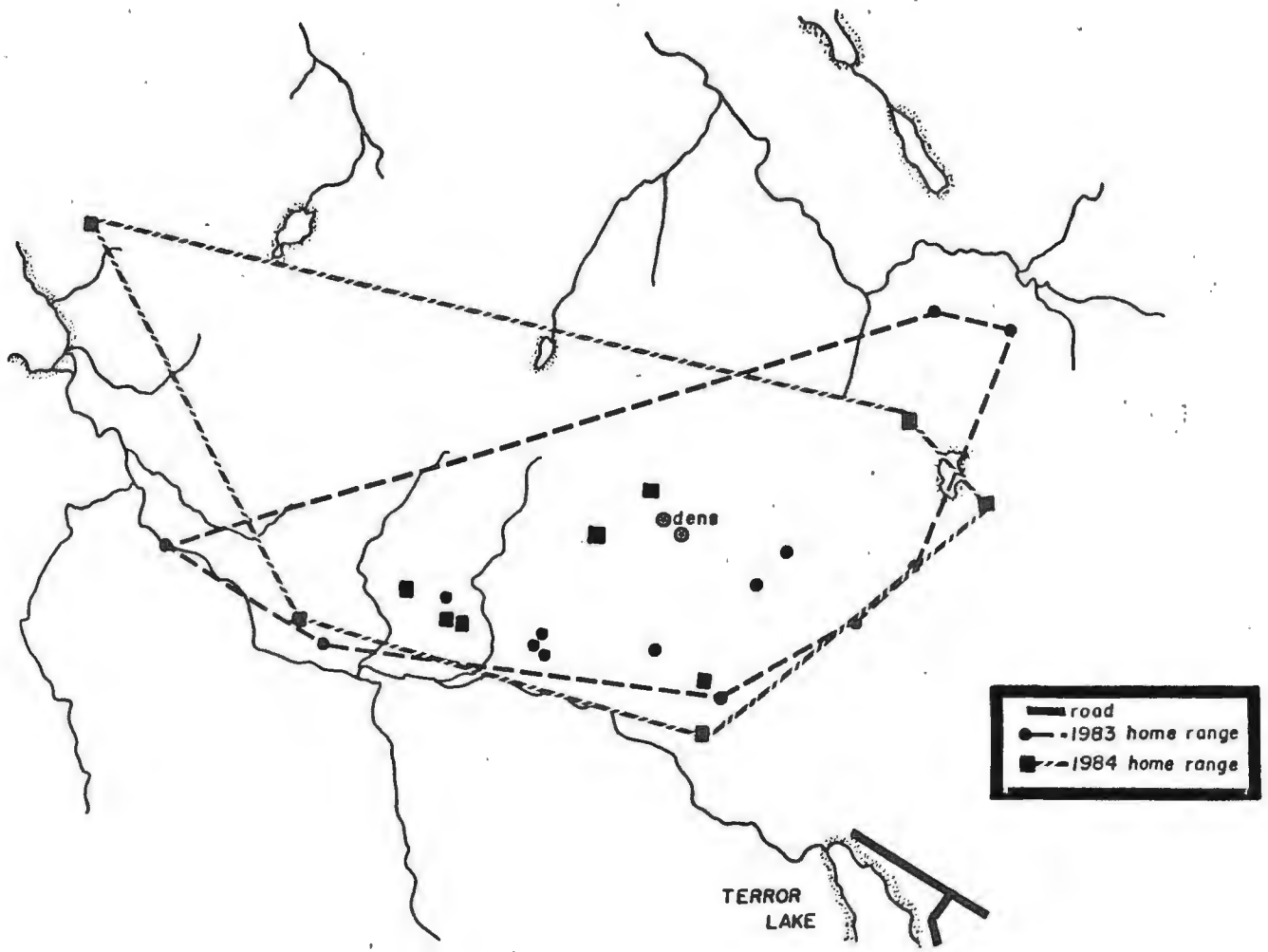

Fig. 15. Point locations and home ranges for female brown bear #088 in 1983 and 1984 (Scale: 1cm = 0.9km)

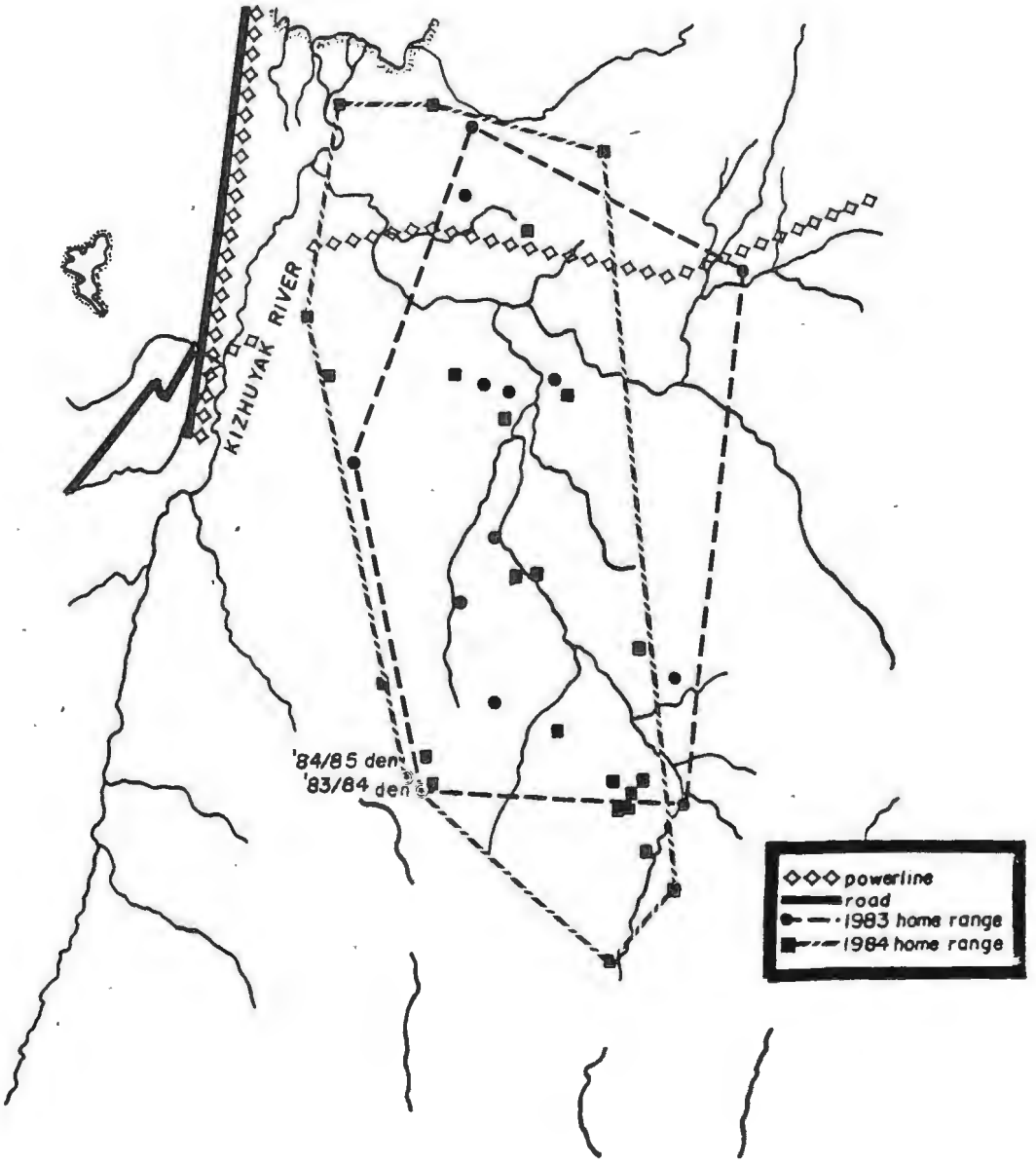

Fig. 16. Point locations and home ranges for female brown bear #091 in 1983 and 1984. (Scale: 1cm = 0.9km)

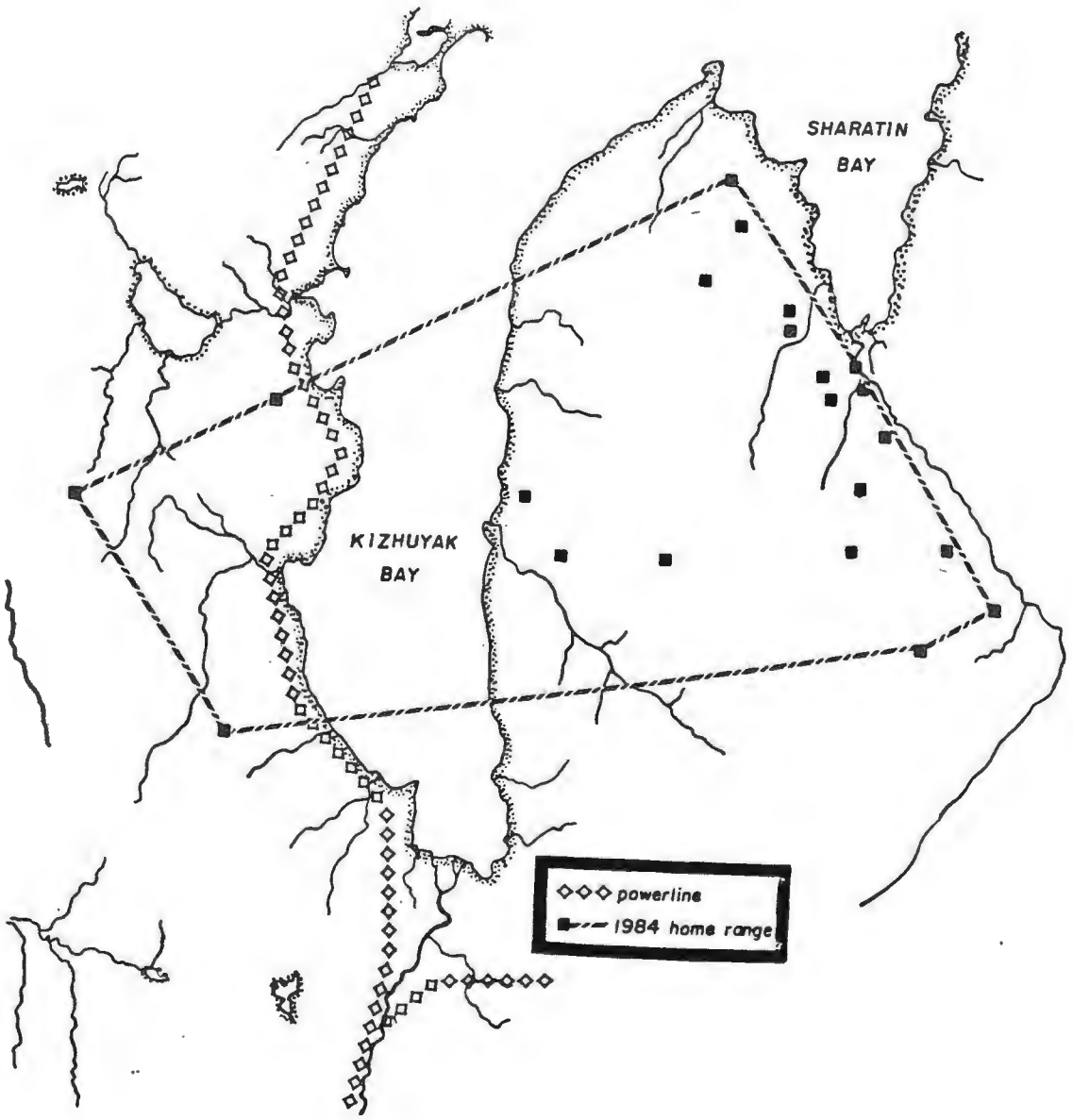

Fig. 17. Point locations and home ranges for male brown bear #098 in 1984. (Scale: 1cm = 1.2km)

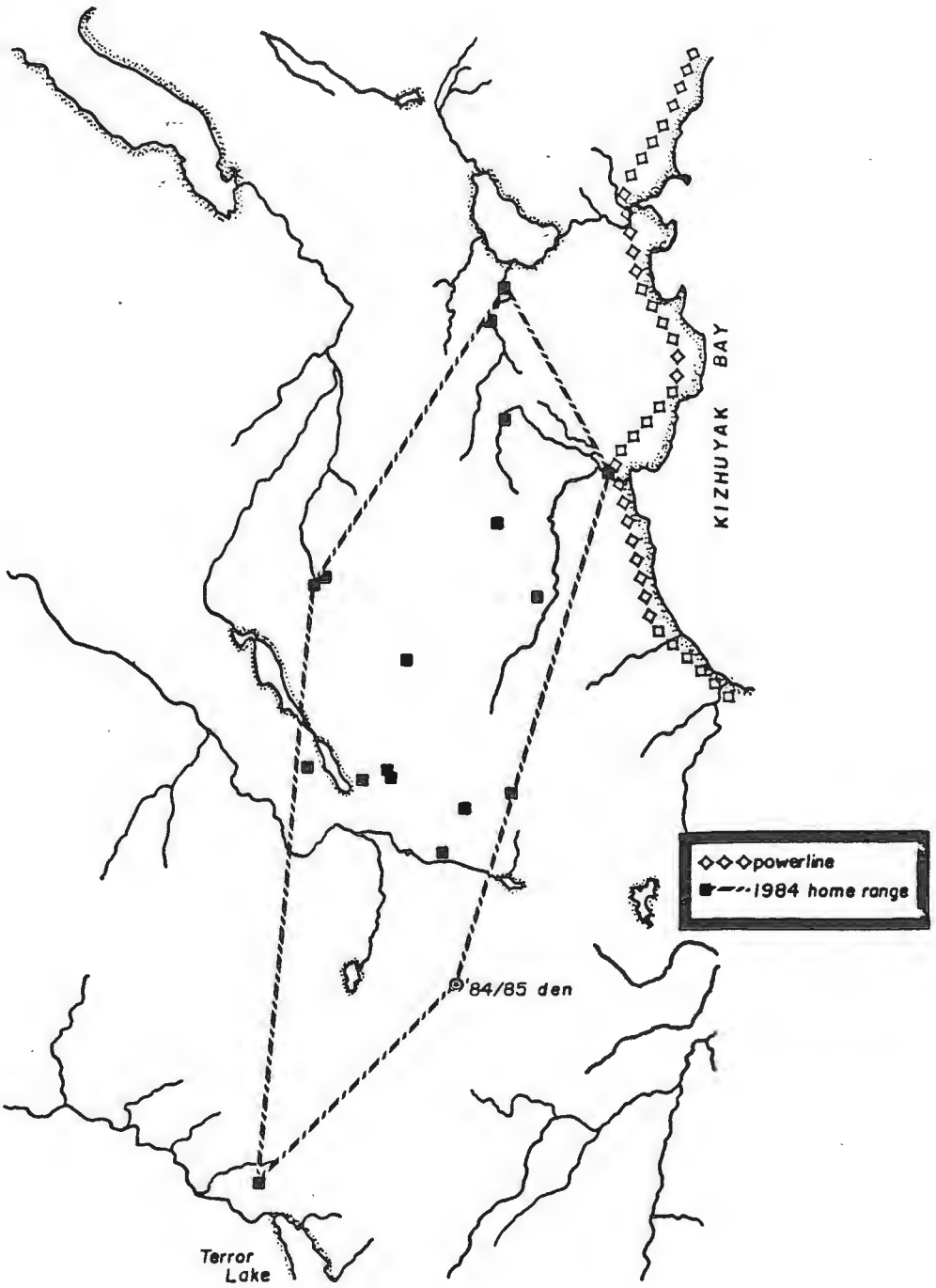

Fig. 18. Point locations and home ranges for female brown bear #099 in 1984. (Scale: 1cm = 1.2km)

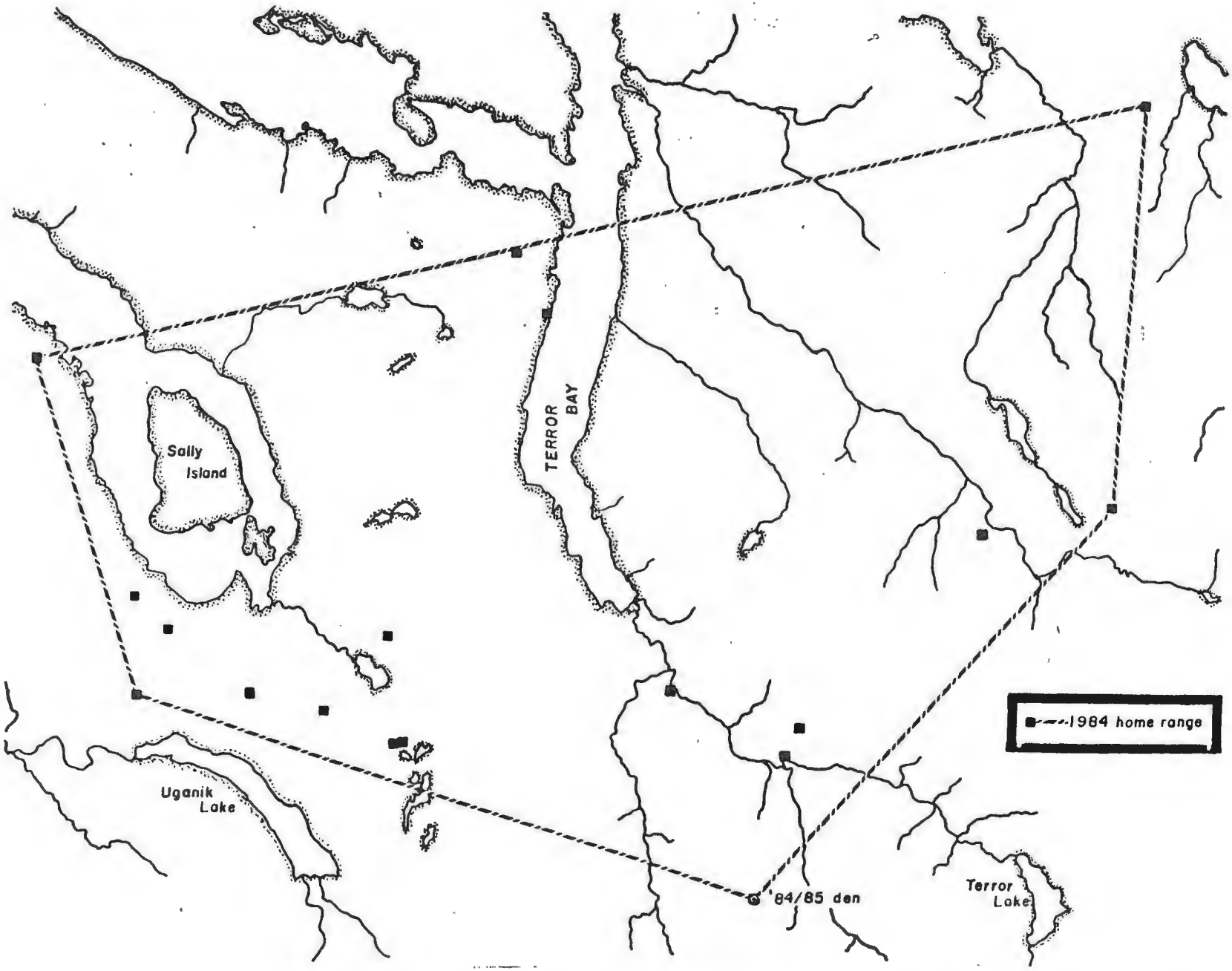

Fig. 19. Point locations and home range for male brown bear #100 in 1984. (Scale: 1cm = 1.3km)

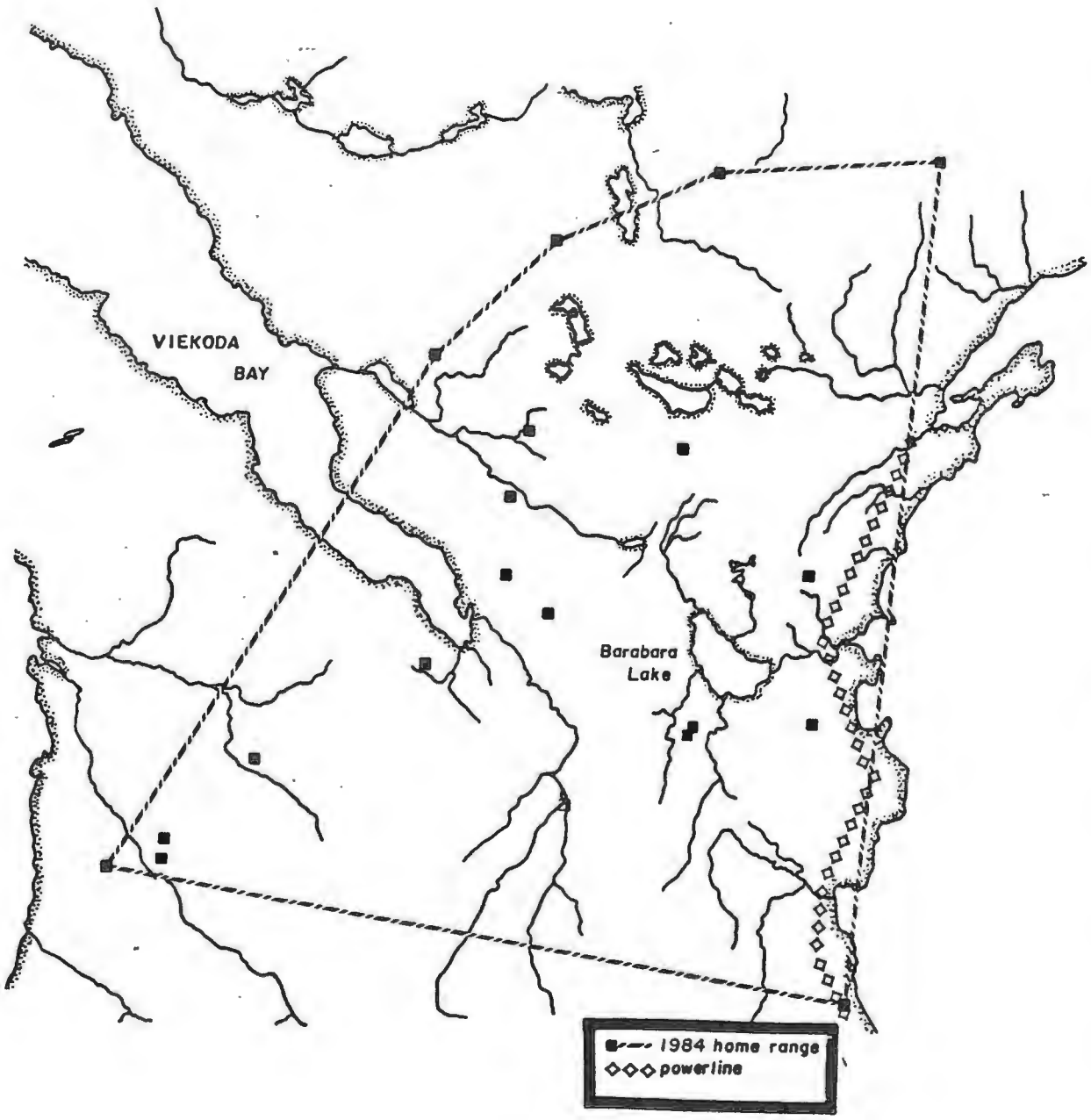

Fig. 20. Point locations and home range for male brown bear #101 in 1984. (Scale: 1cm = 1.4km)

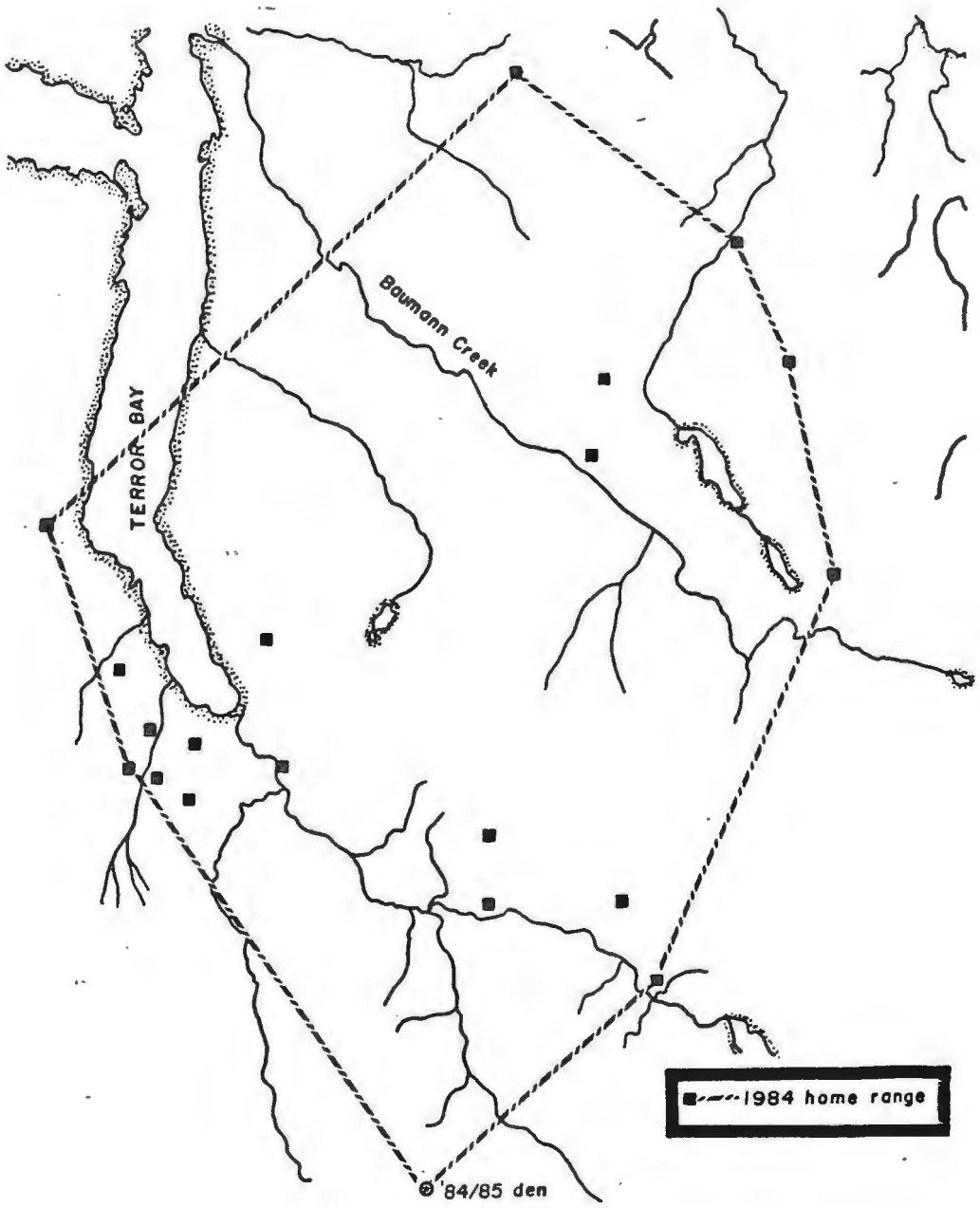

Fig. 21. Point locations and home range for male brown bear #102 in 1984. (Scale: 1cm = 1.3km)

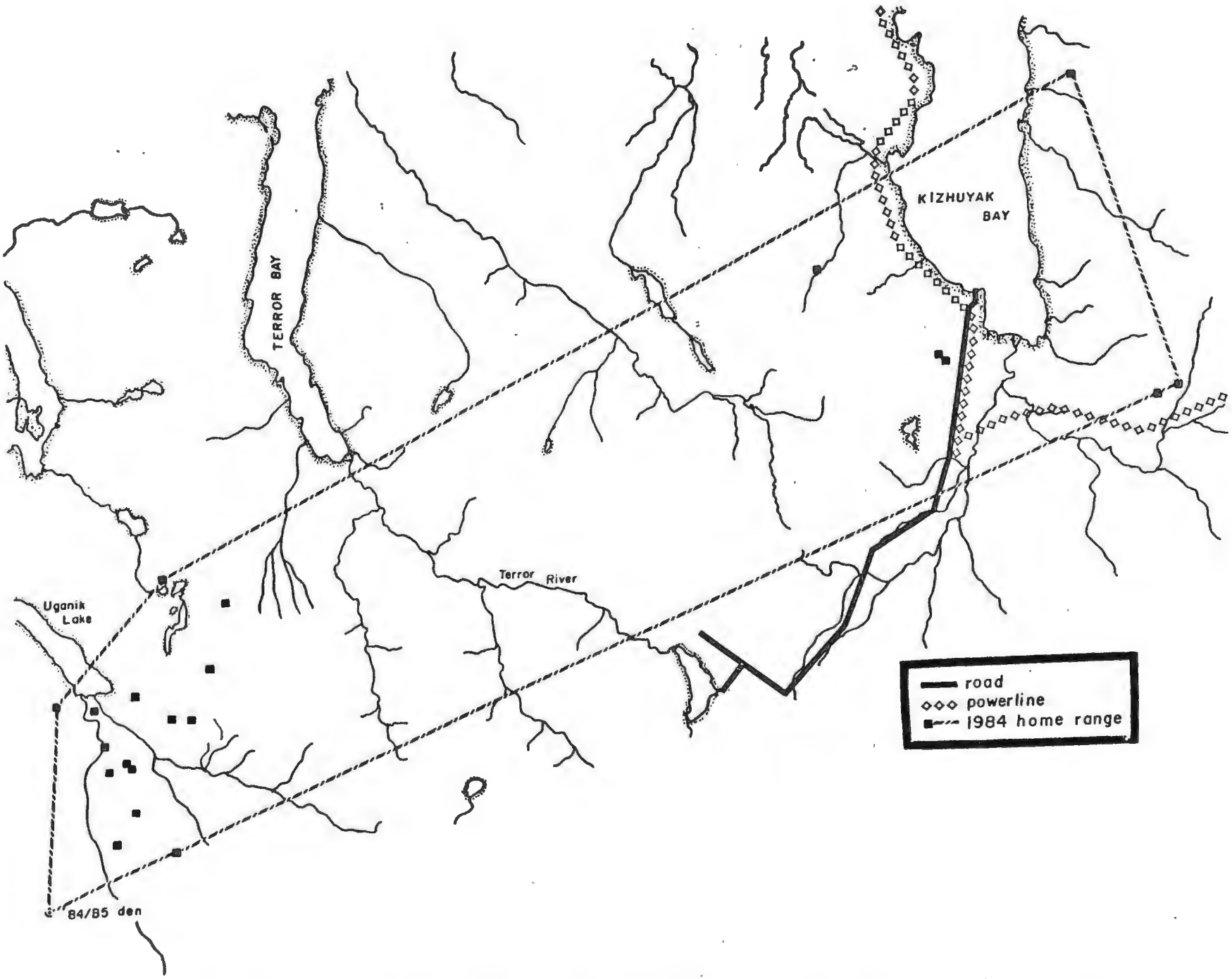

Fig. 22. Point locations and home range for male brown bear #103 in 1984. (Scale: 1cm = 1.5km)

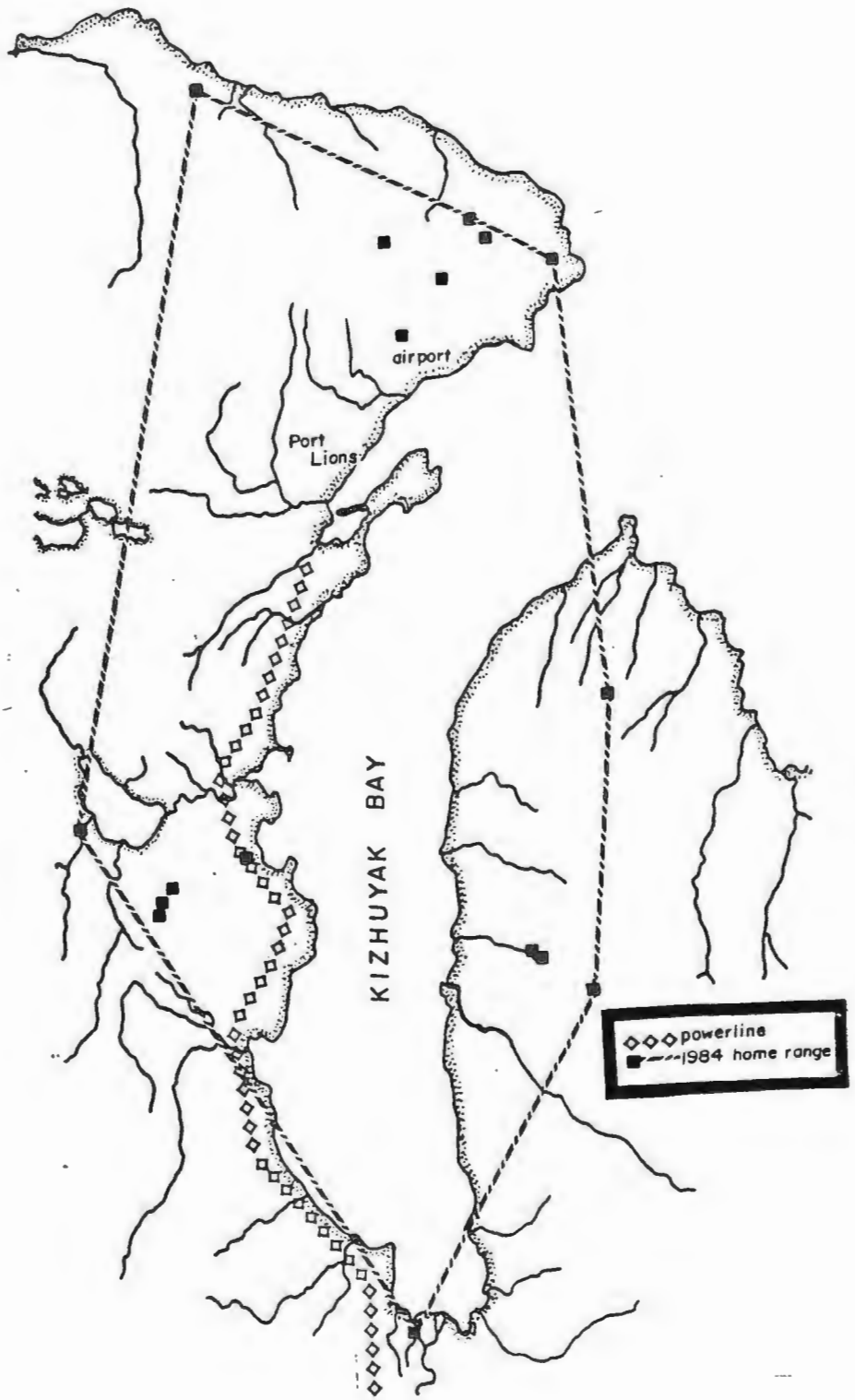

Fig. 23. Point locations and home range for male brown bear #104 in 1984. (Scale: 1cm = 1.3km)

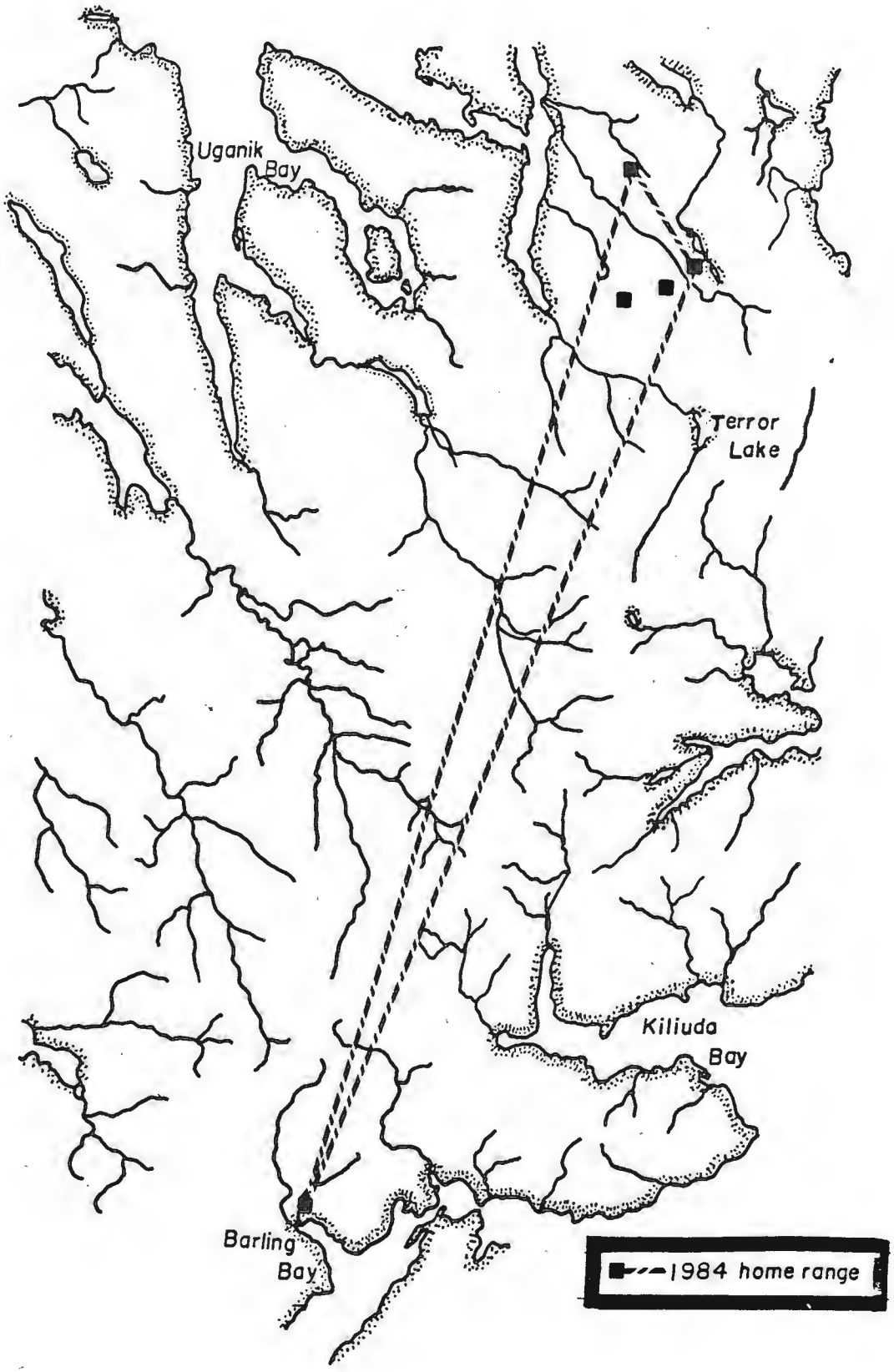

Fig. 24. Point locations and home range for male brown bear #105 in 1984. (Scale: 1cm = 3.9km)

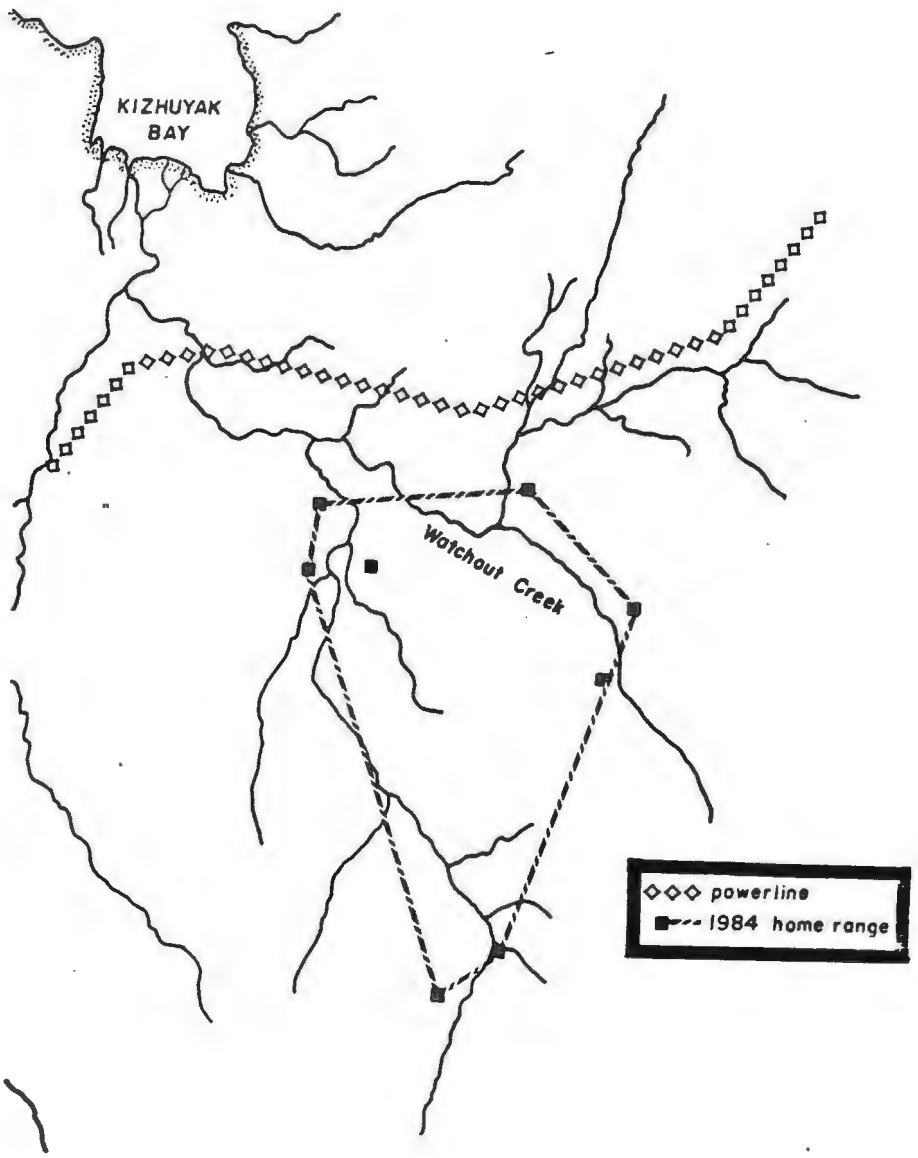

Fig. 25. Point locations and home range for female brown bear #114 in 1984. (Scale: 1cm = 0.9km)

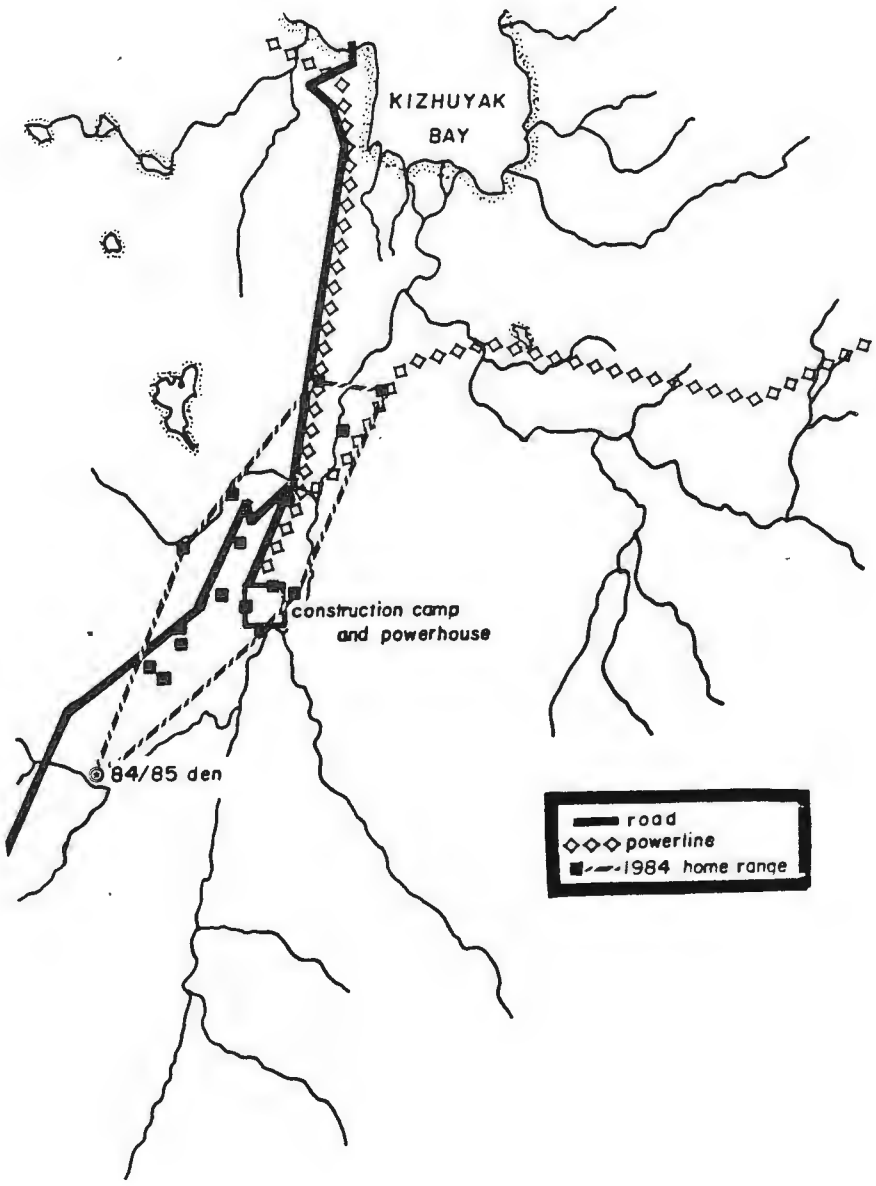

Fig. 26. Point locations and home range for female brown bear #119 in 1984. (Scale: 1cm = 0.9km)

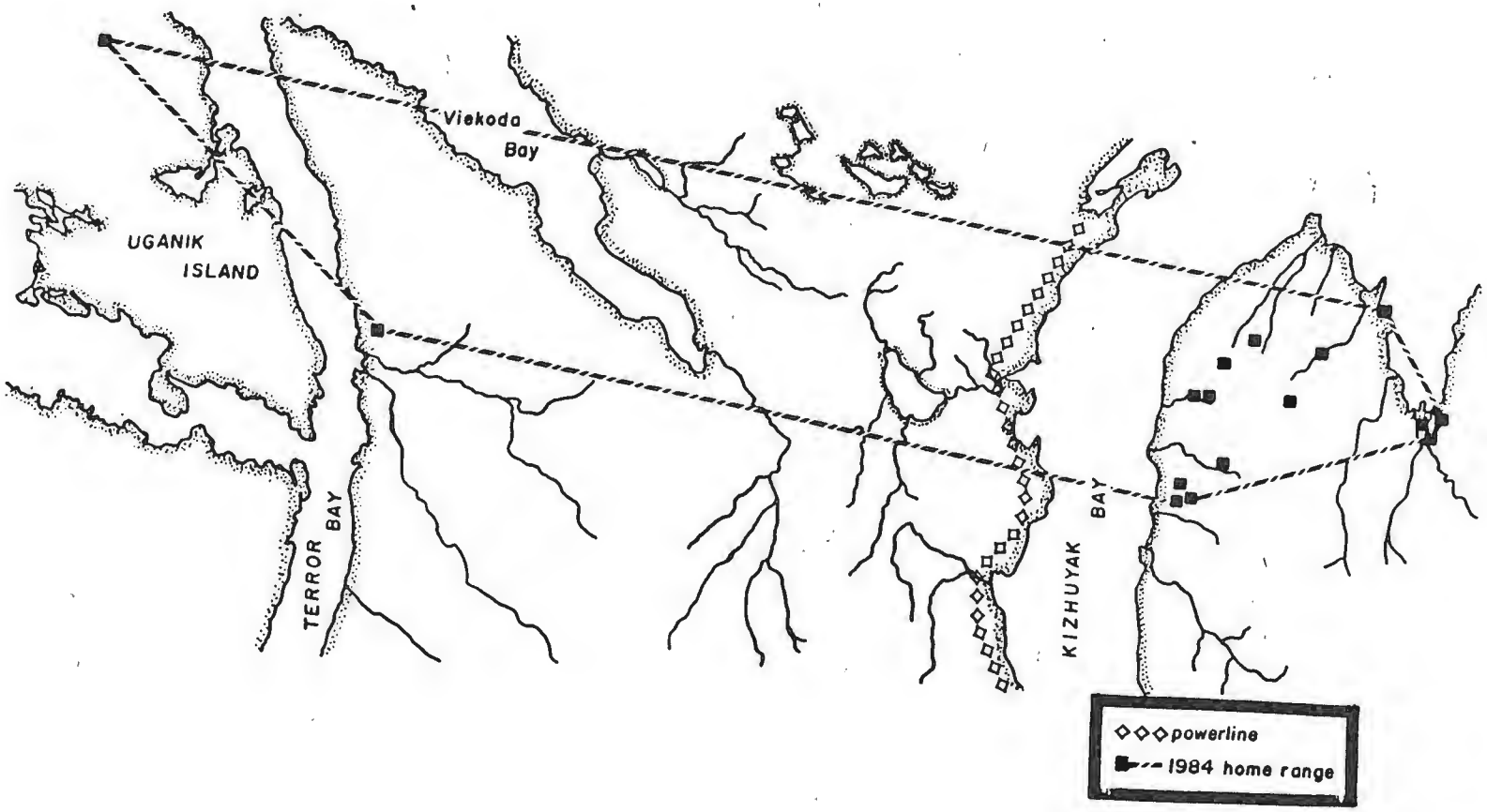

Fig. 27. Point locations and home range for male brown bear #120 in 1984. (Scale: 1cm = 1.8km)

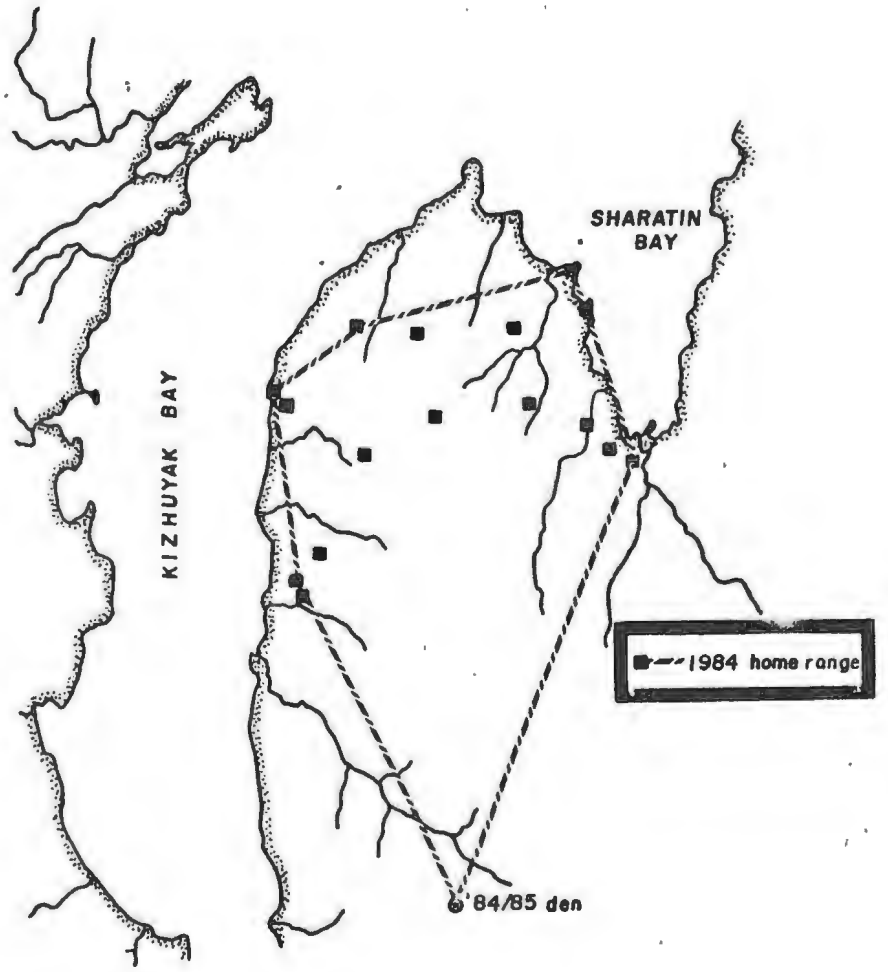

Fig. 28. Point locations and home range for female brown bear #121 in 1984. (Scale: 1cm = 1.3km)

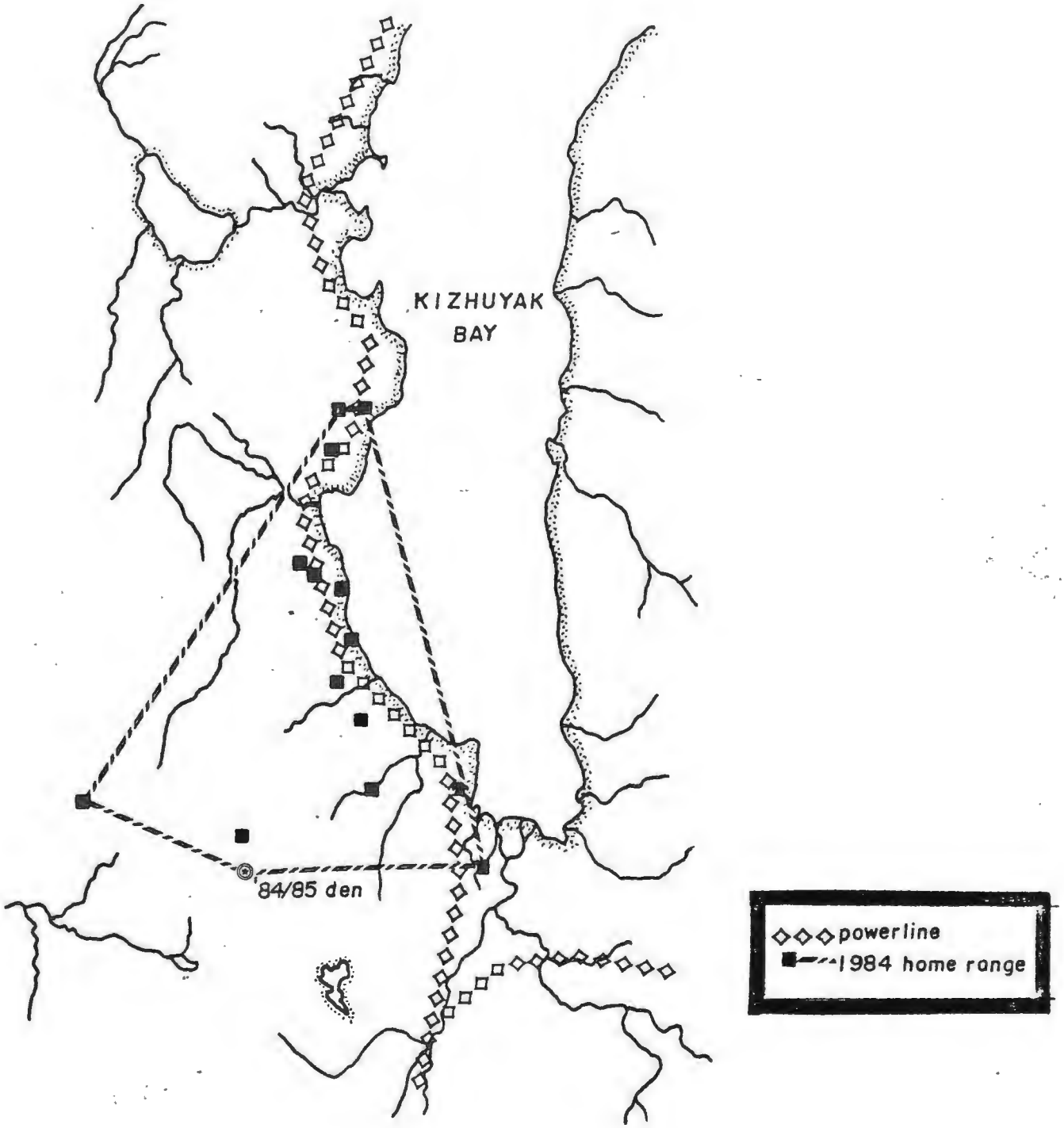

Fig. 29. Point locations and home range for female brown bear #123 in 1984. (Scale: 1cm = 1.0km)

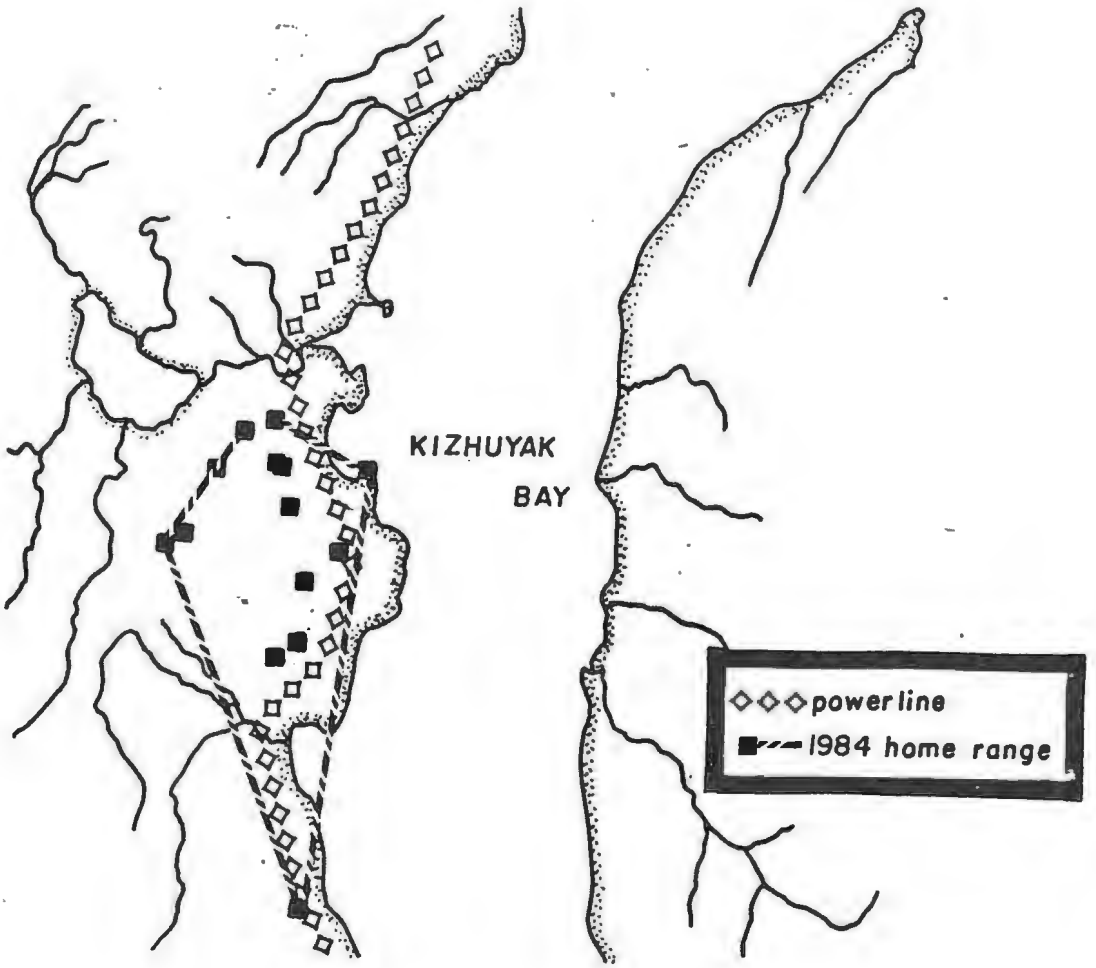

Fig. 30. Point locations and home range for female brown bear #127 in 1984. (Scale: 1cm = 1.0km)

APPENDIX II.

BROWN BEAR OBSERVATIONS BY CONSTRUCTION

PERSONNEL IN TERROR LAKE STUDY AREA,

1982 - 1984

Appendix 2. Brown bear observations by construction personnel in Terror Lake study area, 1982-1984.

Date	Time	No. bears	Association	Location	Drainage	Activity	Habitat	Comments
1982								
9/05	0730	1	single	below tunnel portal	K	W	B	crossing road
9/18	0910	1	adult	1/4 mi N of tunnel portal	K	W	B	moving to east
9/19	1130	1	adult	Kizhuyak R. near MP 2.5	K	SR	W	
9/21	0745	4	sow w/3coy	east of Terror L. tunnel portal	T	R	B	sow charged to within 50 yds of bus
9/21	0900	1	sub-adult	MP 1.5 Kizhuyak road	K	R	B	crossed road from east to west
9/21	0830	3	sow w/3coy	Coho Slough 1/2 mi. east MP 1.5	K	F	W	chasing salmon
9/22	0930	1	adult	Rolling Rock Ck.	K	R	B	moving east to west
9/23	1720	1	adult	near MP 1	K	W	B	crossed road toward Kizhuyak R.; radiocollared w/white collar flag
10/4	1730	3	1 lg adult, 1 sow w/1cub	south of burnpit near near MP 1	K	R	B	crossed road toward Kizhuyak R.
10/6	0750	3	sow w/2coy	upper Falls Ck.	K	W	T	moving to northwest
10/6	0750	1	adult	below lower tunnel portal	K	W	B	moving to west; radiocollared w/red collar flag
10/6	1400	1	adult	1/2 mi above lower portal	K	W	B	moving to Kizhuyak R.
10/7	1620	1	adult	below lower portal	K	W	B	moving to west
10/8	0900	1	adult	below lower portal	K	W	B	moving to east
10/8	1400	1	adult	200 yd north of lower portal	K	W	B	moving across access road headed west
10/9	0800	1	adult	near MP 1	K	W	B	moved across road to west
10/10	0945	1	adult	stream east of MP 1	K	F	E, F	fishing; observed for 15 min.
10/10	1400	1	adult	north Falls Ck. dam site	K	W, R, O	T, B	last seen sitting watching road
10/12	1100	1	adult	200 yds north of lower portal	K	W	G	crossed access road toward Rolling Rock Creek
10/12	1210	1	adult	access road/penstock road	K	W, F	G, B	
10/13	1630	1	small adult	Kizhuyak camp	K	W	C, B	walked through edge of camp
10/14	0700	4	sow w/3coy	Kizhuyak flats	K	W	F	
10/15	0712	1	single	east of access road near burnpit	K	-	B	
10/15	1130	1	adult	200 ft below lower portal	K	W	B	
10/15	1300	1	adult	near lower tunnel portal	K	B	B	
10/15	1755	1	single	near MP 6	K	W	T, B	moving west
10/17	1100	1	adult	Kizhuyak camp	K	W	C, B	entered edge of camp pad, then into trees
11/9	0900	2	sow w/2 yr old	north of Terror L.	T	W, S	B	moving uphill from Terror L.; seen intermittently all day
11/10	1445	2	sow w/1coy	north side Terror L.	T	W	G, B	
11/11	0900	2	sow w/1coy	north side Terror L.	T	W	G, B	3rd consecutive day bears seen
11/12	1245	2	sow w/1coy	north side Terror L.	T	W, F	G, B	4th day seen; last seen at 1330 west of quarry #1
11/14	1230	1	adult	below outlet portal	K	W	G, B	
11/15	0900	1	lg adult	upper Shotgun Ck.	K	W	T, E	moved east across Shotgun Ck.
11/16	0800	2	sow w/2coy	quarry #1 Terror L. dam	T	W	T, B	moving east toward north side lake
11/17	1030	1	adult	upper Falls Creek	K	W	T, E	
11/20	1400	2	sow w/1coy	quarry #1 Terror Lake	T	W	T	possible denning area?

Appendix 2. (Cont'd). Brown bear observations by construction personnel in Terror Lake study area, 1982-1984.

Date	Time	No. bears	Association	Location	Drainage	Activity	Habitat	Comments
1983								
3/19	0930	1	adult	Elbow Ck. near T-line tower #43	S	B	B	possible den
4/08	1550	1	adult	upper Matchout Ck. near T-line tower #42	K	R	B, S	
4/11	1000	1	adult	upper Matchout Ck. near T-line tower #23	K	B	G, B	
4/11	1500	1	adult	upper Matchout Ck. near T-line tower #23	K	M	G, B	same bear in previous observation
4/24	1530	1	adult	Shotgun Creek	K	M	T, S	moving east to west
4/27	0600	1	adult	North of quarry #1 at Terror Lake	T	M	S	
4/27	1230	1	adult	slope south of Terror Lake dam	T	M	S	
5/03	1600	1	adult	between tunnel and camp near power cable	K	S, P, M	G, B	swatting and biting power cable
5/12	0900	1	adult	beach north of Rolling Rock Creek	K	M	G, B	
5/13	0730	1	adult	on access road to Rolling Rock Creek dam	K	M, B, P	E, S	sliding in snow; wouldn't move for road grader
5/13	1000	2	1 large 1 small	above Eagle Ck. Falls	K	B, M, P	G, B	
5/16	1430	1	1 adult	north of Falls Creek	K	R	S	confronted surveyor at 20' and fled
5/16	0800	6	1 sow w/3coy; 2 singles	Kizhuyak R. flats	K	S, M, F	F	
5/16	1045	1	adult	upper Rolling Rock Ck.	K	M, F	B	
5/17	1130	3	sow w/2yrls.	Eagle Ck. above jetty	K	M, P	G, B	
5/19	0500	1	adult	east of Kizhuyak camp	K	M, O	G, B	vocalizing
5/21	1500	1	adult	east of Kizhuyak camp	K	M, B	G, B	
5/21	1700	3	sow w/2yrls.	westside Kizhuyak R. flats	K	M	G, B	
5/23	1800	1	adult	south of tunnel portal	K	M	B	
5/24	1100	1	adult	ridge east of Kizhuyak	K	F	G, B	dug up grass patch
5/24	1745	2	adults	upper Rolling Rock Ck. near portal	K	F, M	B	
5/25	0600	1	adult	north of Rolling Rock Ck.	K	M	B, G	
5/25	0910	1	adult	above outlet portal	K	M	T, G	
5/25	1900	4	sow w/3yrls.	westside Kizhuyak flats	K	F, R, P, M	G, B, T	
6/05	AM	3	sow w/2- 2 yr old	in quarry and spillway at dam	T	S, M	E	bears previously observed several times
6/07	---	3	sow w/1coy	Terror River above lake	T	M	S	moving up Terror River
6/09	1600	2	adults	above outlet portal	K	S, M	G, B	
6/10	1230	2	adults	west of Terror L. dam	T	P	S	repeatedly sliding in snow
6/11	0630	2	adults	west of Terror L. dam	T	M, P	S	sliding on snow
6/11	0630	1	adult	outlet below Terror L. dam	T	M	B	

Appendix 2. (Cont'd). Brown bear observations by construction personnel in Terror Lake study area, 1982-1984.

Date	Time	No. bears	Association	Location	Drainage	Activity	Habitat	Comments
6/12	1600	3	adults	above tunnel portal	K	M	G, S	crossed access road east to west
6/14	0700	1	sub-adult	garbage burnpit at outlet portal	K	F	E	feeding on garbage
6/15	0730	1	adult male	access road near tunnel inlet	T	S, M	S	stood on hind legs; sex verified
6/16	0730	1	adult	southwest of outlet portal	K	S, M	B	
6/17	1000	2	adults	1/4 mi above Shotgun Ck. dam	K	M	S	
6/18	1205	1	lg adult	Falls Ck.-Shotgun Creek confluence	K	R, M	G, B	
6/22	1530	1	sub-adult	near penstock	K	M	B	probably same bear next 2 obs.
6/22	1700	1	sub-adult	near penstock	K	M	B	
6/22	2100	1	sub-adult	near penstock	K	M	B	
6/23	0700	1	lg adult	near T-line Kizhuyak R.	K	B	E	bedded on spoils pile at towerbase
6/23	1930	1	sub-adult	Kizhuyak camp near dorms	K	S, M	C	seen several times near pad
6/24	0700-1000	3	sow w/2coy	Kizhuyak R. delta	K	S, B, M	G	seen several times
6/26	1930	1	sub-adult	Kizhuyak camp	K	M, R	C	seen several times in camp
6/27	1000	1	sub-adult	Kizhuyak camp	K	M	C	
6/29	1130	3	sub-adults	Port Lions T-line	K	S, M	G, B	
6/30	1000	1	small adult	upper Rolling Rock Ck.	K	M, F	G, B	
6/30	1200	1	adult	west of Terror Lk camp	T	M	S	seen on skyline
7/02	2300	1	adult	west edge of quarry #1 Terror Lake	T	S	B, E	drills and equipment operating within 100 yds.
7/03	1000	2	adults	west of Terror L. camp	T	M	G, B	
7/05	1300	1	lg adult	east of Falls Ck pass	K	S, R	T	
7/08	1600	1	sub-adult	waste disposal site Kizhuyak camp	K	S, M, R, F	E	rummaging in incinerated waste
7/10	0630	1	adult	MP 2 Kizhuyak road	K	R	B	
7/10	1600	1	adult	Falls Creek pass	K	F	T	
7/11	0830	1	sub-adult	Falls Creek diversion	K	M, F	G, B	moving to southeast
7/11	1600	1	sub-adult	Falls Creek pass	K	M	G	
7/11	1700	2	adults	Falls Creek diversion	K	R	E, G, B	ran into worksite, stopped, retreated
7/12	0720	1	adult	Falls Creek pass	K	M, F	G, B	
7/12	1800	1	adult	north of Rolling Rock Creek diversion	K	F	T	
7/13	0830	1	adult	Falls Creek "knob"	K	M, F	G, B	bear seen twice later in day
7/13	1030	1	adult	NW of quarry #1 Terror L..	T	M, F	S	spotter plane circling bear
7/13	1400	1	adult	Falls Ck snow guage	K	M	S	
7/15	0530	1	adult	south of outlet portal	K	M, F	T, G	
7/16	0423	1	adult	Kizhuyak camp	K	M	C	walked around dorms
7/16	0900	1	adult	1/4 mi. north of access road east Terror L.	T	M, F	T, G, R, S	
7/16	1000	2	adults	1/2 mi north of quarry #1 Terror Lake	T	M, F	T, R	
7/19	1145	1	adult	storage pond Rolling Rock Creek mouth	K	M	G, B, E	
7/21	0700	1	small adult	access road Rolling Rock	K	R	B, E	

Creek mouth

Appendix 2. (Cont'd). Brown bear observations by construction personnel in Terror Lake study area, 1982-1984.

Date	Time	No. bears	Association	Location	Drainage	Activity	Habitat	Comments
7/21	2000	1	adult	access road near MP 1	K	W, R	B	crossed road from east to west
7/22	0700	1	adult	between outlet portal and Falls Creek	K	R	G, B	
7/22	0800	1	adult	Falls Ck. snow guage	K	F	G	
7/22	0800	2	adults	NW of quarry #1 Terror L.	T	S, W, F,	G, B	seen intermittently from 0800 to to 1400.
7/22	0820	1	adult	NW of quarry #1 Terror Lake	T	W	G, B	largest bear seen
7/23	1615	1	adult	Falls Ck. diversion	K	R	G, B	
7/24	0800	1	sub-adult	Kizhuyak camp	K	W	C	likely same bear previously reported
7/25	1600	3	adult and 2 cubs?	Port Lions T-line	K	R	B	bear between pilot and helicopter
7/26	0800	1	adult	Port Lions T-line	K	W	B	
7/26	1300	1	sub-adult	Kizhuyak camp waste site	K	R, O	E	rummaging in debris
7/26	1300	1	sub-adult	Kizhuyak camp waste site	K	R, O	E	rummaging in debris
7/26	1510	1	adult	1/4 mi north of Kizhuyak camp	K	R, F	B	fed on salmonberries near road for 2-3 hrs; crossed road
7/27	0630	2	adults	Port Lions T-line	K	R	B	bears near work party; helicopter hazed bear away; 1 bear radiocollared
7/28	1930	1	sub-adult	entrance of tailrace into Kizhuyak River	K	B	R	bear bedded on gravel bar
7/29	---	4	sow w/3 cubs	Port Lions T-line	K	R	B	sow "slow-charged" survey crew; crew climbed tree
8/08	1430	1	adult	near storage yard on access road	K	S, W	B	radio-collared; walked toward Kizhuyak River delta
8/09	1300	1	small adult	penstock excavation	K	W, R	E	bear appears when helicopters sling concrete
8/09	1330	1	sub-adult	penstock excavation	K	W	E	moving to north
8/10	0730	3	sow w/2 lg cubs	Port Lions T-line	K	R	B	work crew retreated and bears left
8/10	0900	1	sub-adult	near Kodiak T-line Kizhuyak River	K	W	G, B	walking from east to west
8/10	1030	1	adult	access road MP 1	K	W	B	crossed access road west to east
8/11	1730	1	adult	Kizhuyak R. near T-line	K	W	R	carrying a deer fawn
8/11	1945	1	adult	Kizhuyak R. near T-line	K	W	B	radio-collared; cream collar flag
8/12	0805	1	small adult	MP 2 access road	K	R	B	crossed road from west to east; radio-collared; cream collar flag; bear seen several times this week
8/12	1330	1	adult	MP 2.5 access road	K	W	G	
8/16	1430	1	small adult	Kizhuyak camp	K	W	B, C	
8/17	0800	3	sow w/2cubs	Port Lions T-line	K	W, R, P	B	sow radio-collared; 1 cub w/green left and red right ear flag, bears traveled in T-line ROW
8/18	1530	2	different size	east of Kizhuyak R	K	W, R	G, B	larger bear radio-collared
8/28	1830	1	adult	MP 1.5 access road	K	R	B	moving to west
8/29	1600	1	small adult	Falls Ck. "knob"	K	W	G	
8/29	1900	2	cubs	MP 1.5 access road	K	R	B	natal rings

Appendix 2. (Cont'd). Brown bear observations by construction personnel in Terror Lake study area, 1982-1984.

Date	Time	No. bears	Association	Location	Drainage	Activity	Habitat	Comments
8/30	1930	1	adult	MP 1 access road	K	R	B	
8/31	1915	1	medium adult	1/2 mi north Kizhuyak camp	K	R, W,	B	crossed road and ran uphill; disturbed by helicopter hauling concrete
9/01	0800	1	small adult	east of penstock	K	F	G	feeding on deer fawn
9/01	0825	1	---	access road near Rolling Rock crossing	K	R	B	ran across road toward west
9/01	0600	1	adult	Kizhuyak R. east side	K	F	W	catching and eating salmon
9/05	0730	1	adult	access road near Kizhuyak R. flats	K	R	E	scared by vehicle and ran toward east
9/11	1715	1	adult sow	Kizhuyak camp	K	W, S	B, C	alternately walked from camp pad to to brush SE of pad
9/12	1000	1	adult	Kizhuyak R.	K	W, R	B, R	frightened sport fisherman
9/13	0700	1	adult	Kizhuyak R. flats	K	F	W	
9/14	0615	2	adults	MP 2 access road	K	R	B	smallest adult w/radiocollar; crossed road from west to east
9/15	1315	1	lg adult	Kizhuyak River	K	F	W	fishing; bear moved into brush by fisherman's shouting
9/15	1900	1	adult	Kizhuyak R/Watchout Creek junction	K	F, W	W	fishing
9/16	0730	1	adult	Kodiak T-line near Kizhuyak River	K	W	G, B	moving to east
9/17	1430	1	small adult	Kizhuyak R. below Rolling Rock Creek	K	W	W	
9/19	0900	4	sow w/3coy	Kizhuyak R., Beaver Dam Creek	K	W, R. F	G, B, W	fishing; crossed flats westward into brush below access road
9/19	1100	1	adult	Kizhuyak R., Beaver Dam Creek	K	F	G	
9/19	1100	1	sub-adult	Kizhuyak camp	K	W	E, C	walked through disposal site and camp pad
9/20	0545	1	---	powerhouse	K	W	E, C	worker and bear equally surprised
9/20	1600	2	adult, sub-adult	Beaver Dam Creek	K	F, W, R	G, B	fishing; helicopter spooked larger bear, but small bear kept fishing
9/21	1800	5	---	Kizhuyak R. delta	K	F, W	W	fishing
10/16	1200	1	adult	penstock road	K	W, F	G, B	
10/19	0700	1	adult	east of Shotgun Ck. dam	K	W	B	
11/15	1345	1	adult	east of Kizhuyak R. near stream guage	K	W	G, B	
11/16	1015	1	adult	east of Kodiak T-line, Watchout Creek	K	O	G, B	sitting
11/17	1530	1	adult	base of cliffs north of Rolling Rock Ck.	K	W	B	
11/26	1200	1	adult	300 yds east of Falls Creek dam	K	B	S	

Appendix 2. (Cont'd). Brown bear observations by construction personnel in Terror Lake study area, 1982-1984.

Date	Time	No. bears	Association	Location	Drainage	Activity	Habitat	Comments
1984								
4/12	1930	1	single	within 200 yds. of gravel pit at Kizhuyak camp	K	M	E	
5/01	0530	1	single	400 yds. west of Kizhuyak camp	K	O		chewing on power cable
5/07	1900	1	single	near MP 3 on access road	K	M, B, F	B	grabbing for roots
5/11	1100	1	single	1/2 mi east of MP 3	K	M	G, B, M	moving toward Kizhuyak R.
5/20	1620	3	sow w/2cubs	between access road and Rolling Rock Ck.	K	S, M,	B, R	
5/24	1500	1	adult	on road 1/4 mi below Kizhuyak tunnel portal	K	R	B	crossed road into Rolling Rock Ck
5/25	2000	3	sow w/2cubs	near water tank in Kizhuyak camp	K	M	C	
5/25	1520	1	adult	1/4 mi. N. of access road switchbacks	K	M	G, B	
5/26	2000	1	single	1/4 mi S. of penstock	K	S, M, F	G, B	
6/01	0700	1	adult	upper Falls Creek	K	O	G, R	attempting to prey on goats; chased or knocked one goat kid off 100' cliff
6/11	2100	1	single	east of MP 0.5	K	F	G, R	eating grass
6/17	2045	1	single	at tailrace near power-house	K	M, F	B, E, M	
6/28	1915	1	single	west of Shotgun Ck. dam	K	M, F	B, R	
6/30	1630	1	single	1/4 mi west of access road near Falls Ck.	K	F	T, B	
7/10	1730	1	adult	west of upper Falls Ck	K	M, F	T, G	feeding on alpine blossoms
7/13	0900	1	lg adult	near Falls Creek	K	F	T, G	feeding on grass
7/23	1930	1	single	east side Kizhuyak Bay	K	R	R	scared by motorboat
7/26	0650	1	single	1 mi south of Kizhuyak tunnel portal	K	M	G, B	red flag in one ear
7/29	1430	2	2 adults	Dovolno Pt. near cabin	K	M, F	G, O	one bear walking on beach; larger bear feeding on hillsite
7/30	0700	1	3-4yr old	1/2 mi from outlet valve house	T	R	G, B, R	
7/30	0645	1	adult	near Falls Ck dam	K	M	T, R	
9/17	0800	2	sow w/ 1-2 yr old	east of MP 2	K	F	F, M	catching salmon
unk/	2245	1	single	near Kizhuyak tunnel portal	K	M	G, B, R	walking and sliding down slope; crossed access road; radio-collared

Key to abbreviations

Habitat

B - brush
C - camp pad
E - excavation, road, storage pad
F - tide flats
O - other
R - rock, bare soil
S - snow
T - tundra
W - stream, lake

Activity

B - bedded, sleeping
F - feeding
O - other
P - playing
R - running
S - standing
W - walking

Association

coy - cubs-of-year

Drainage and location

K - Kizhuyak Bay, River
S - Sharatin Bay, Elbow Creek
T - Terror Bay, River
MP - milepost on access road

APPENDIX III.

AGREEMENT BETWEEN KIENIT-GROVES AND STATE OF ALASKA

RE: GARBAGE DISPOSAL PRACTICES-

TERROR HYDRO PROJECT

Agreement Between Kiewit-Groves and State of Alaska

Re: Garbage Disposal Practices - Terror Hydro Project

1. All garbage and food-contaminated utensils, paper etc. will be collected and burned in the camp incinerator on at least a daily basis. No burning of food scraps or food containers will be done at work sites anywhere in the project area.

2. The incinerator will be operated at a temperature sufficient to completely burn food and other organic matter to a mineral ash.

3. The incinerator and compound will be maintained in proper working order. Gates and doors will be kept securely closed and kept in good repair.

4. Unlined plywood containers will not be used for temporary storage of garbage. Only metal containers or other suitable containers with water-proof liners will be used. Containers will be cleaned frequently with disinfectant to minimize odors.

5. Trash bags from dwellings, mess hall and job sites will be transferred directly to the truck or other conveyance and no temporary storage of trash bags outside the buildings will be done.

6. Food, lunch containers, and other food-contaminated refuse will not be left in open vehicles, pickup beds or in other conveyances where such items would be easily accessible to bears.

7. Designated containers for lunch sacks, drink cups and utensils will be provided in secure areas at all job sites. Containers shall be lined with clean plastic bags and be kept securely covered.

8. No food or food-contaminated refuse will be disposed of anywhere in the project area except in designated food containers.

9. The kitchen area and any area used for storage of food will be securely fenced to prevent entry by bears.

10. All new employees and current employees will be informed of proper garbage disposal and food handling practices. New employees shall be so informed upon their first arrival at the site. Employees shall be expressly informed that these procedures are required by the State of Alaska, and that failure to comply with these practices could subject the company or its employees to criminal or civil liability for attracting bears to the site.